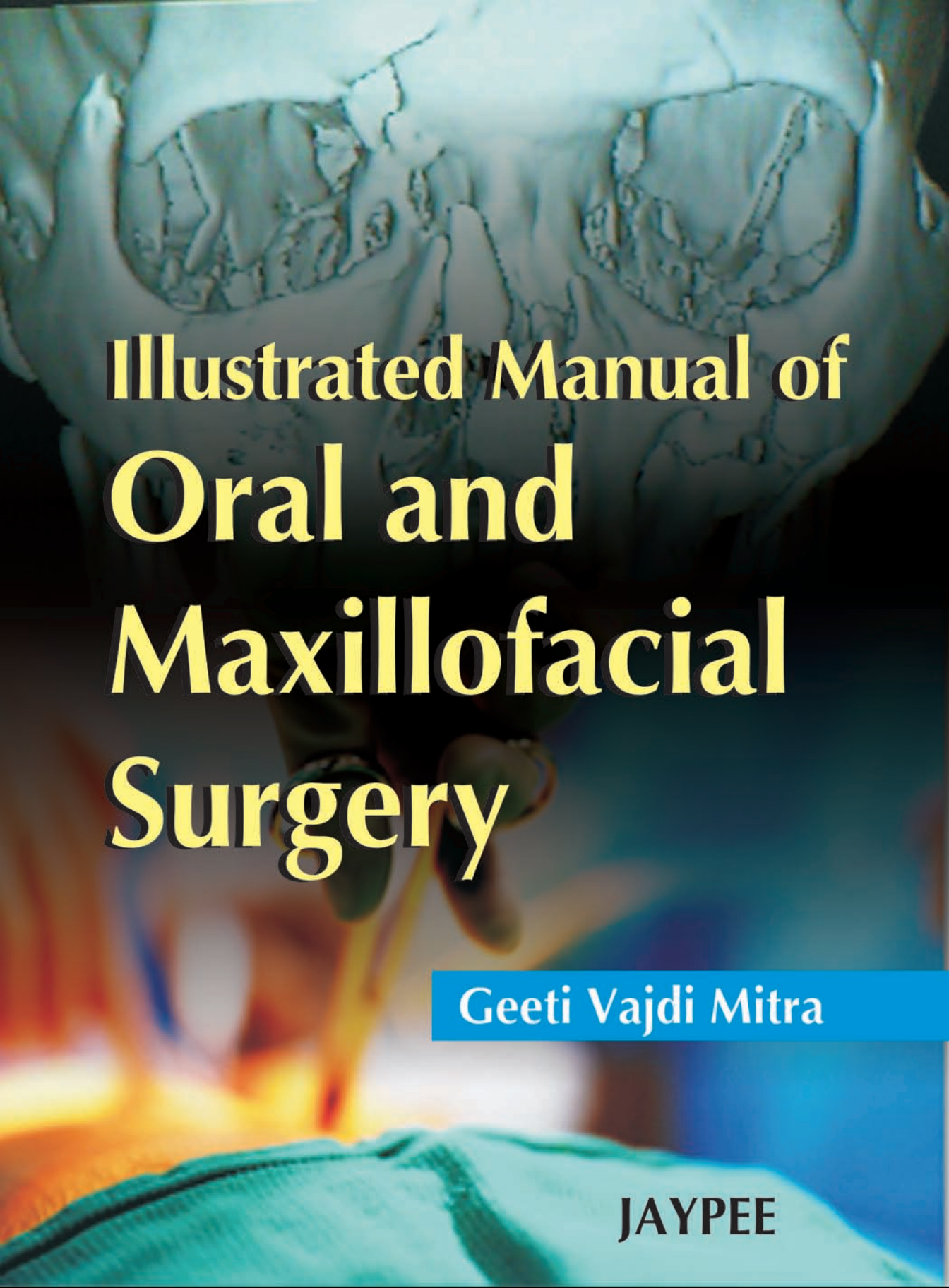
Illustrated Manual of
Oral and
Maxillofacial
Surgery
Geeti Vajdi Mitra
JAYPEE

Illustrated Manual of Oral and Maxillofacial Surgery

Illustrated Manual of Oral and Maxillofacial Surgery

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Illustrated Manual of Oral and Maxillofacial Surgery

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Dedicated

In the fond memory of my father
Mr KH Vajdi

I also dedicate this work to my mother
Dr TK Vajdi

and

my husband
Dr Avijit Mitra
the two constant sources of my inspiration

Preface

There are two ways of healing sickness—material means and spiritual means. The first is by the use of remedies, of medicines; the second consists in praying to God and in turning to Him. Both means should be used and practised.

—Bahai Writings

The God has been very generous to me. I have had a smooth sailing in life so far. I also had a good hand at sketching. As a student, I always understood the topics that had more diagrams. I could also reproduce them by sketching and explaining. Later in life as a teacher, I realized that the drawings I made while explaining something remained with the students for a longer period of time. Sometimes they reproduced the same in exams. As time passed, some ex-students told me that what I had explained them years back, is still vivid in their memories.

This made me think that there are at least some percentage of students like me who have a better memory when the topic is related with a visual impact rather than only written lines. Keeping this in mind, I started compiling this manual.

It is primarily addressed to the undergraduates and will also enable the postgraduate students to understand the basic concepts of the subject. My sincere attempt in creating this book is to enable the students to remember the text through drawings and also to reproduce the surgical procedures and create in them confidence regarding the subject of oral surgery.

I have not put any photographs, but have tried to sketch the surgical procedures in a simplified and step-wise manner, wherever possible. The clinical signs and symptoms, and treatment planning have also been illustrated using drawings so that the students can easily understand, remember and reproduce them.

This is my humble work for the students of oral surgery and I have in no ways tried to replace the knowledge that has been given to us by great authors and surgeons of the field of Oral and Maxillofacial Surgery. I welcome any suggestions made by you for the future editions.

I can be contacted at geetivajdi@gmail.com.

Geeti Vajdi Mitra

Acknowledgements

The source of all good is trust in God, submission unto His command, and contentment in His holy will and pleasure

—Baha'u'llah

Dr BH Sripathi Rao, I could not have asked for a better teacher. He taught me my skills but watching him I also learnt to be a teacher. He never withheld knowledge but spoke to us, his postgraduate students, as a friend and guide. I shall never have words enough to thank him.

I am deeply indebted to Dr Vinod Bhandari, Chairman, Sri Aurbindo Institute of Medical Sciences, for providing me with all the facilities in my institution that made this book possible. The working atmosphere was that of contentment and satisfaction.

I take this opportunity to thank my teachers Dr KM Cariappa, Dr AK Das, Dr VP Jallili, Dr BM Shrivastav, Dr SV Dhodapkar, Dr HC Neema, Dr MC Patni, Dr HA Saifee and Dr LD Gupta for all the trouble they took to pass on their skills and knowledge.

Sameer Sharma is the backbone of my work. He is a friend and an IT expert who taught me the basics of computers, did all my scanning, printing and IT work, and also came to help every time I was stuck.

My daughter, Mehek took a lot in her stride. It was only due to her, that I could to finish this manual. Carmel and Hena, my nieces, have been angels in trying to organize my paper work, and act as my proofreaders. I have tested this book on them always saying, "If you understand what I'm trying to convey, I'm sure the dental students will too."

Dr Deshraj Jain and Dr Alka Gupta, two of my friends who have always stood by me, I have no words to express my gratitude to them for always guiding me in all my professional endeavors.

My friends and colleagues Dr Minaxi Khandelwal, Dr Vilas Newasker, Dr Deepak Agrawal, Dr Sanjay Gupta, Dr Vishal Munjal, Dr Sumeet Jain always encouraged me and made me continue, when I was not sure about the work I was putting in regarding this manual.

Dr Sushmita Tauro, Dr Nawang Noden, Dr Atul Bhat, Dr Richa Gulati and Dr Smita Bhure, and all my colleagues in the department have supported me during my work, I am extremely grateful to all of them.

My thanks are due to Mr Abdul Rehman, my corel draw artist; Mr KK Raman (Production Manager), Mr Manoj Pahuja (Graphic Designer), Mr Bharat Bhushan and Mrs Kamlesh Bisht (DTP Operators), Mr Akhilesh Kumar Dubey (Proofreader) of Jaypee Brothers Medical Publishers (P) Ltd for helping me corel draw these sketches and formatting this book exactly the way I had envisaged it to be.

Last but not the least, I thank Shri Jitendar P Vij (CEO) and Mr Tarun Duneja (Director Publishing) of Jaypee Brothers Medical Publishers (P) Ltd for taking up this manual and doing such a wonderful job of publishing.

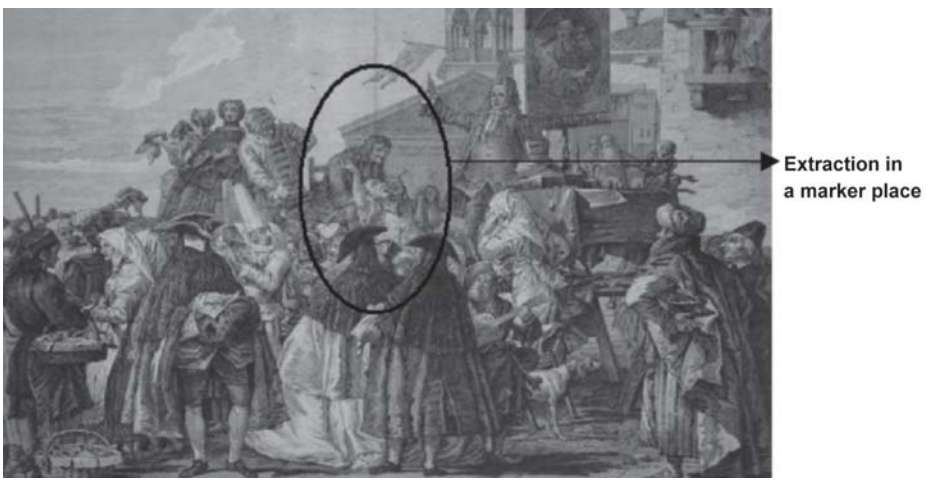
Contents

Chapter

1 Introduction to Oral Surgery

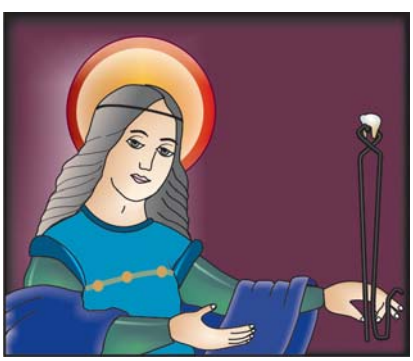
Oral Surgery: Oral surgery is that branch of dentistry which deals with the diagnosis, prevention and/or treatment of diseases, disorders and/or conditions of the oral cavity.

As humanity progressed, we saw an immense rise in the field of oral surgery. Initially, the thought of a dental treatment horrified people, however, as time passed, dentistry took a giant leap forward and the terror has been done away with.

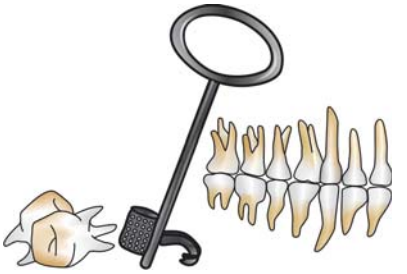


If we are to take a journey back to earlier times, we shall find that the first dentist was an Egyptian, Hesi Re (3100- 2181 BC). Due to lack of advanced tools, extraction was the first choice for dentists.

Moving on, in about 249 AD, a woman named Apollonia was burned after having her teeth removed. Today, she is famed as the 'Patron Saint of Dentists' and she is depicted with forceps.



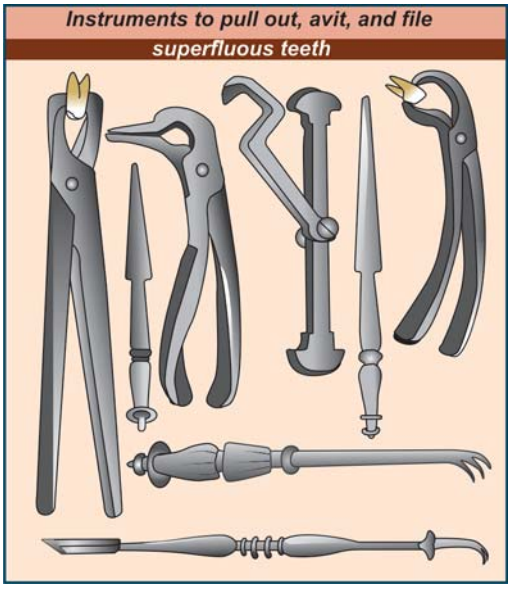
It is also of great interest to note that in 1764, dentists in American colonies used keys to extract teeth and often blacksmiths who made the keys, served as local dentists.



In 1790, Josiah Flagg, using the design of a Windsor chair, constructed the first chair specifically for dentists. It had adjustable arms that held instruments.

In the 18th century, dental instruments were seen more as objects of art and were made of ivory, mother of pearl, gold, silver and different woods.

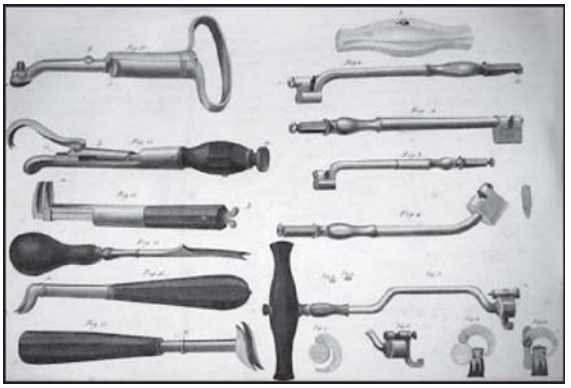
But, by the end of the 19th century, the demand for antiseptic instruments precluded the further use of decorative implements.



Forceps are probably the oldest of all dental instruments and have been known by different names such as parrot's beak, crow's bill and stork's bill.

Some of the early extraction kits

Tools over ages



Tools over ages

We are now in the modern era and the branch of oral surgery has moved from simple extractions to complex surgeries. The oral surgeon is now referred to as a maxillofacial surgeon. There are no sharp lines separating a maxillofacial surgeon from an ENT or a plastic surgeon and therefore many of us are referred to as 'craniofacial surgeons'.

Chapter 2

Armamentarium

It is well said that a carpenter is as good as his 'TOOLS'. Similarly, a good oral surgeon is one who knows his instruments.

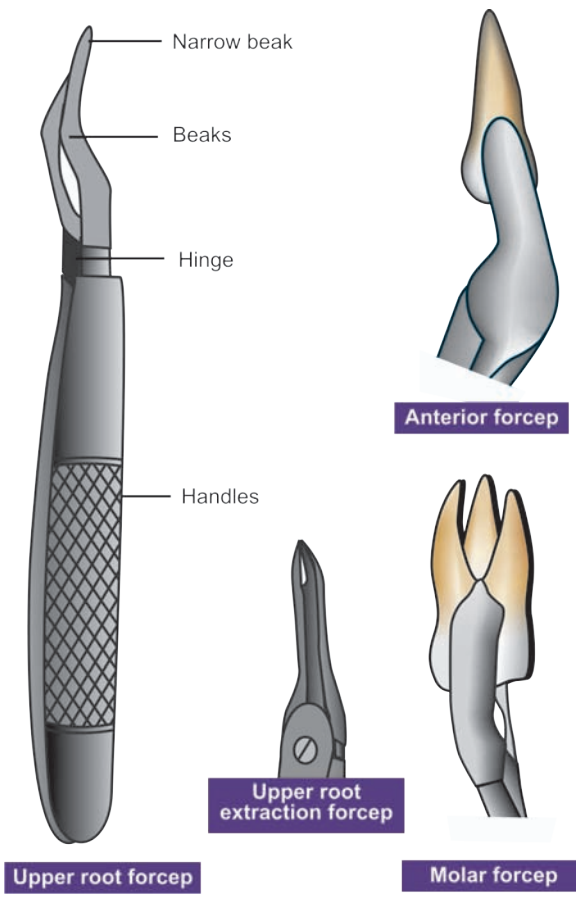
EXTRACTION FORCEPS

Maxillary Forcep

The beaks are kept parallel to the long axis of the tooth. The forcep is designed for single rooted and three rooted teeth. The forcep for single root has either straight beaks for extraction of anteriors or has slightly curved beaks for extraction of premolars otherwise it is a straight forcep.

The upper molars have two roots buccally, and a single root palatally. The beaks are designed to accommodate these roots. The pointed side of the beak fits onto the furcation of the buccal roots and therefore there are right and left sided forceps.

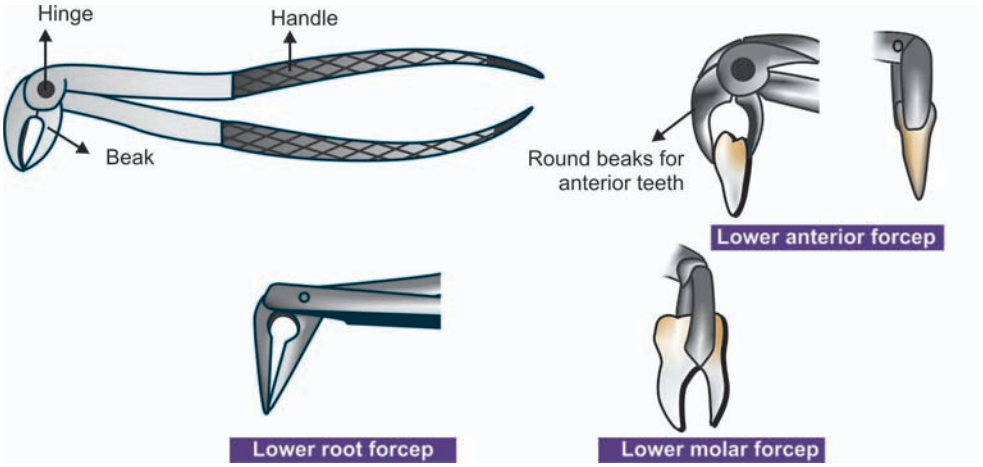
The beaks that are narrower are meant to extract the roots that are broken.



Mandibular Forcep

These are designed for single rooted (anterior and premolars) and two rooted (molars) teeth. These forceps have beaks that are at right angle to the handle which during extraction point inferiorly.

i. The forceps for single rooted teeth have both the beak tips rounded.
ii. The forceps for molars have both the ends of the beak pointed to engage the furcation between the mesial and distal roots.

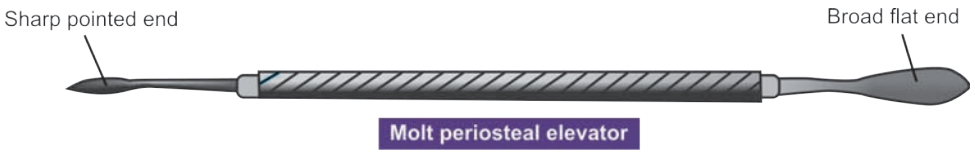


PERIOSTEAL ELEVATORS

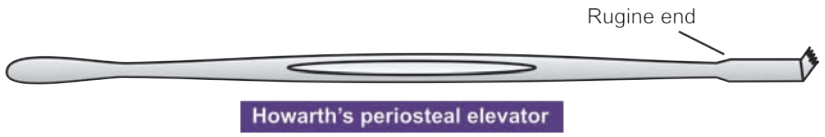
Periosteal elevator are instruments used to elevate the mucoperiosteum during extraction and surgical procedure. Elevators are:

Molt's periosteal elevator: Double ended instruments with one end broad, spatulate and slightly curved is used to reflect mucoperiosteal flap.

The other end is narrow, tapering and ends in a pointed tip that is slightly curved. This end is used to reflect interdental papilla and attached gingiva.

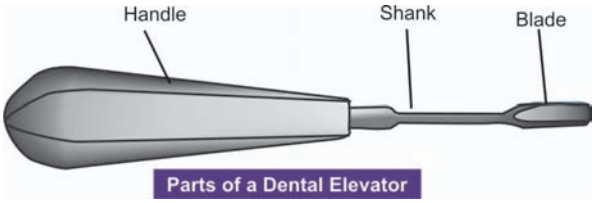


Howarth's periosteal elevator: Double ended. One end is flat, broad with sharp edges to reflect mucoperiosteal flap. The other end, called the rugine end is rectangular. This ends in a tip that has small sharp projections perpendicular to the blade. This end is used on the incision line to separate the tough periosteum.



Dental Elevator

These instruments are used to luxate teeth from the surrounding bone. Loosening of teeth before extraction facilitates extraction of the tooth or roots if they happen to break.



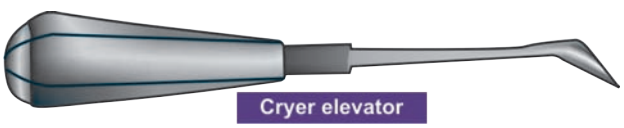
Parts of a Dental Elevator


Coupland's elevator

***Straight or Coupland's Elevator*:** these are used most often. The blade is concave on its working surface. It works on wedge principle. The crest of interseptal bone is used as fulcrum.

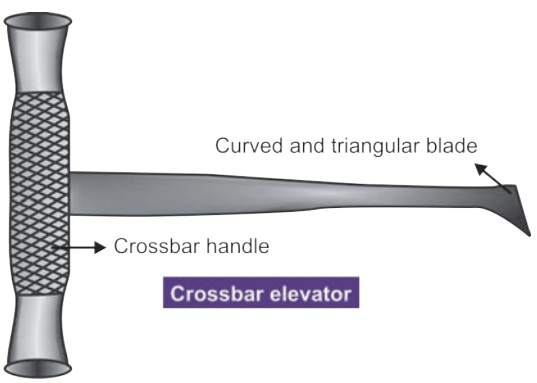
Straight Elevator Hospital Pattern: It is used to luxate the tooth prior to placing the forcep. The serrated flat side of the blade faces the tooth to be extracted. It works on the wedge principle.


Straight elevator hospital pattern

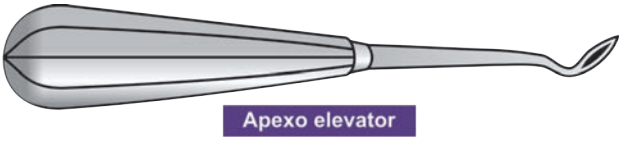

Cryer elevator

Cryer Elevator: They have triangular shaped blade. They come in pairs as they are used for specific roots. These elevators work on wheel and axle principle.

Crossbar Elevators: These work on the principle of wheel and axle and therefore generate a large amount of force. Therefore, these elevators should be used with caution. They are also available in pairs as each one is used for specific root only in the mandible.

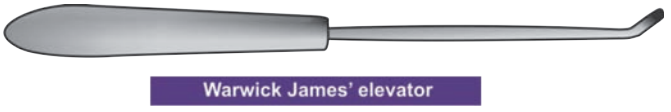


Crossbar elevator


Apexo elevator

Apexo Elevator: The blade is at an angle to the shank. The blade is narrow with a deep concavity on its working side. These are available in pairs are used to remove fractured roots. The pointed tip wedges between the tooth fragment and the alveolar bone. Works on the wedge principle.

Warwick James' Elevator: They are a set of 3 instruments. Two being angled and one straight. They are used to remove fractured roots without application of force.


Warwick James' elevator

INSTRUMENTS FOR INCISING/CUTTING SOFT TISSUES

Bard Parker Handle: It is used to fix different sizes and shapes of blades. It is held in a pen grasp to make an incision.

Dissecting Scissors: These scissors have blunt ends and are used to cut the tissues in the deeper layers.

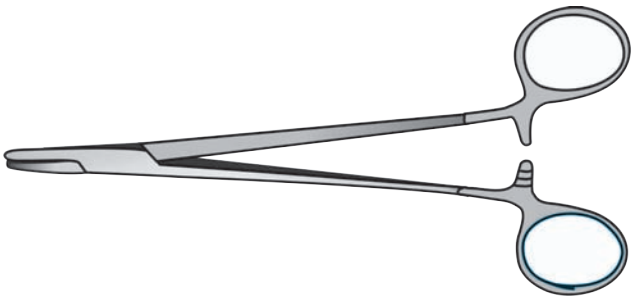

Metzenbaum scissors curved

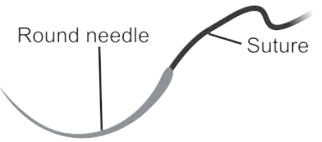
Mayo dissecting scissors

Mayo scissors straight, blunt

SUTURING INSTRUMENTS

Needle Holding Forcep: To hold the needle with during suturing.





Needle holder

Adson Tissue Holding Forcep: It is used to hold the tissue while suturing is being done. They are of (i) toothed, (ii) non-toothed variety.

Adson tissue forcep (plain)

Adson tissue forcep (toothed)

Suture Cutting Scissors: They are a variety of shapes. The tips of these scissors are sharp, to facilitate its entry under the suture and cut it without causing pain.

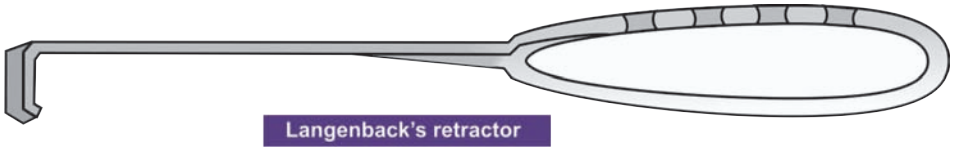
RETRACTORS

As a group are meant to retract tissue out of the surgical site to facilitate surgery.

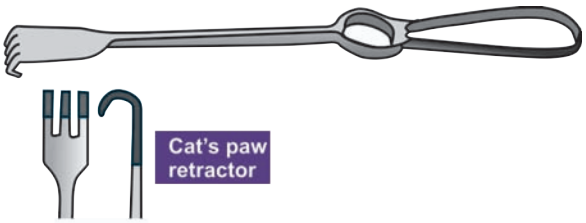
Austin Retractor: This is a short right-angled retractor, used for retracting the cheek, tongue and the mucoperiosteal flaps.

Austin retractor

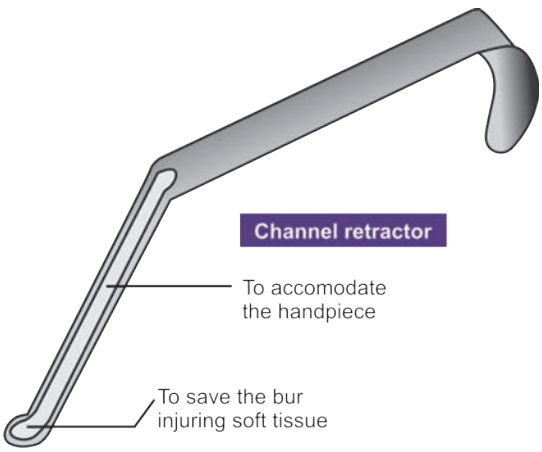
Langenback's Retractor: It has a long handle and an 'L' shaped blade. It comes in different sizes. It is used in surgical procedures to retract the tissues.



Cat's Paw Retractor: It is used to retract small amounts of tissue with little force, too much force will tear the tissues.



Channel Retractor: These retractors are designed to accommodate the handpiece. Thus, there is the safety of retraction and availability of space for working the handpiece. Used in orthognathic surgery.



Tongue Depressor: It is an 'L' shaped instrument. It has a broad smooth blade for depressing the tongue.

This instrument is also useful to visualize the tonsil, retracting the tongue during intraoral procedures.

Mandibular Retractor: This retractor is used while performing surgeries on the mandible.

Mandibular retractor

BONE CUTTING INSTRUMENTS

Bone File: Used to smoothen the rough surface of bone as in alveoloplasty.

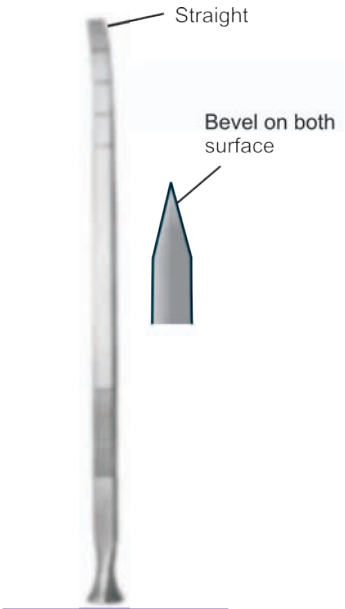
These work in one direction only with a pull movement. They are used with light finger pressure on one end or a heavier thumb pressure on the other end.

Bone file

Chisel: These instruments have a beveled and a flat surface. They are used with the bevel towards the surface of the bone that is to be sacrificed. Thus, making sure that a clean cut bone edge is left behind. The chisel must be held at right angle to the bone surface.

Chisel

Osteotome: This is a bi-beveled instrument. It is used in surgeries where splitting of bone is required. Different shapes and sizes are available. It is used in orthognathic surgeries where it is necessary to preserve both the parts of the split bone.



Osteotome

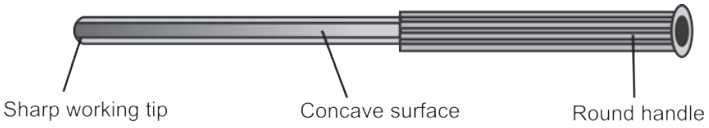
Pterygoid osteotome

Pterygoid Osteotome: This is used in maxillary osteotomies, wherein the splitting of the pterygoid plates from the maxilla are required. The end of this osteotom is bent at an angle to facilitate its use through the oral cavity.

Mallet: It is used to give controlled taps on chisel, osteotome or bone gouge. They are made of wood, rubber, nylon or stainless steel. It should be used with sharp pulled-out movements. In oral-surgery a 6 inch mallet is usually used.

Mallet

Bone gouge: It is used for removing cancellous bone for grafting procedures. For entering the maxillary sinus during caldwell Luc procedure. To remove irregular pieces of bone.



Rongeur Forceps: These forceps are used to remove bone. They have curved handles with spring action that increases the efficiency of the instrument. They are also referred to as 'bone nibblers' as they nibble out bone. The tip has concave inner surface and is angulated forward from the handles. They may be only side cutting or side and end cutting types. They are used to trim sharp bony margins during alveoloplasty. To nibble out small, sharp pieces of bone after surgical procedure.

Beyer rongeur

Cleveland bone cutting forcep

Bone Cutting Forcep: They are very similar to the rongeur forcep, except its tips have sharp cutting edges. They only work with side cutting action. They are used to remove sharp bony projections.

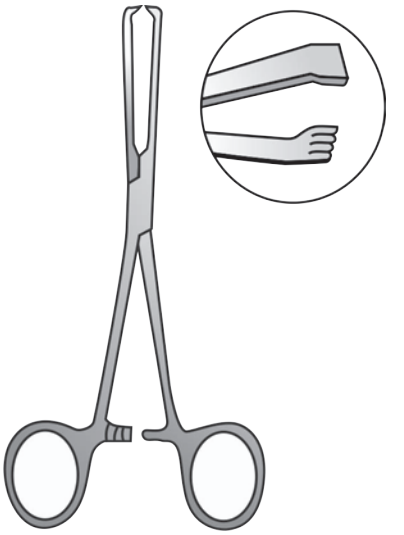
FORCEPS USED ON SOFT TISSUE

Hemostat or Artery Forceps: A hemostat is used to clamp and control bleeding from torn blood vessels until it can be controlled by other methods. Smaller vessels may simply be crushed but the larger vessels need to be ligated. They are of the straight and curved types. The small hemostats are referred to as 'mosquito forceps'. These forceps have a locking handle.

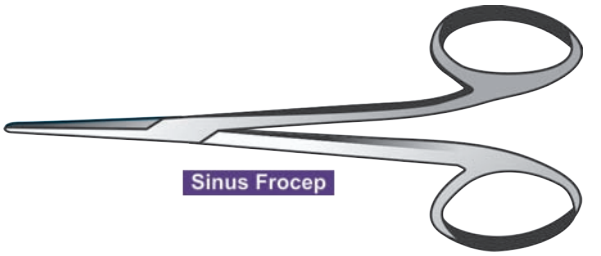
Straight and curved artery forcep

Mosquito forcep

Allis Tissue Holding Forcep: These forceps have a locking handles. The tips have teeth that grip the tissue firmly and allow it to be placed in the proper position. They are never to be used on soft tissues that are to be left behind or in the oral cavity as the teeth cause a lot of tissue destruction. These forceps are specially used where a large amount of fibrous tissue is to be removed. They can be used to retract tissue from surgical field by locking on to the subcutaneous tissue.



Lister's Sinus Forcep: These forceps are designed without a locking device. They are used for probing and forcing an entry into an abscess cavity. This forcep can be opened inside the abscess cavity.

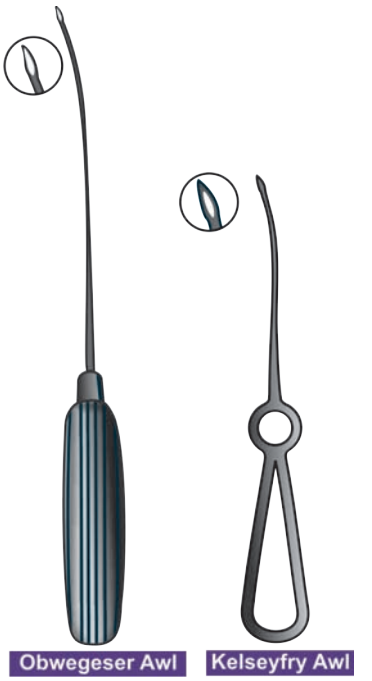


OTHER INSTRUMENTS

Awl: These instruments that are long needle shaped with a handle for easy manipulation. They have an eyelet at the tip through which wires are passed. These instruments are used for circumferential wiring.

Zygomatic Awl or Obwegeser Awl: It is longer and is used for circum-zygomatic wiring.

Mandibular Awl or Kelseyfry Awl: It is smaller and is used for circum-mandibular wiring.



Skin Hooks: This instrument is used to stretch the skin while suturing of the skin is being done. This has a hook at its end that gets engaged to the skin at the incision corner.

Skin hook

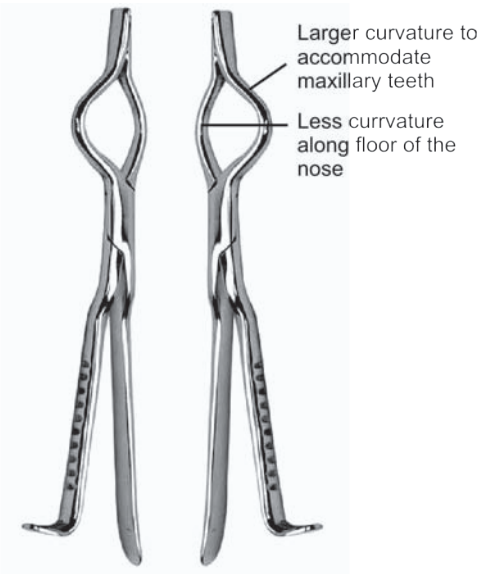
Mouth Prop: It is a device for maintaining the jaw of a patient in an open state. It consists of vertical blocks of rubber that have concave surfaces to accommodate the mandibular and maxillary posterior teeth. Blocks of different sizes are attached to each other with a chain.

Molt curette

Double ended curette

Curettes: These instruments are sharp, spoon-shaped used to clear the lining out of the bony cavities as in cyst enucleation. They are available in different sizes to be used in different sized cavities. They are also available as single ended or double ended curettes.

Rowe's Disimpaction Forcep: The instrument is used in pairs for the reduction of maxilla in Le Fort fractures to disimpact the impacted maxilla.



Rowe's maxillary disimpaction forceps

Suction tip: This tip is used to suck out the blood/saliva during the surgical procedure. This helps to clear out the surgical field. One end is attached to the sterilized rubber tube which inturn is attached to the suction machine.

Suction tip

Boyles Apparatus

This machine is used to maintain a patient under general anesthesia.

Endotracheal Tube: It is a flexible plastic tube that is put from the mouth/nose into the trachea. The tube is inserted in direct vision with the help of a laryngoscope.

Laryngoscope: It is used to look into the larynx. It is inserted through the mouth into the upper airway. It is used during endotracheal intubation to give GA to have a direct visualization the vocal cords.

Chapter

3

Principles of Suturing

SUTURING MATERIAL AND TECHNIQUES

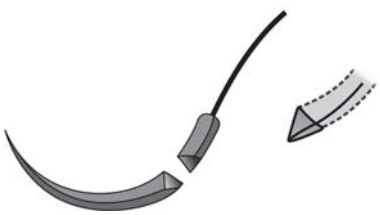
NEEDLES

Needles are of two shapes, straight and curved.

Curved in turn are of tapering and cutting types.

The straight needle require large space for manipulation and are of little importance to an oral surgeon.

The curved cutting needle are: (a) conventional or (b) reverse cutting type.



The conventional has one of its cutting edge on the curved inner surface.

Reverse cutting has a flat inner surface.

The curved needles can be either swaged or eyed.

i.e. suture material is inserted into the hollow of the needle by the manufacturers.

i.e. the suture has to be threaded.

SUTURE MATERIALS

These are meant to hold the incised/lacerated tissue together till healing takes place. They are available in different sizes, and are numbered according to the thickness of the suturing material, e.g. 3-0 or 5-0. As the number increases the suture material becomes finer.

Suturing materials are classified into two types.

i. Absorbable and
ii. Non-absorbable.

Absorbable Materials

They are made of natural and synthetic material. These materials lose their tensile strength within 60 days. They are acted upon by the enzymes of the body. They are made of the natural or the synthetic material.

Natural Absorbable Materials

- Catgut
  - This material is made from the sheep serosa.
  - It is commonly used and is available as plain and chromic.
  - This material is kept in isopropyl alcohol which acts as a preservative.
  - The plain catgut is a little more difficult to use, as it is stiff and does not have a good knot holding characteristic.
  - The chromic gut is the catgut tanned in a solution of chromium salts causing an increase in strength, less stimulation to the tissue.
  - It retains its strength for 2 to 3 weeks.

- Collagen
  - This suture material behaves in the same way as the catgut suture material.
  - This is also available in plain and chromic form.
  - It is stiffer than catgut and therefore its handling is more difficult.
  - It is made by extruding homogenized tendon Achilles of beef cattle and are 100 percent pure collagen.
- Fascia lata
  - This material is obtained from the thigh muscle of beef cattle.
  - It can also be obtained from the thigh of the patient.
  - Earlier it was used in the repair of hernia.

Synthetic Absorbable Material

- *Vicryl (Polyglactic acid):* It is a co-polymer of lactide and glycolide, has a coating of polygalactin 370 and calcium stearate. This material has good handling and knot-tying capacity. It has a minimal tissue reaction. It is braided and comes in clear undyed or violet-dyed forms.
- *Dexon (Polyglycolic acid):* It is a polymer of glycolic acid. It has less tissue reaction than catgut. It has good tensile strength and knot-tying capacity.
- *Polydioxanone (PDS)*
  - Polydioxanone is a polymer.
  - It is useful where extended wound tensile strength is required. It is a stiffer material.

Non-absorbable Materials

These are made of natural and synthetic materials.

Natural Non-absorbable Materials

- *Silk*
  - It is made from the cocoon of silk worm.
  - It is braided, has good handling and knot-tying.
- *Cotton:* This material is made from the pods of cotton plant.
- *Linen*
  - It is made from flax and is cellulose material.
  - It is twisted to form a suture material.

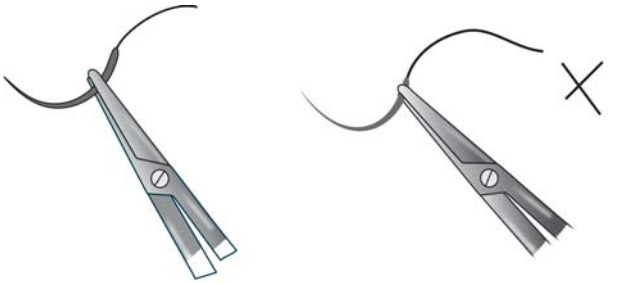
Synthetic Non-absorbable Suture Materials

- *Nylon:* It is the most common material used. It is monofilamentous. It has high tensile strength, minimal tissue reaction. Its main disadvantage is that a number of knots have to be tied as it has a tendency to open out.

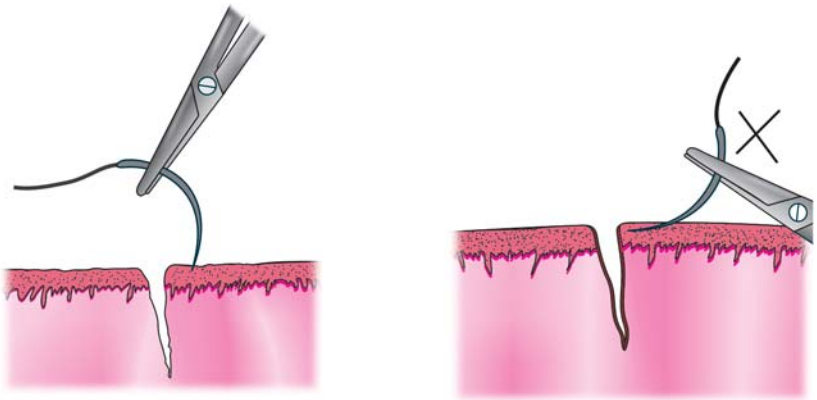
- *Polypropylene (Prolene or Surgilene):* It is an extremely inert material. Its tissue reaction and tensile strength is like that of nylon. It stretches to accommodate the wound hence little cutting through the tissue.
- *Braided polyesters (Dacron, Ethiflex, Ethibond, Mersilene):* Braided polyesters are manufactured to provide the same high tensile strength and low tissue reactivity as the monofilaments. Due to the braiding there is an improvement in its handling and knot security. They are either coated or uncoated. Mersilene and Dacron are uncoated braided polyester.
- *Polybutester (novafil):* It is monofilamentous suture. It is made to be stronger, less stiff and possess lower coefficient of friction than nylons and polypropylene. This suture has the capacity to stretch 50 percent of its length at loads of only 25 percent of its knot breaking level. Due to this suture stretches once there is tissue edema, thus, it does not cut through the tissue and so less marking and scarring.

PRINCIPLES OF SUTURING

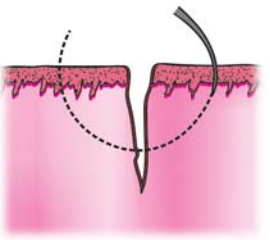
1. The needle should be held approximately 1/4th of a distance away from the threaded end as any closer to the suture end will cause its breakage.



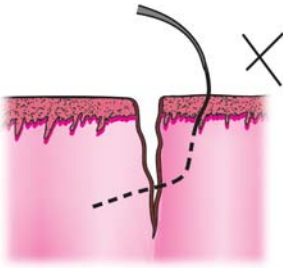
2. a. Needle penetration should be perpendicular to the tissue surface.
   b. On oblique piercing tissue may tear.



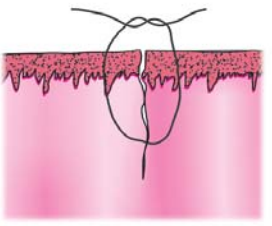
3. a. The needle should move in the tissue according to its curvature.



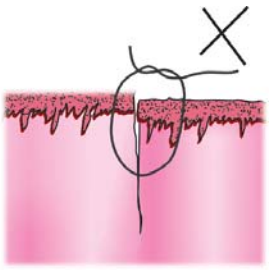
b. Any other movement may cause bending or breakage of the needle.



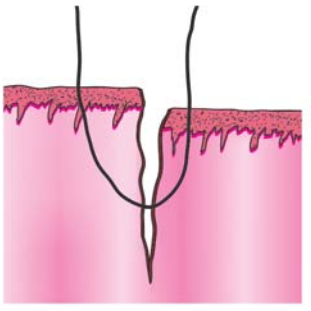
4. a. The suture should be placed at equal distance from both the cut ends approximately 2-3 mm.



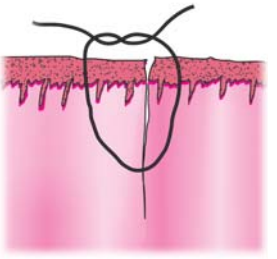
b. Unequal distance may cause the cut margins to lie at different levels.



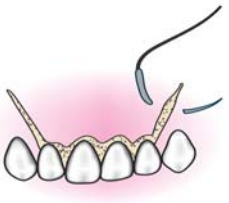
5. a. If the cut edges are at different levels, then passing of the suture closer to the edge of the lower side and further from the edge of the higher side.



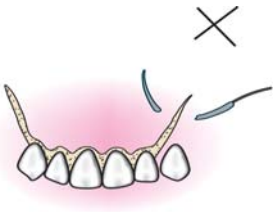
It will cause the approximation of the edges at the same level.



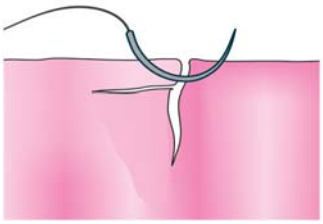
6. a. The needle should always be passed from free flap to the fixed tissue.



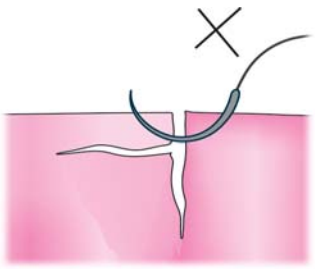
b. Not from the fixed to the free side.



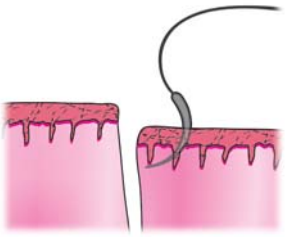
7. a. The needle should be passed from the thinner to the thicker side.

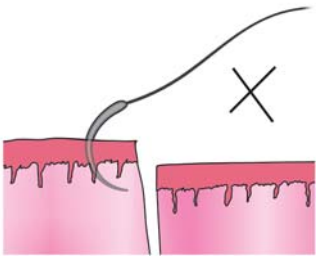


b. Not from thicker to thinner side.

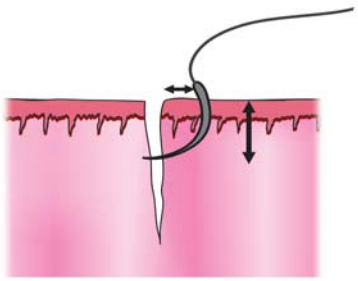


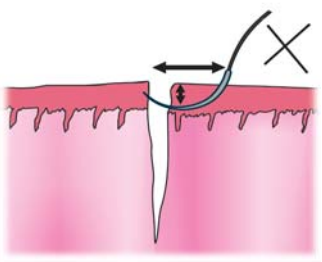
8. The needle should be passed from the deeper to the superficial side.





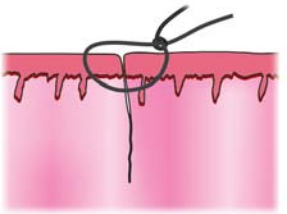
9. The depth of needle penetration shoul be greater than the distance from the tissue edge.

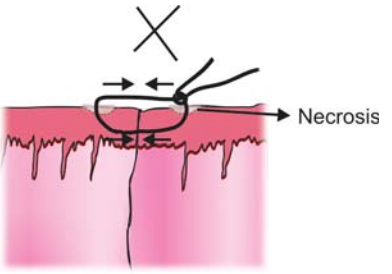




10. a. The tissue should not be crossed under tension.

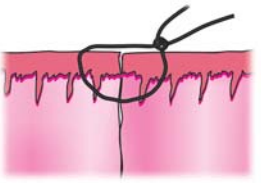
b. Tension will cause necrosis around the suture.

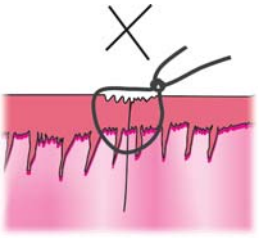




11. a. The tissue should be approximated.

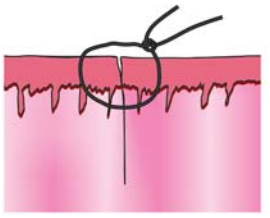
b. Not blanched.

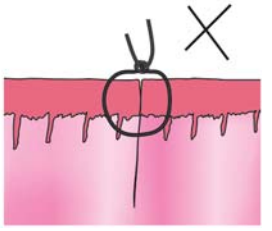




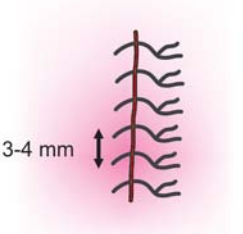
12. a. The knot should be placed away from incision line.

b. Not on the incision line.

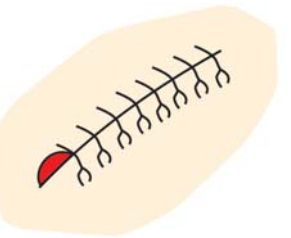




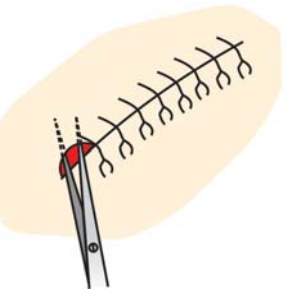
13. Normally suture should be placed about 3-4 mm apart.



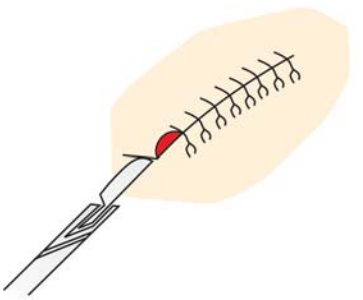
14. a. If extra tissue is present on one side,



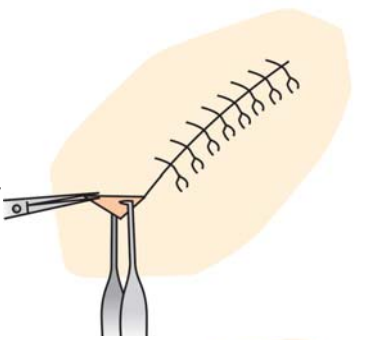
b. then undermine the excess tissue,



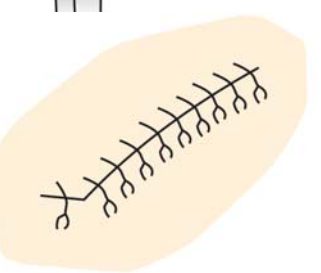
c. incise at approximately 30 degree angle,



d. excess tissue is placed over incision and excised,



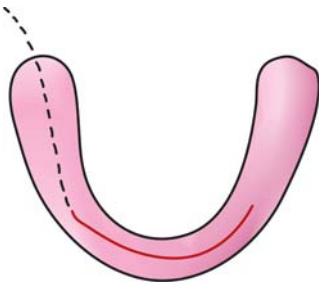
e. incision sutured.



FLAP DESIGNING

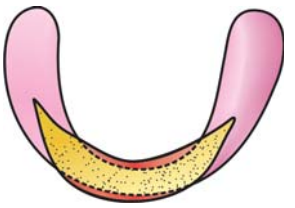
Envelop Flap

In this flap, an incision is made such that it will divide the interdental papillae then run along the necks of standing teeth,



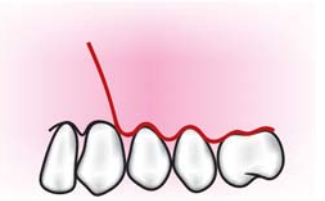
or in an edentulous ridge this incision is made along the ridge.

This incision line will allow the buccal and/or lingual mucoperiosteal flap to be raised, just as an envelop.



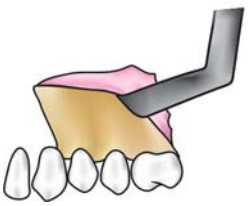
This type of flap is generally used in alveoloplasty, multiple root removal, etc.

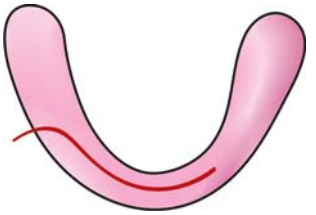
Triangular Flap or Two Sided Flap



If a second incision is added at the end of the crestal incision along the buccal side, the flap raised will be triangular. It allows sufficient space for many small dentoalveolar procedures.

It is easily retractable can be easily put back by simple suture.



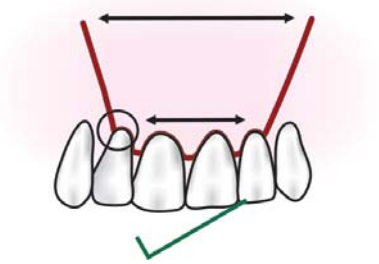


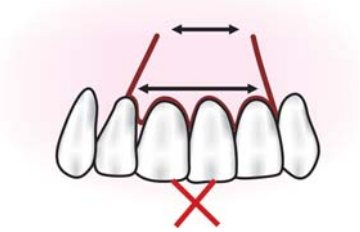
Three Sided Flap

To the same crestal incision, two vertical incisions are added one on each side. Care being taken to include interdental papilla at both the ends of the flap, this will facilitate suturing when the flap is being repositioned.

Care to be Taken

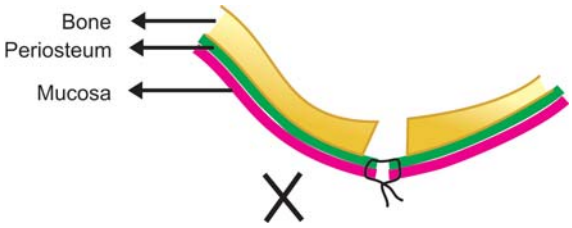
- The flap should include the interdental papillae.
- The base should be wider than the crestal incision.



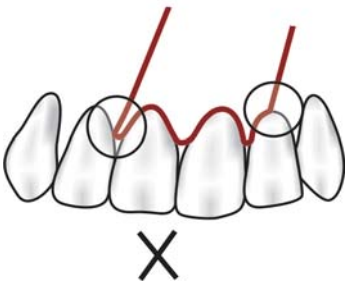


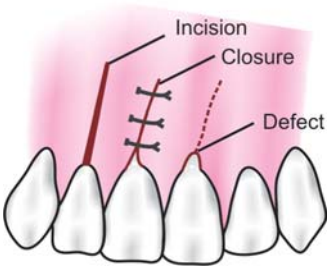
- The angle at the gingival margin should be no more than 100 degree otherwise a very narrow strip of attached gingiva shall remain which can get necrosed.

- The incision line should never lie over a cavity. It should be so planned that after the surgery the suture lie on healthy bone.



- The incision should never be made either from the center of the interdental papilla or from the center of the cervical region.





Defect following cervical incision

As there may be difficulty in replacing the flap or healing will leave a defect cervically.

Semilunar Incision/Flap

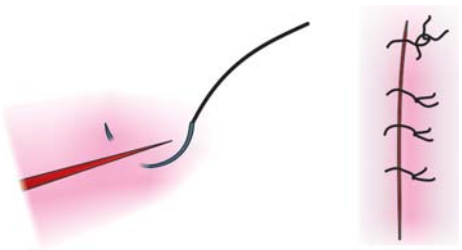
It is an incision sometimes used in cases of apicoectomy. Care is to be taken not to make it too close to the gingival margin, never less than 1/3 of the depth of the sulcus. If the remaining strip of gingiva is less, its blood supply will be compromised, causing it to slough. Sometimes, it is difficult to predict the size of the cyst and therefore the flap may be small and the cystic opening larger creating problems and therefore careful evaluation should be done before making this incision.

Suturing Techniques

1. Simple Interrupted

This is the most often used type of suture. It has advantages over the other forms of suturing, e.g.

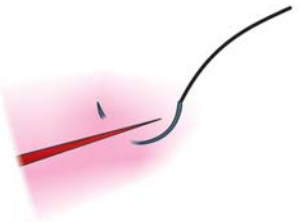
- As each suture is made individually the depth and length of each bite can be adjusted according to requirement.
- If for some reason, e.g. infection, sutures are to be removed. It is not necessary to remove the complete suturing, the removal of only a few is sufficient.
- If there is a break or loosening in a suture it does not affect the others.



- In this type of suturing the needle is passed from one side to the other side of the incision and the knot-tied.

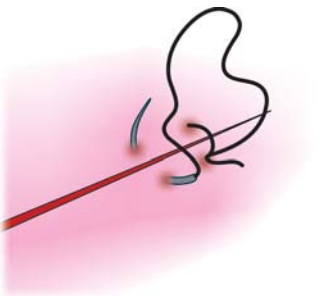
2. Continuous

In this technique suturing is started from one end, and closed at the other end of the incision.

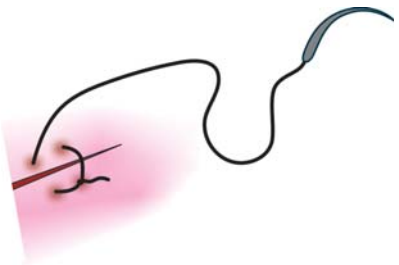


The needle is passed from one side of the cut end, and pulled out through the other.

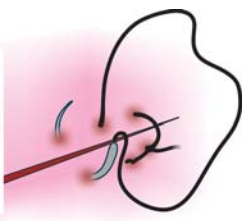
The knot is tied away from the incision line and the free end is cut.



The needle is then passed through the same side and brought out of the other side of the incison line.

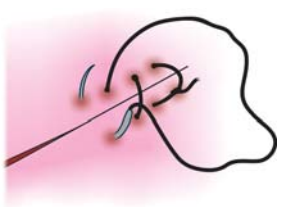


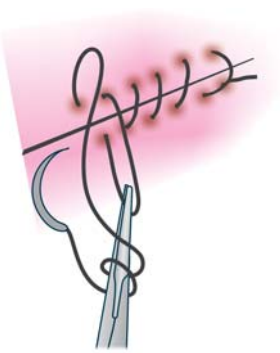
The thread is then pulled.



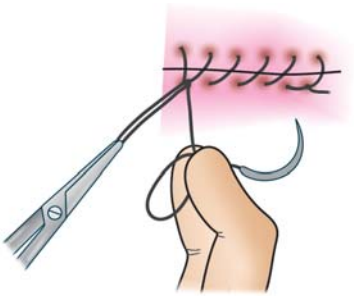
The needle is again passed from the first side and pulled out of the other side of the incision line.

The procedure is repeated till the other end of the incision line is reached.





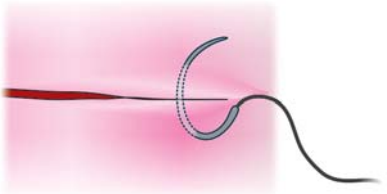
For closing the last stitch is pulled and held by the needle holder and the knot-tied around it.



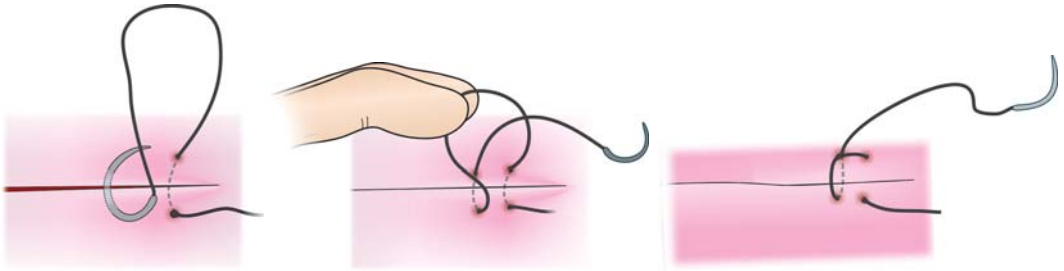
Never should the two ends be tied like this.

3. Continuous Interlocking

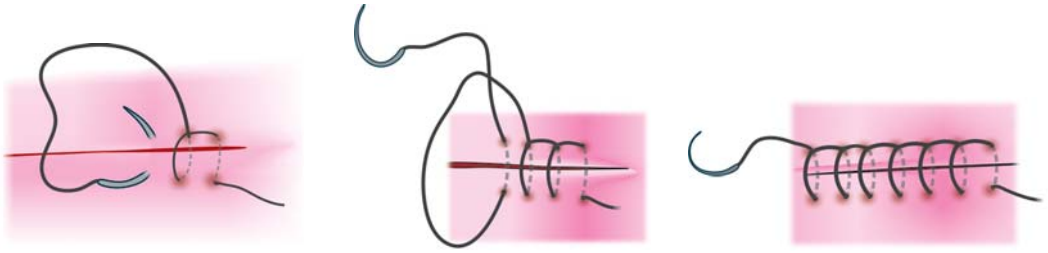
The starting of this technique is done exactly as in the continuous type of suturing.



The needle is then passed through the loop, and pulled.

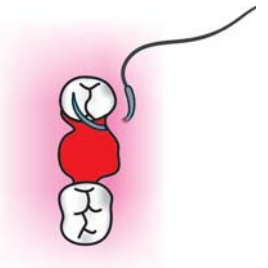


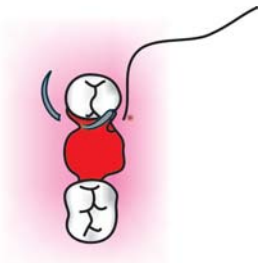
This procedure is repeated till the end of the incision, and the knot-tied.



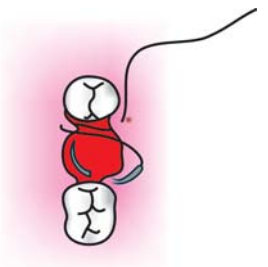
4. Figure of Eight

This type of suture is applied in cases like extraction socket. As it provides protection to the blood clot. The needle is passed from one interdental papilla (say medial) on the buccal side,

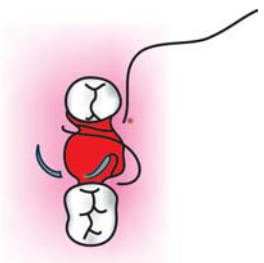




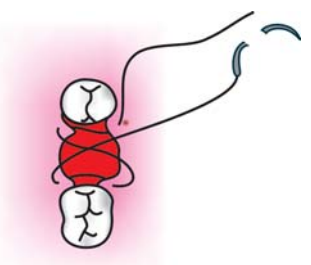
and then it is passed through the interdental papilla of the palatal side, (mesial) making the 1st stitch horizontal.



Then the needle is passed through the distal interdental papillae of the opposite side, i.e. buccal.

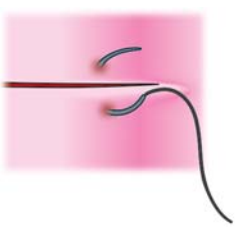


Finally, the needle is pulled through the distal papillae of the palatal side.

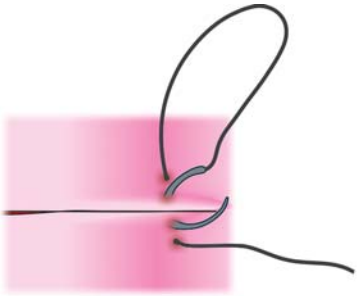


The knot is tied on the buccal side making a perfect eight.

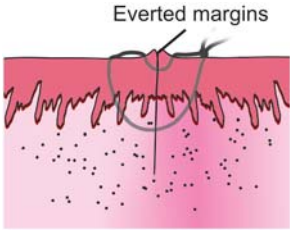
5. Vertical Mattress



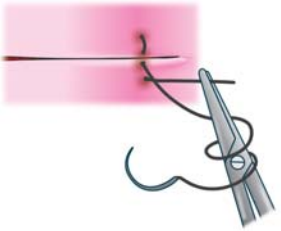
This technique of suture is to be used when eversion of margins at the edges are required. The 1st bite is taken exactly like in interrupted suturing.



Then the needle is passed back from the same side as the one from which it was pulled. But closer to the incision line.

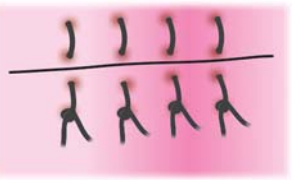


Care being taken to keep the second bite, in the same line as the 1st bite.



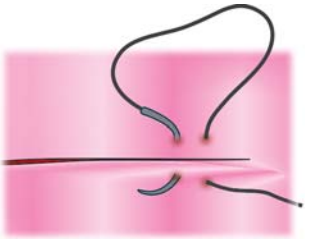
The first bite should be deeper than the second.

This will evert the margins of the incision line when the knot is tied. Ensuring proper healing. Many such sutures can be given or can be used along with simple interrupted sutures.



6. Horizontal Mattress

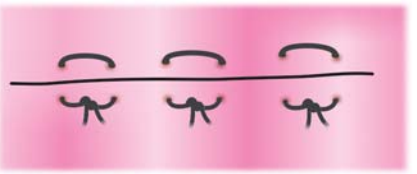
These sutures have the similar advantage, i.e. of eversion of the margins. The 1st bite is taken in the usual manner.



The returning bite is taken from the same side, but a little distance away from the 1st.

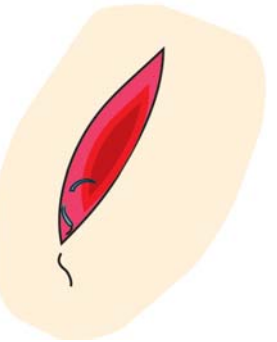
The knot is tied allowing the margins to evert.

Its disadvantage is that if not done correctly it can constrict the blood supply leading to the necrosis of the edges.

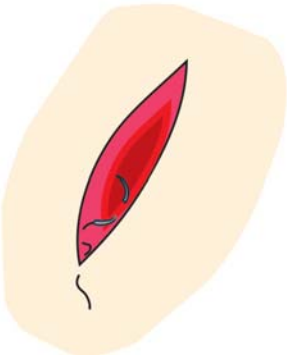


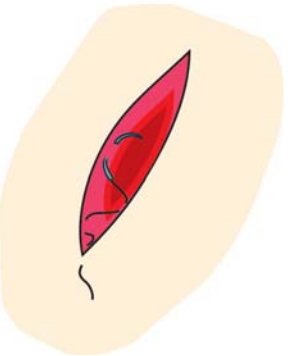
7. Subcuticular

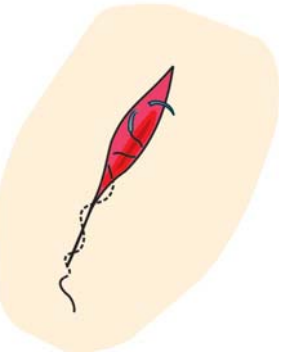
This type of suturing is done for cosmetic results where even the minute needle puncture marks are to be avoided over the skin. The first bite is taken from the skin and then the second bite is taken just under the cuticle of one side of the incision.



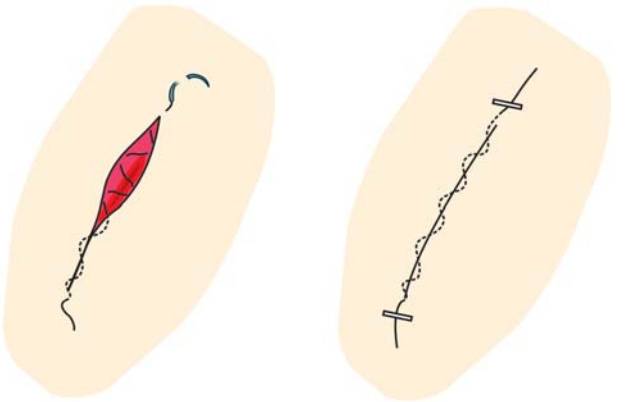
The next on the other side in a continuous manner. Care being taken to take each bite just under the skin.





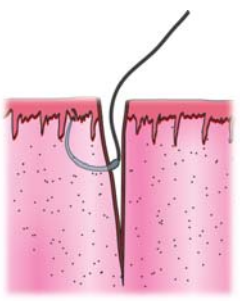


When the suturing is complete the last stitch is also taken on to the skin and the two ends of the suture pulled. This will bring the approximation of the lacerated skin. Tapes can be applied at the two ends. This suture can be removed by pulling from one end.

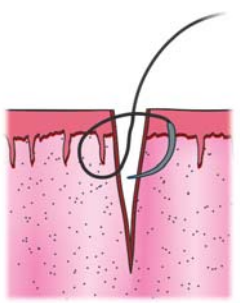


Difference between Submerged Suture and Skin Suture

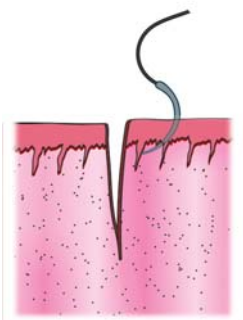
The first bite is taken on the deep surface and brought out just under the skin.



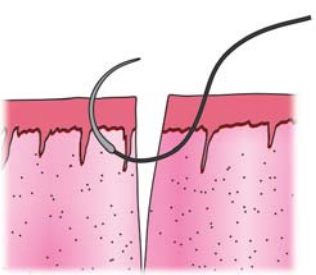
Then the needle is passed from just below the skin and brought out on the deep tissue.



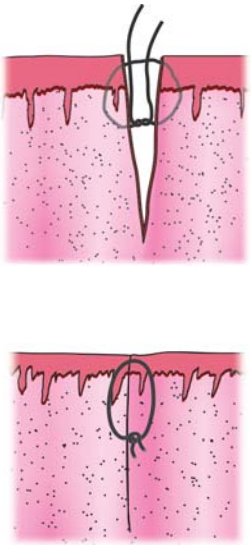
The first bite is taken on the skin surface.



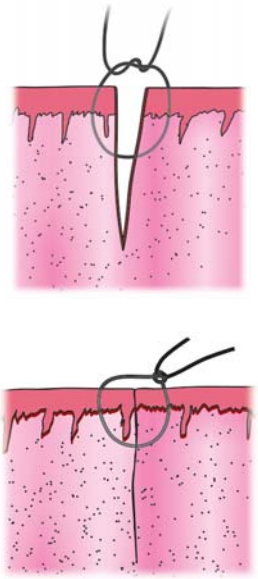
Then from the deep surface back to the skin surface.



The knot is tied which lies embedded under the tissue, i.e. submerged.



The knot is tied that lies over the skin surface, i.e. skin suture.



Chapter

4 Impaction

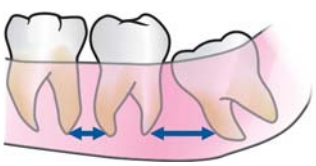
DEFINITION

A tooth that is partially erupted or unerupted, beyond the chronological date of eruption, and will not assume a normal relationship with the other teeth and tissue is refered to as impacted.

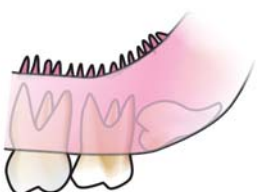
Order of Frequency

The teeth that are impacted are generally the mandibular 3rd molars but the maxillary molars and cuspids can all get impacted. The order of frequency is:

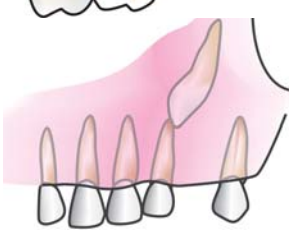
1. Mandibular 3rd molars.



2. Maxillary 3rd molars.



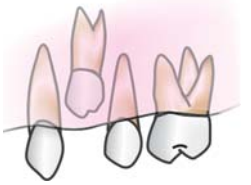
3. Maxillary cuspids.



4. Mandibular bicuspids.

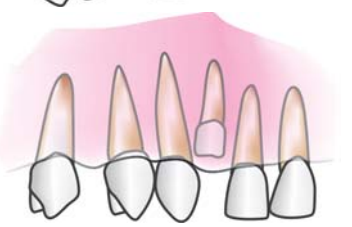
5. Mandibular cuspids.

6. Maxillary bicuspids.



7. Maxillary central incisors.

8. Maxillary lateral incisors.

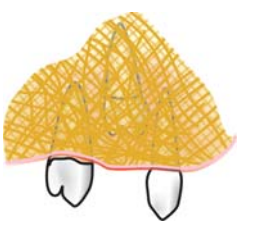


Maxillary and mandibular 1st molars rarely impacted.

Causes of Impaction

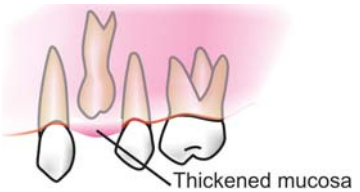
Local Causes (according to Berger)

1. Irregularity in the position and pressure of an adjacent tooth.



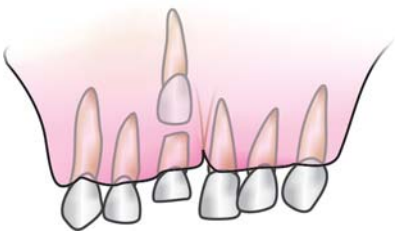
2. The density of the overlying or surrounding bone.

3. Longstanding chronic inflammation, with resultant increase in density of overlying mucous membrane.

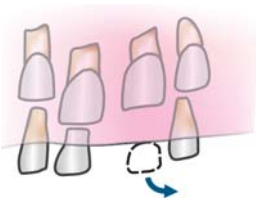


4. Lack of space due to under-developed jaw. Arch length and tooth size discrepancy.

5. Over-retained primary teeth.

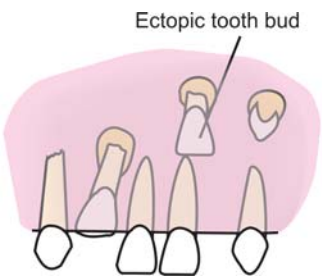


6. Premature loss of the primary teeth.



7. Acquired diseases, e.g. necrosis due to infection or abscesses.
8. Inflammatory changes in the bone due to exanthematous diseases in children.
9. Abnormal path of eruption of the tooth, due to traumatic forces, during the eruption period.

10. Ectopic position of the tooth bud.



Systemic Causes (according to Berger)

1. Prenatal
   a. Heredity
   b. Misconception
2. Postnatal
   a. Rickets
   b. Anemia
   c. Congenital syphilis
   d. Tuberculosis
   e. Endocrine dysfunctions
   f. Malnutrition
3. Rare conditions
   a. Cleidocranial dysostosis
   b. Oxycephaly
   c. Progeria
   d. Achondroplasia
   e. Cleft palate.

Indications for Removal of Third Molar

1. For preventing the development of periodontal diseases. The mere presence of an impacted 3rd molar decreases the amount of bone on the distal aspect of the adjacent 2nd molar and the gingivitis causative bacteria have access to a large portion of root surface causing severe periodontitis.

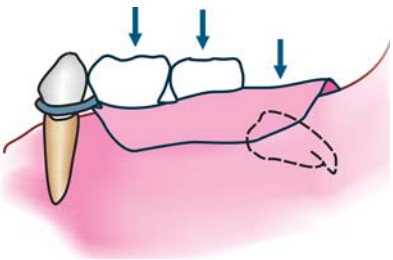
2. For preventing dental caries in the distal aspect of 2nd molar or mesial aspect of 3rd molar.

3. For preventing pericoronitis, which is an infection of the soft tissue around the crown. This happens when the resistance of the patient is low.

4. For preventing root resorption of adjacent tooth.

5. For preventing the formation of pathologies like the odontogenic cysts and tumors. Although in most patients the dental follicle maintains its original size rarely it may undergo cystic degeneration forming a dentigerous cyst or keratocyst.

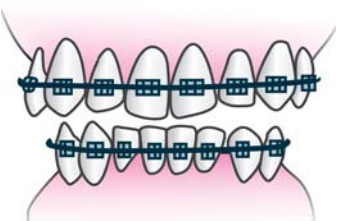
6. For preventing ulceration or pain under a prosthetic appliance. As after extraction and placement of denture there is slow resorption of alveolar bone, the impacted tooth becomes closer to the surface. The overlying soft tissue is compressed by the denture resulting in ulceration and pain.



7. For treating unexplained pain. When no other cause is found removal of 3rd molar often relieves the pain.

8. For preventing fracture of the mandible, in case the tooth is too large and weakens the mandible.

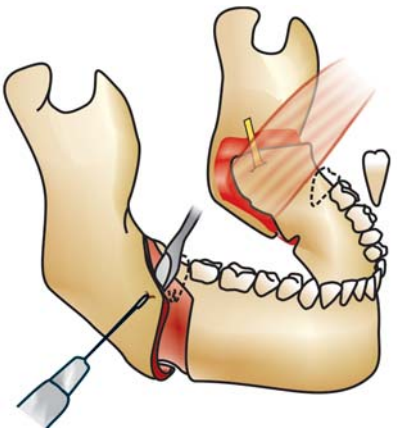
9. For facilitating orthodontic treatment. If the 3rd molar interferes with retraction of the anterior teeth, it is recommended that prophylactic removal should be done.



10. When caries have developed in an impacted tooth and the tooth is unlikely to be usefully restored.

11. Removal of a 3rd molar may be indicated prior to orthognathic surgery, e.g. when sagittal split osteotomy is planned.

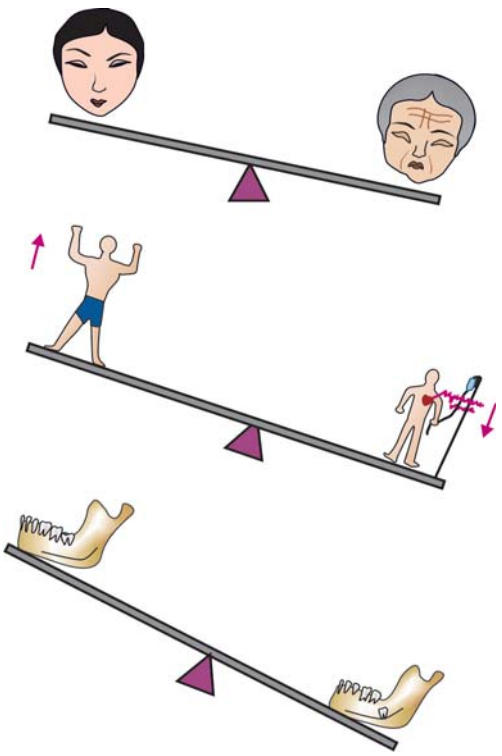
12. Prophylactic removal in presence of specific medical and surgical condition. For example, bacterial endocarditis, organ transplant, radiotherapy, etc.



Contraindications for Extraction of Impacted III Molar

All impacted teeth are to be removed unless specific contraindications justify leaving them as they are. If the benefits are less than the complications extraction should be avoided.

1. Advanced age is the most common contraindication. As age increases bone becomes more calcified and hence less flexible. Therefore, any pressure will increase the chances of bone/tooth fracture.
2. Compromised medical status. If the tooth is asymptomatic its extraction in a medically compromised patient should be avoided. But if extraction is indicated then it should be done with the consent of his/her physician.
3. If extraction jeopardizes adjacent structure, e.g. nerve, tooth, etc. then it should be avoided, unless absolutely indicated.



4. When there is adequate space, unerupted teeth should be left as such and wait for their natural eruption.

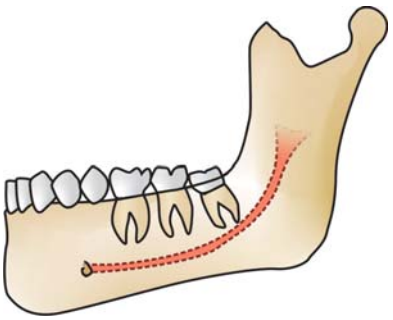
5. Partially impacted teeth that can be used as abutments in the construction of fixed prosthesis.

CLASSIFICATION OF IMPACTED MANDIBULAR THIRD MOLAR

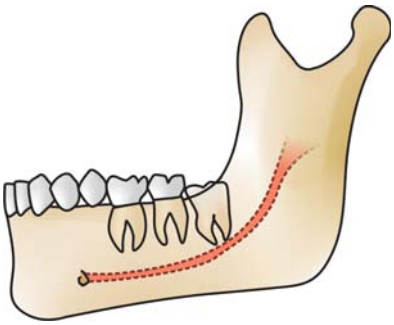
Pell and Gregory's Classification

A. Relation of the tooth to the ramus of the mandible and the second molar:

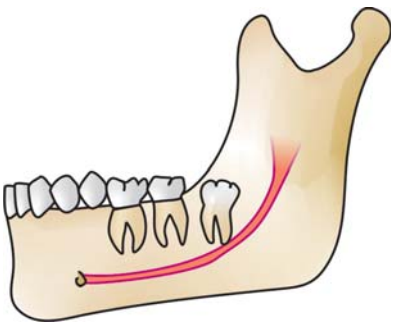
Class I: There is a sufficient amount of space between the ramus and the distal surface of the second molar for the accommodation of the mesiodistal diameter of the crown of the third molar.



Class II: The space between the ramus and the distal surface of the second molar is less than the mesiodistal diameter of the crown of the third molar.

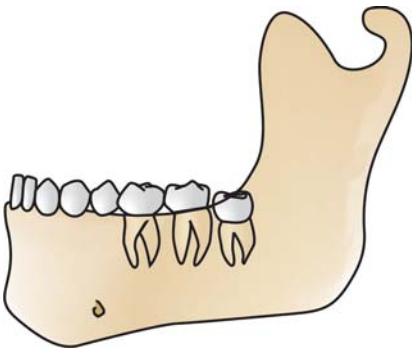


Class III: All or most of the third molar is located within the ramus.

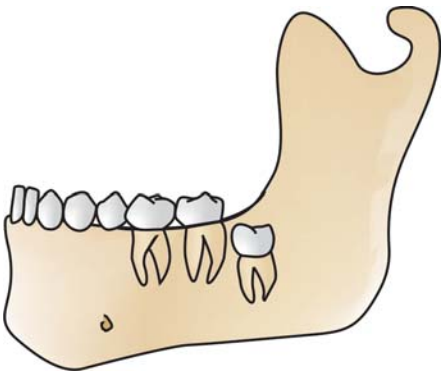


B. Relative depth of the third molar in bone:

Position A: The highest portion of the tooth is at level with or above the occlusal line.



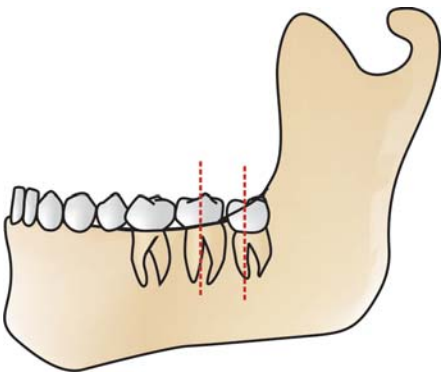
Position B: The highest portion of the tooth is below the occlusal plane, but above the cervical line of the second molar.



Position C: The highest portion of the tooth is below the cervical line of the second molar.

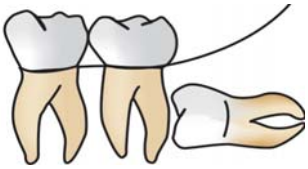
C. The position of the long axis of the impacted mandibular third molar in relation to the long axis of the second molar. This is included from Winter's classification.

Winter's Classification

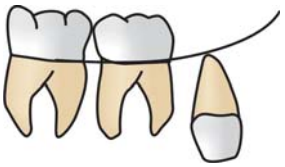


1. Vertical: The long axis of the impacted tooth is parallel to the long axis of the second molar.

2. Horizontal

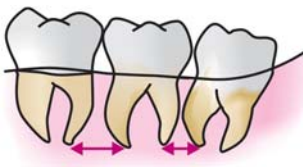


3. Inverted

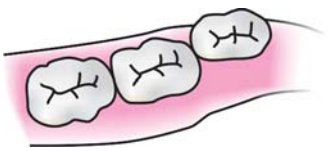


4. Mesioangular

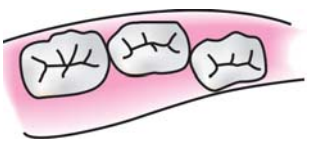
5. Distoangular



6. Buccoangular

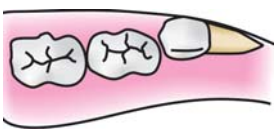


7. Linguoangular

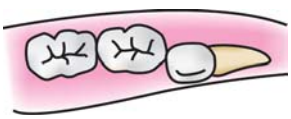


All of these may occur in

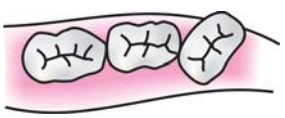
a. Buccal version



b. Lingual version



c. Torsion



Based on the nature of the overlying tissue:

i. *Soft tissue impactions:* Dense, fibrous tissue overlying the teeth sometimes prevent eruption.
ii. *Hard tissue impaction:* (e.g. when tilted teeth interfere with eruption)
iii. When eruption is prevented due to overlying bone.

Clinical Features

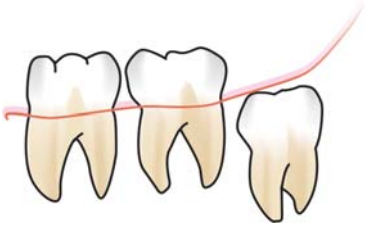
The patient with an impacted tooth that is infected may show:

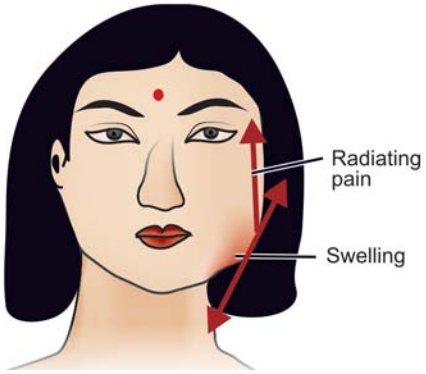
1. Swelling
2. Trismus
3. Pain
4. Fetid odor
5. Partially erupted 3rd molar or deep caries.

Clinical Assessment of a Patient

The patient should be carefully examined clinically and radiographically before the surgical removal of the impacted 3rd molar is attempted.

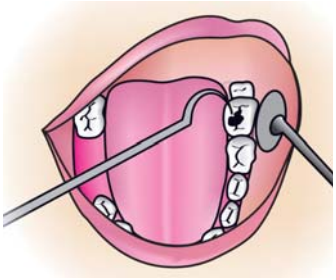
1. The eruption status of the 3rd molar and its position in the oral cavity should be carefully examined, as it gives us an idea of the amount of surgical time that will be required for its disimpaction.





2. Presence of infection. The patient may have infection, swelling and pain that could be radiating to the condyle, neck and mandible on the affected side or it could be limited in the form of pericoronitis around the erupting tooth. Antibiotic cover should be given before attempting the removal of the 3rd molar.

3. Caries present on the 3rd molar or its adjacent tooth, i.e. 2nd molar should be examined and the teeth restored. Sometimes, it is necessary to remove a badly carious 2nd molar and allow the 3rd molar to erupt without obstruction, so that it can be later used as an abutment for fixed prosthesis.



4. Periodontal condition of the adjacent teeth.

5. Regional lymph nodes should be palpated for infection.

6. Temporomandibular joint function should be assessed carefully because pain from an infected 3rd molar very often radiates to the TMJ causing limited movements.

Radiographic Assessment of an Impacted Tooth

- IOPA
- OPG
- Lateral mandibular 30 degree oblique.

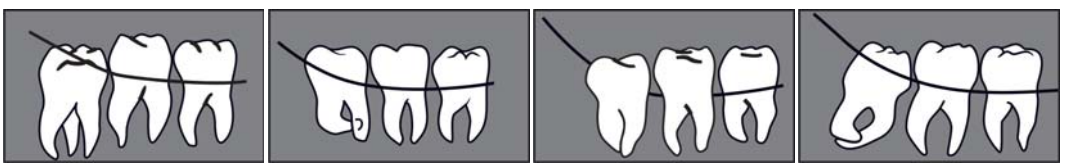
Any can be used to view and examine the position of impacted 3rd molar.

IOPA's can be used in most of the patients. Sometimes, however, the patient is unable to open the mouth wide enough to place the film due to infection, gagging sensation or pain. Sometimes, the film cannot be pushed far back to get the complete impacted tooth in the intraoral film or the tooth may be associated with a pathology, in these cases extraoral radiographs should be taken.

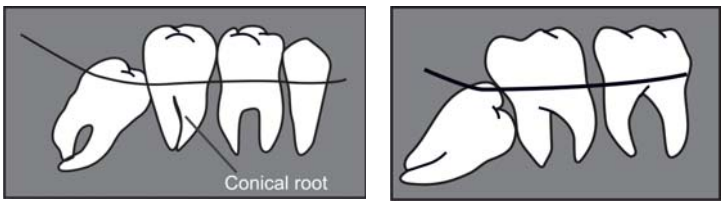
Information that the IOPA can be used for giving:

1. Inclination of the external oblique line gives us an idea about the access. If the inclination is steep (vertical) the access will be tough. But if the oblique ridge appears horizontal the approach to the impacted 3rd molar is generally easy.
2. The position and depth of the impacted tooth can be ascertained by George Winter's three imaginary lines drawn on an IOPA (details given below).
3. The shape of the root of the impacted 3rd molar should be viewed carefully on the radiograph.

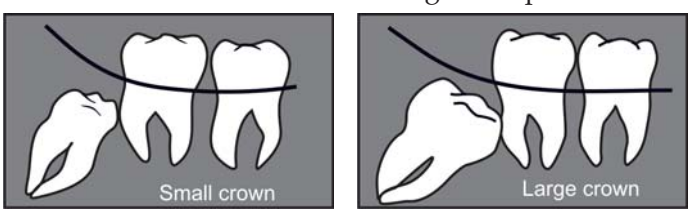
   The root pattern, their numbers, angulations all are important to decide the approach of the surgery. If the root is conical and tapering the extraction will be relatively simple. On the other hand if the roots are divergent, angulated and bulbous they tend to lock the bone and hence the extraction of such a tooth is difficult and splitting of the tooth has to be carried out.



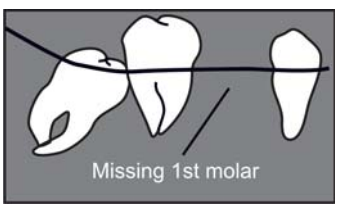
4. Position and root pattern of 2nd molar is an important aspect for consideration, as roots that are conical and thin will not have a lot of resistance, therefore care should be exercised not to let any force fall on the 2nd molar while trying to elevate the impacted 3rd molar. A 2nd molar with strong roots is less likely to get dislodged during elevation.



5. Shape and size of the crown of the impacted tooth is also important. If it is small and has flattened cusps, chances of its getting locked are less and extraction of the tooth is easier than the one whose crown is large with prominent cusps.



6. Presence of 1st molar will prevent the tilting of the 2nd molar if uncontrolled excess pressure is applied on the 2nd molar during elevation of the 3rd molar. Although its absence will surely allow the 2nd molar to get dislodged on application of excess pressure.

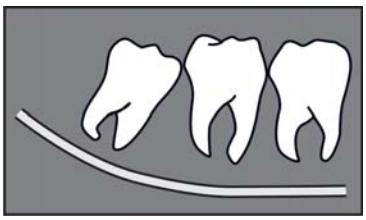


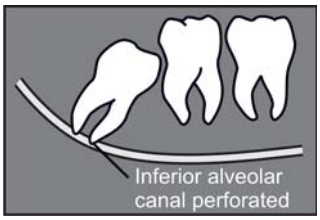
7. Texture of the bone around the impacted tooth can be examined for its trabecular pattern. Usually the bone that appears with large spaces and fine bone structures is generally elastic and extraction in these bones is generally easy, such bone structures are seen in young patients. The older patients have a more sclerotic bone that on the radiograph has smaller space and dense shadows.

Elastic bone with large spaces

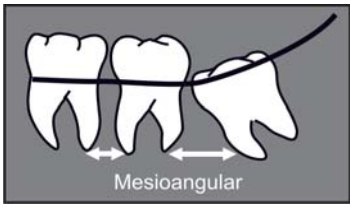
Sclerotic radioopaque bone

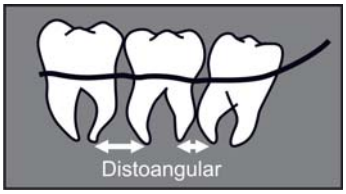
8. The inferior alveolar canal can also be viewed as a radiolucency often crossing the mandibular third molar. This appearance can be due to radiographic superimposition. Sometimes either grooving or even perforation of the root of the 3rd molar may be present. This is viewed as a band of decreased radio-opacity crossing the roots and coinciding with the outline of the inferior alveolar canal.





9. The angulation of the tooth can be assessed. A mesioangular tooth will have the crown closer to the 2nd molar and its roots will be further apart from the roots of the 2nd molar. The bony interface between the roots of the 2nd and 3rd molar is much more than the bone between the roots of the 2nd molar and the 1st molar. Whereas in a distoangular tooth, there will be very little space between the roots of the 2nd and 3rd molars. Also the Winter's white line will converge anteriorly.

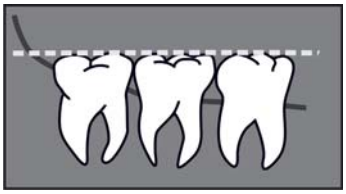


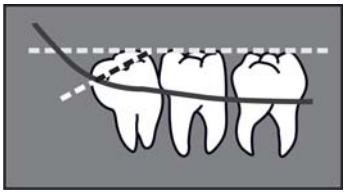


WAR LINES OR WINTER'S LINES

- George Winter's three imaginary lines are also known as the WAR lines.
- They are used to detect the position and depth of an impacted 3rd molar.

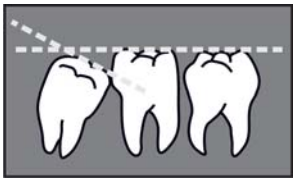
1. The 1st imaginary line is the Winter's white line which tells us about the inclination of the impacted 3rd molar. The white line is drawn on the IOPA along the erupted molars and extended posteriorly.



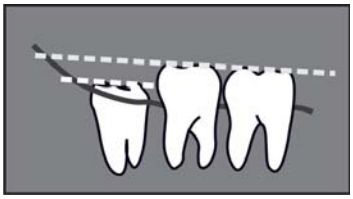


In case of the **disto-angular impaction** the line on the 3rd molar converges to meet the white line anterior to the 3rd molar.

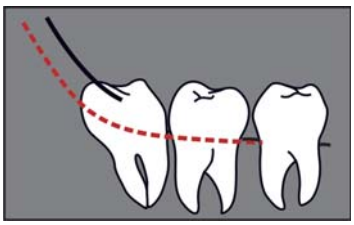
In case of mesioangular impaction the line on the 3rd molar converges to meet the white line posterior to the 3rd molar.

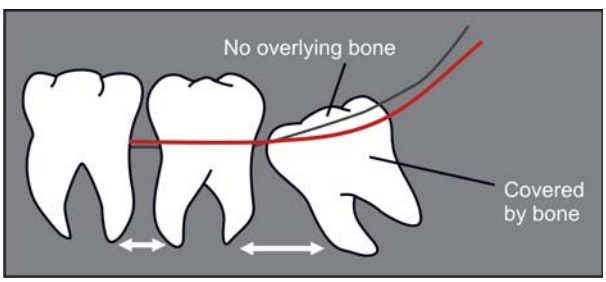


In the **vertically impacted** tooth the white line is parallel to the line drawn on the occlusal surface of the 3rd molar.



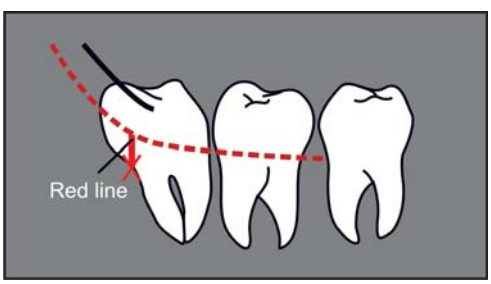
2. The 2nd imaginary line, the AMBER, is drawn along the shadow of the external oblique ridge that is lying distal to the 3rd molar and extended to the crest of the interdental bone of the molars.

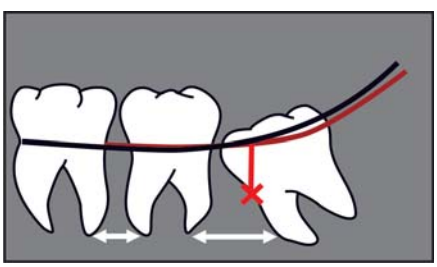




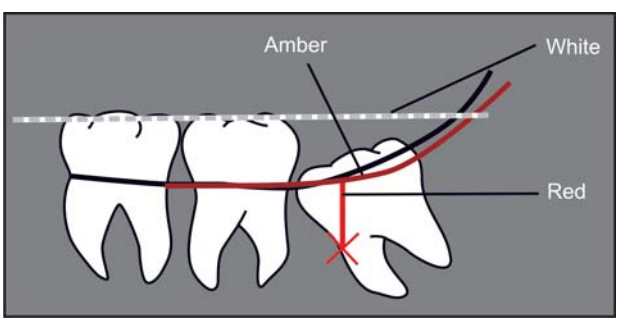
This line shows us the amount of crown that will be visible after reflection of the soft tissue, i.e. the portion which is above this line is not covered by the bone. The portion which is below this line is encased in the bone. This gives us an idea of the amount of bone cutting that will be required prior to the elevation of the tooth.

3. The 3rd imaginary line, is the red line which is used to measure the depth at which the tooth lies within the mandible. It is a perpendicular dropped from the amber line to an imaginary point of application for an elevator.





The length of the red line shows how deeply embedded the tooth is. The more the length the more difficult is the extraction.



SURGICAL TECHNIQUE FOR REMOVAL OF MANDIBULAR FIRST MOLAR

Anesthesia

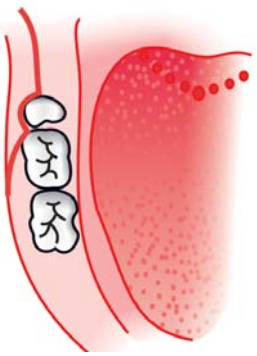
Generally local anesthesia is used. An inferior alveolar nerve block, lingual and long buccal nerve blocks are given.

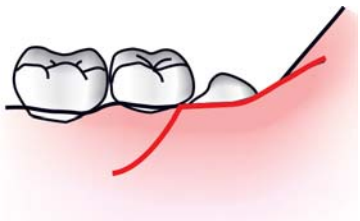
General anesthesia is indicated when the surgeon feels that the surgical time might get prolonged due to the deep seated impacted tooth, i.e. red line is more than 5 mm, or when two impacted molars have to be removed in the same sitting, etc.

The Incision

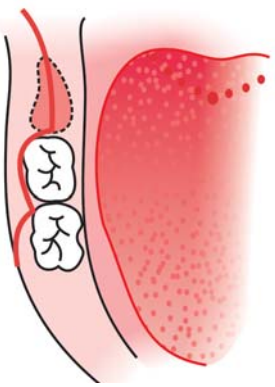
The incision for elevating the mucoperiosteal flap, runs from the distobuccal corner of the 2nd molar and ends anteriorly alongside the mesiobuccal cusp of the 2nd molar.

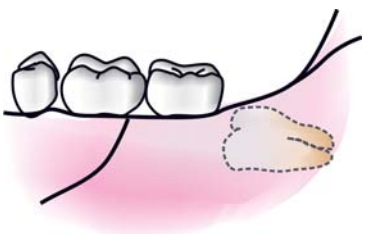
Care being taken not to extend the incision into the mucobuccal fold. It is then extended distally to the external oblique ridge, care being taken to make the incision buccally. Thus, the posterior part of the incision is made outwards as well as backwards.





A wider working area may be required in some patients, e.g. deep seated tooth, horizontal impaction, etc. in whom the incision can start from the distobuccal corner of the 1st molar.

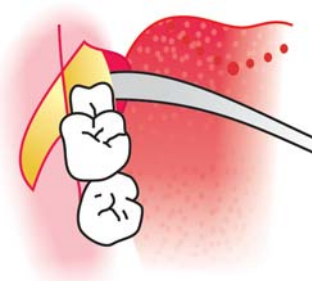




The Flap

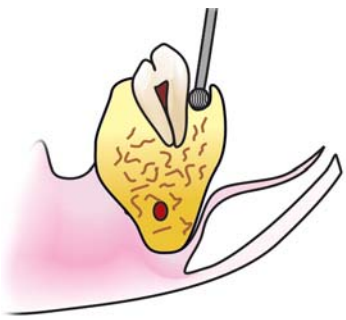
It is elevated and reflected, following all the general principles. Thus, making sufficient space for bone cutting.

Before cutting the bone, care should be taken to protect the lingual mucosa. A periosteal elevator can be passed between the bone and the lingual mucosa to protect the lingual tissues.



Bone Removal

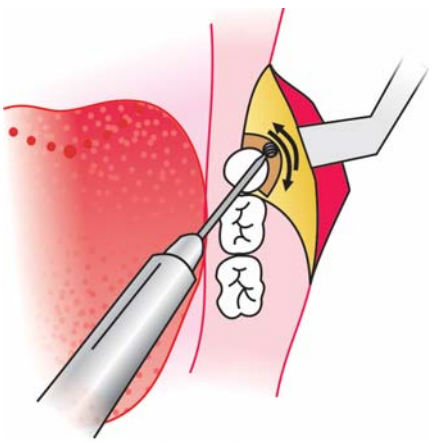
The bone cutting can be done using either chisel or bur or both. The bone should be removed buccally, distally and superiorly. While distal bone is removed the soft tissue must be protected with a retractor.



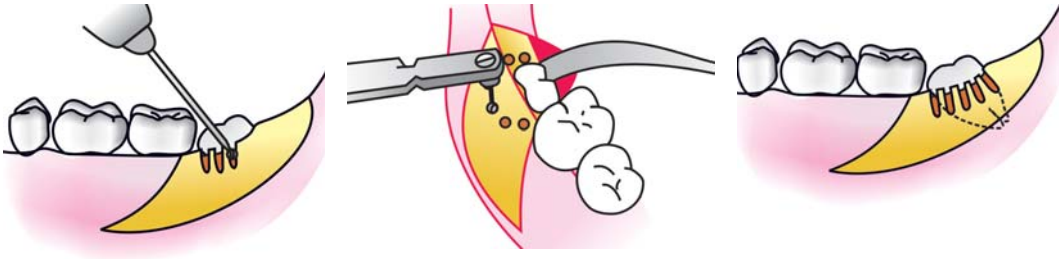
Using Rotary Instruments

The bur is used to create a space around the neck of the impacted tooth. The bone must be removed around the buccal and the distal aspect to expose the entire crown up to the cementoenamel junction. Great care being taken not to overheat the bur.

Guttering technique: A rose-headed bur is used to create a "gutter" along the side of the tooth. The bur should be made to run slowly under a steady flow of sterile water or saline.



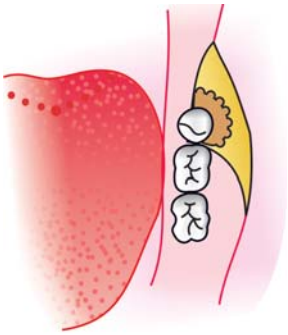
Postage stamp technique: In this technique a small round bur is used to make a series of holes outlining the portion of the bone to be sacrificed.



Round bur used to make holes

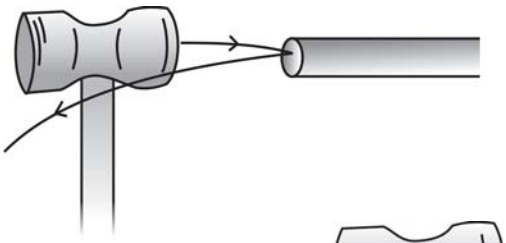
These bur holes are then joined by either a bur or chisel cuts.

Holes joined with a flatfissure bur

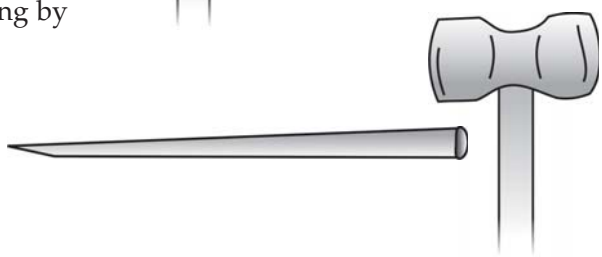


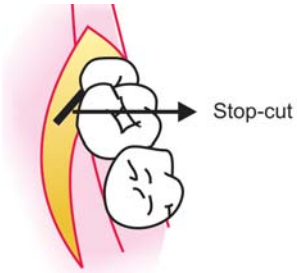
Using Hand Cutting Instruments

Chiselling is a quick clean method of removing young elastic bone. It should be avoided in patients with sclerotic bone or a tooth or root that is deeply embedded in thin atrophic mandible. Chiselling should be done with sharp-pulled out tapping by the mallet on the head of the chisel.



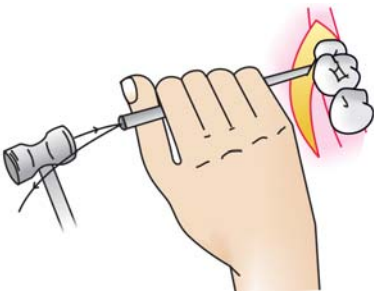
The chisel used, should be sharp.





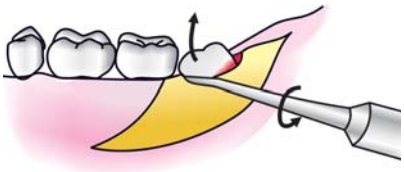
The 1st bone cut that must be made, is the vertical stop-cut. It is placed at the mesial end of the portion of bone to be removed.

The chisel is used with the bevel towards the bone to be sacrificed. The chisel must be held at right-angle to the bone surface. The tapping on the chisel should be done with a surgical mallet. The chisel must be given sharp light taps and not heavy blows.

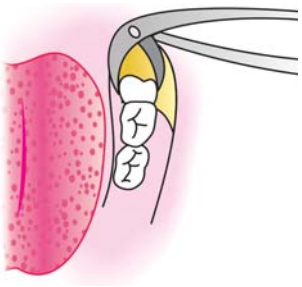


Removal of the Tooth

The bone should be removed in sufficient quantity to clear the crown of any obstruction. Also there should be sufficient space for the application of an elevator. The bone distal to the tooth should be sufficiently removed to make space into which the impacted tooth can be displaced while removing it. The straight elevator is applied mesially on the cementoenamel junction of the impacted tooth, and sufficient force applied so that it gets rotated and it can be then delivered out of the socket.

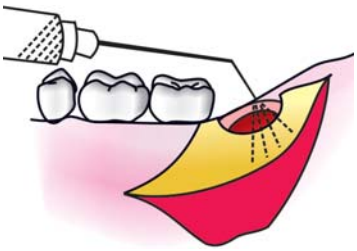


If required an extraction forcep can be used.



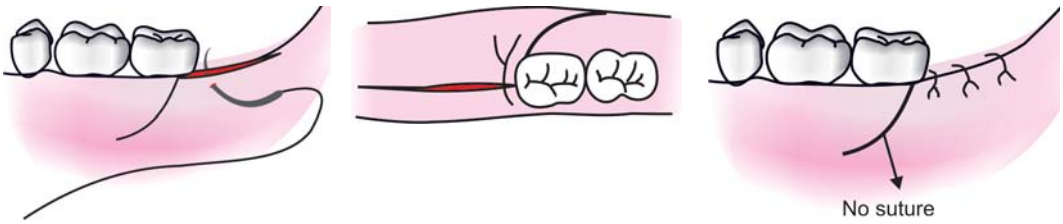
Wound Toilet

The socket should be carefully cleaned. Flushing it, to encourage the debris to be washed out.



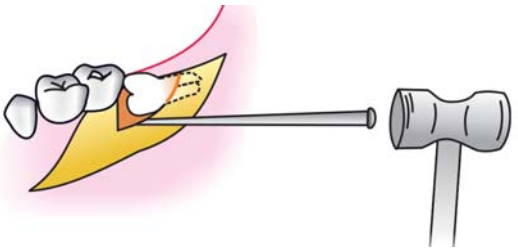
Wound Closure

The 1st suture that is given to close the wound, is placed as close to the distal surface of the second molar as is possible. No suture is required along the vertical limb of the incision, as the two ends will remain well approximated post-surgery.



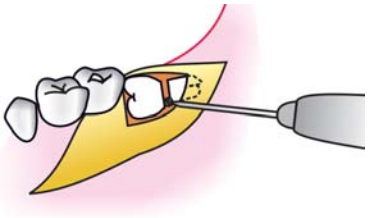
Tooth Division for Extraction of a Horizontally Impacted Third Molar

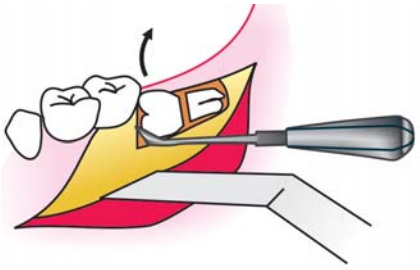
The incision made is from the 1st molar.



This will give a wider reflection and a larger flap the bone that is buccal and overlying the tooth is removed using a chisel and bur.

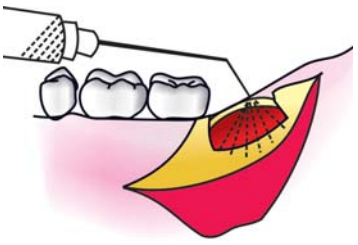
A bur is used to complete the exposure of the crown, to remove the distal bone, divide the tooth and create points of elevation.



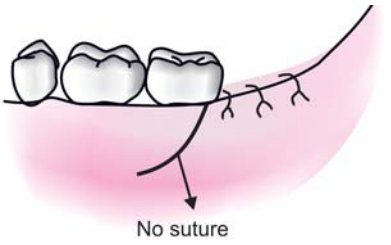


The separated crown is removed using an elevator.

The cut root is then removed by using a straight or a cryer elevator.

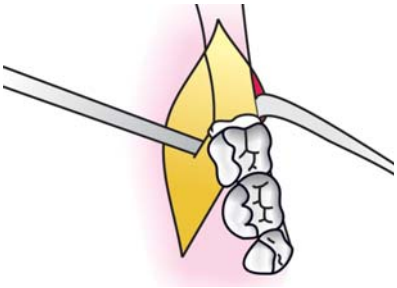


The surgical site is carefully irrigated and cleaned to remove all the bone and tooth debris.



Sutures are given and the patient is kept under antibiotic, and anti-inflammatory medication.

LINGUAL SPLIT TECHNIQUE

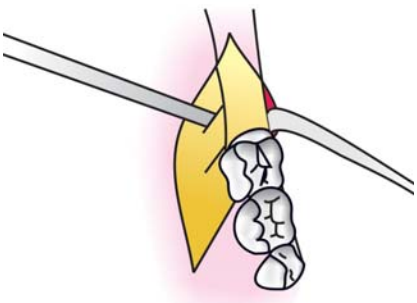


This technique was 1st described by 'Sir William Kelsey Fry'. This technique can be used in a lingually placed impacted teeth. It takes the advantage of the thin lingual plate by fracturing it, thus preserving the buccal plate and external oblique ridge.

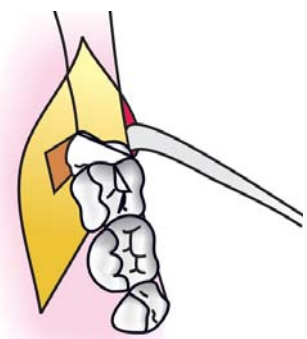
Lingual split technique should be used only in the young patients, as their bone is elastic.

A mucoperiosteal flap is elevated exposing the bone covering the impacted tooth.

A vertical stop cut about 5 mm in height is made immediately distal to the second molar.

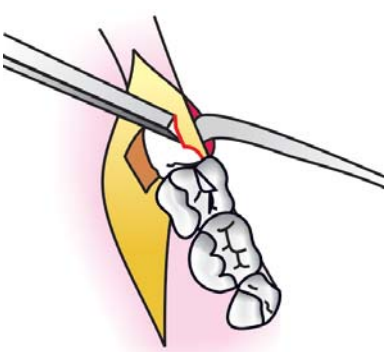


A second, vertical stop cut, is made about 4 mm distobuccal to the 3rd molar crown.



The two vertical cuts are joined by horizontal cut and the buccal plate covering the crown is removed. When complete there should be enough space to insert an elevator beneath the mesial aspect of the impacted tooth.

A chisel is then placed on the inner side of the lingual plate at an angle of 45 degree to the upper border with its cutting edge parallel to the 'external oblique line'. Making sure the bevel of the chisel faces lingually.

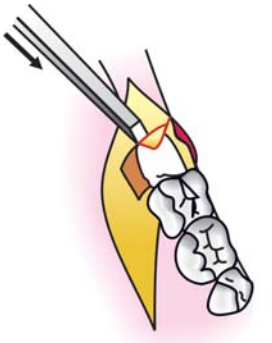


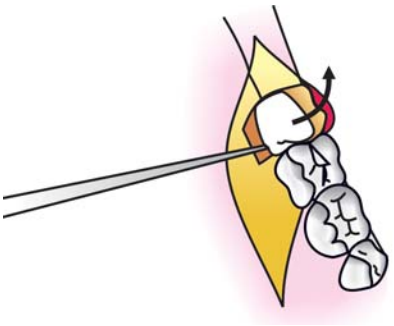
Few light taps will split the lingual plate from the alveolar bone and hinge it inwards on the soft tissue that are still attached to it.

Care must be taken that the cutting edge of the chisel is not held parallel to the internal oblique ridge as this may lead to the extension of the lingual split to the coronoid process.

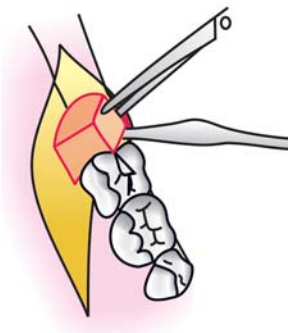
Any bone that remains between the buccal and lingual cuts is then removed.

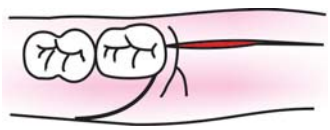
A straight elevator is then applied to the mesial surface of the tooth. The tooth is elevated with minimum of force, upward and backward, out of its socket. This happens because the split lingual plate is displaced facilitating delivery of the tooth.





The fractured lingual plate is then separated from its soft tissue attachment and lifted out of the surgical site.





Thus, completing the saucerization of the bony cavity. The wound toilet is done and sutures given.

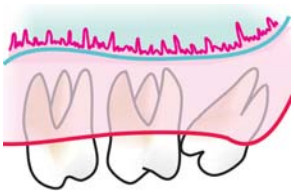
IMPACTED MAXILLARY THIRD MOLAR

Classification

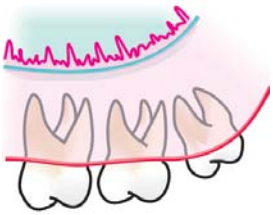
Based on anatomical position.

1. Relative depth of the impacted maxillary 3rd molar in the bone.

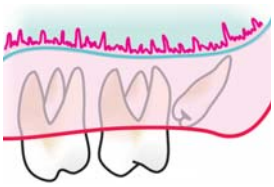
Class A: The lowest portion of the crown of the impacted maxillary 3rd molar is on a line with the occlusal plane of the second molar.



Class B: The lowest portion of the crown of the impacted maxillary 3rd molar is between the occlusal plane of the 2nd molar and the cervical line.

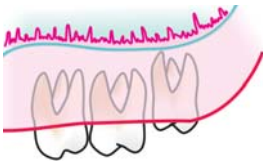


Class C: The lowest portion of the crown of the impacted maxillary 3rd molar is at or above the cervical line of the 2nd molar.

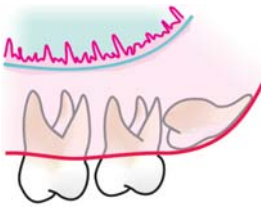


2. The position of the long axis of the impacted maxillary 3rd molar in relation to the long axis of the 2nd molar.

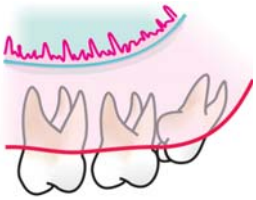
a. Vertical



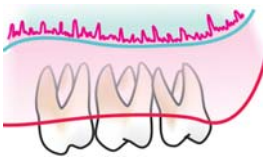
b. Horizontal



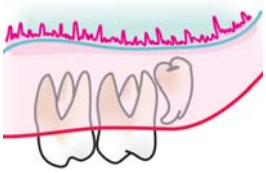
c. Mesioangular



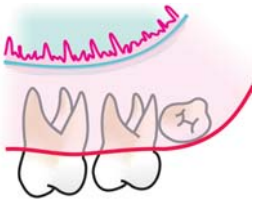
d. Distoangular



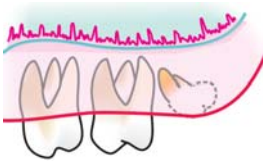
e. Inverted



f. Buccoangular.



g. Linguoangular.

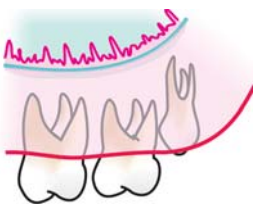


All of these may simultaneously occur in :

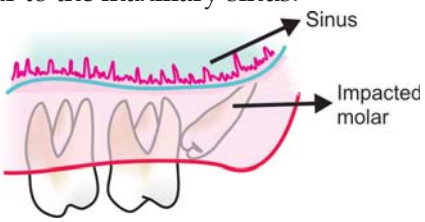
i. Buccoversion

ii. Lingual version

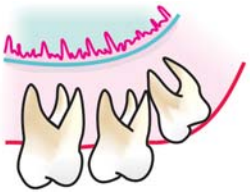
iii. Torsoversion



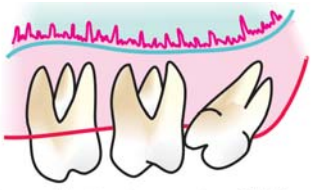
3. Relationship of the impacted maxillary 3rd molar to the maxillary sinus:
   - **Sinus approximation (SA):** No bone, or a thin partition of bone between the impacted maxillary 3rd molar and the maxillary sinus, known as "maxillary sinus approximation".



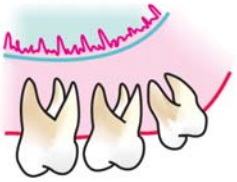
- **No sinus approximation (NSA):** Two mm or more bone between the impacted maxillary 3rd molar and the maxillary sinus, known as "no maxillary sinus approximation".



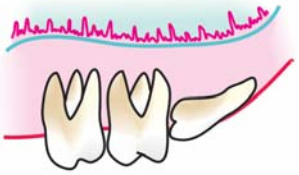
Examples



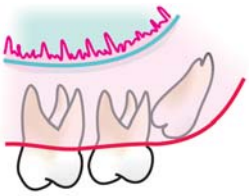
Class A, Mesioangular, NSA



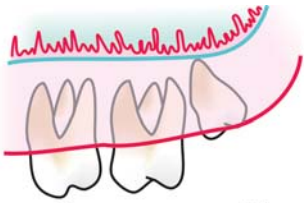
Class B, Distoangular, NSA



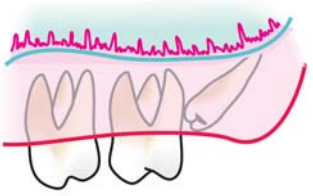
Class B, Horizontal, NSA



Class C, Mesioangular, NSA



Class C, Distoangular, SA



Class C, Mesioangular, SA

MAXILLARY IMPACTED CANINE

Classification

Class I : Impacted cuspids located in the palate.

a. Horizontal

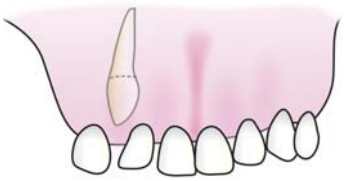
b. Vertical

c. Semivertical

Class II : Impacted cuspid located in the labial or buccal surface of the maxilla.

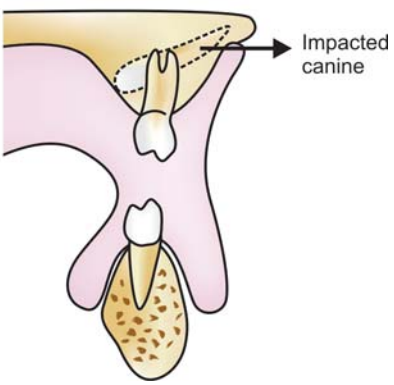
a. Horizontal

b. Vertical

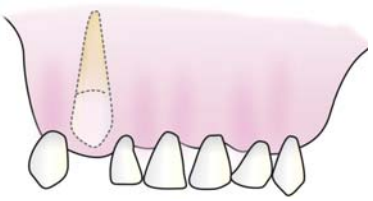


c. Semivertical

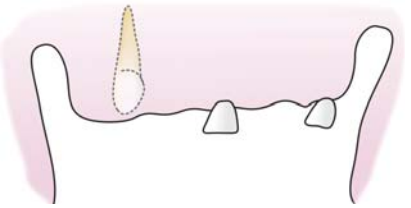
Class III : Impacted canines located in both the palatal process and labial or buccal maxillary bone, e.g. the crown is on the palate and the root passes through between the roots of the adjacent teeth in the alveolar process, ending in a sharp angle on the labial or buccal surface of the maxilla.



Class IV: Impacted canines located in the alveolar process, usually vertically between the incisor and 1st bicuspid.



Class V: Impacted canines located in an edentulous maxilla.

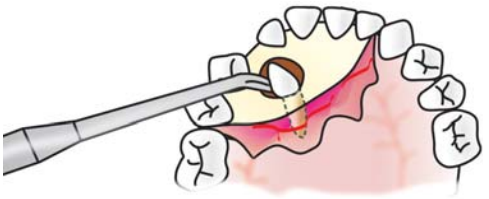


Surgical Removal of Class I Vertically Impacted Canine

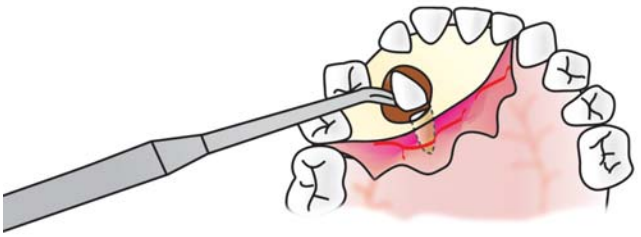
The palatal mucoperiosteal flap is raised.

Using a bur, the bone around the crown of the impacted canine is removed.

The tooth is to then be elevated using the Apexo elevators care being taken not to injure the adjacent roots. If the tooth cannot be elevated from its socket, then further attempts should be made using two elevators, one on each side or a root forcep.

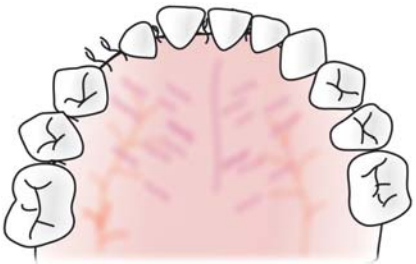


If the tooth does not come out, then the tooth should be sliced, separating the crown and root.



The crown is then elevated out of the socket.

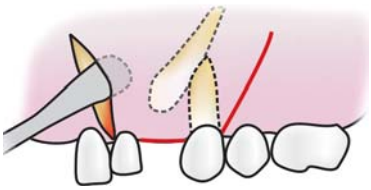
Then a groove is made on to the root and the elevator is locked into the groove to remove the root out of the socket. It comes out more easily as now space is available after the crown is removed.

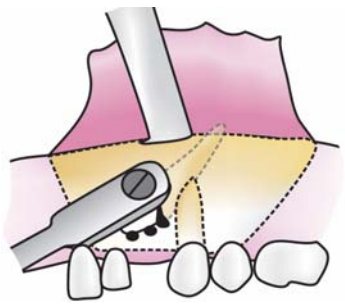


The flap is repositioned and sutured.

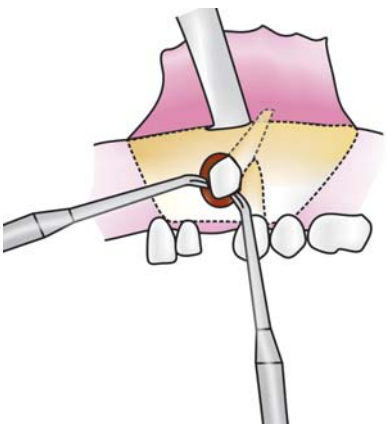
Surgical Removal of an Impacted Canine in Vertical, Class II Position

The buccal flap is raised, making sure that the incision line will rest on firm bone after closure.

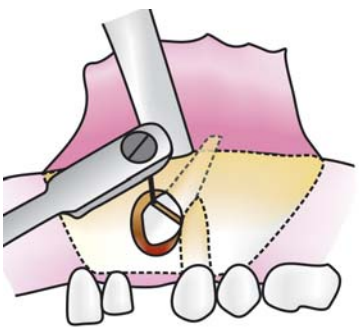




Using the bur, bone over the crown portion is removed.

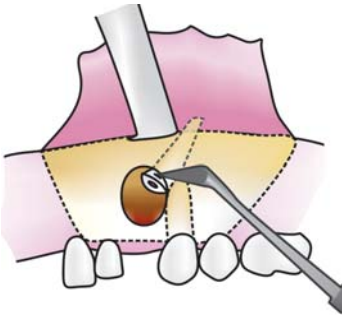


The tooth is elevated out of the socket using elevators.



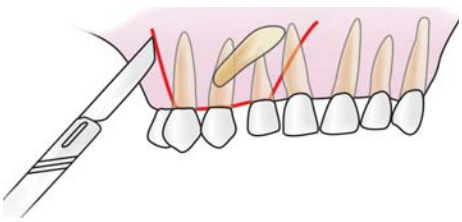
If it does not come out, then, the bur is used to cut the crown portion. The crown is then elevated out of the socket.

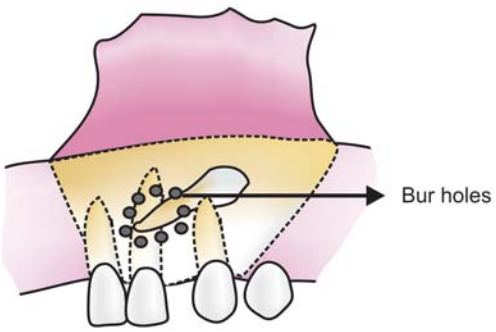
A point of elevation is then made on the root which is then removed.



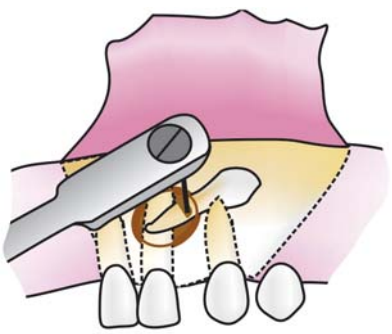
Surgical Removal of an Impacted Canine in Class III Position

A mucoperiosteal flap is to be raised. Making sure that its size is such that, its margins will lie on firm bone, after the required bone cutting is done.

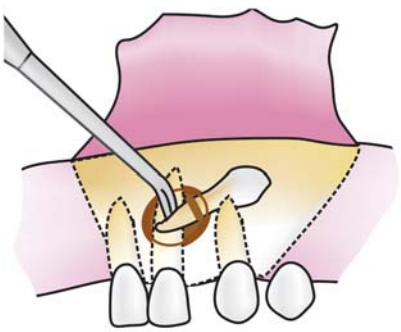




The bone over the root (the portion of the crown on the buccal side) is removed using the bur or chisel or both. Exposing the root.



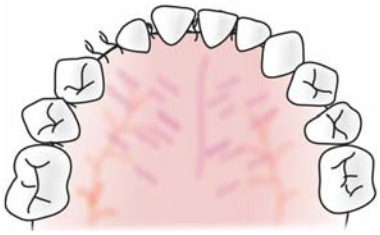
The visible portion of the root is then cut with a bur.



Cut root is then removed with an elevator.

Then the palatal flap is raised.

The bone is removed to expose the crown. A blunt instrument is then placed buccally on the cut end of the root. It is then tapped with a mallet, this will push the crown out.



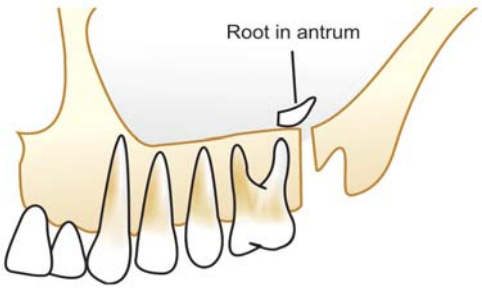
The two flaps are then repositioned and sutured in place.

COMPLICATIONS

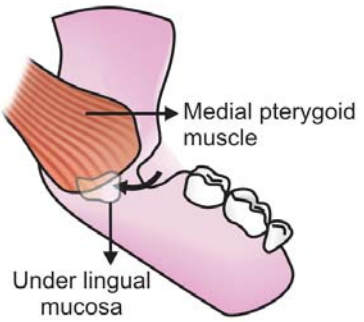
During Surgery

1. Exposure of the inferior alveolar canal, and its injury, will lead to bleeding which can be very severe.

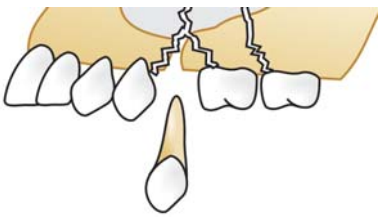
2. Fracture of the root of the maxillary 3rd molar may be forced into the maxillary sinus.



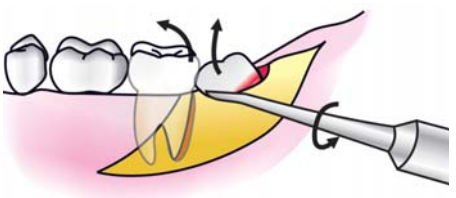
3. The mandibular tooth or roots may be dislodged through the thin lingual cortical bone into the submandibular space.



4. Fracture of a large portion of the alveolar process.

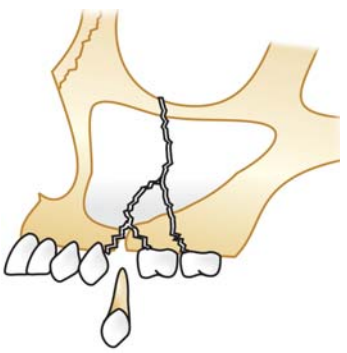


5. Dislodgement or trauma to the adjacent tooth. Leading in a non-vital tooth.

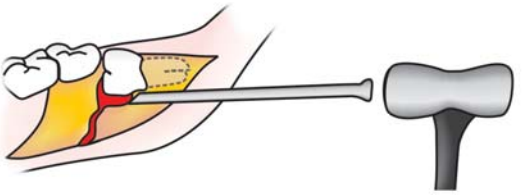


6. Injury to the lip, cheeks or mucous membrane from the use of vigorous or careless instrumentations. Sometimes, there can be extensive lacerations.

7. Opening into the maxillary sinus. The maxillary tooth can be forced into the pterygomaxillary fossa.

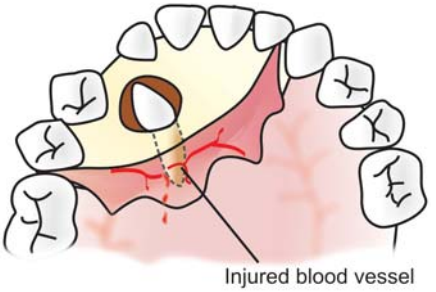


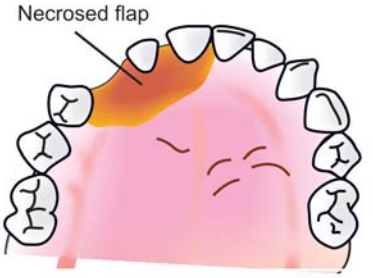
8. Opening into the nasal cavity while extracting any of the impacted upper anterior teeth can happen.
9. Fracture of the maxilla or the mandible while extracting the teeth, but this happen only when the operator uses uncontrolled forces, or there is some bony pathology.



Post Surgery

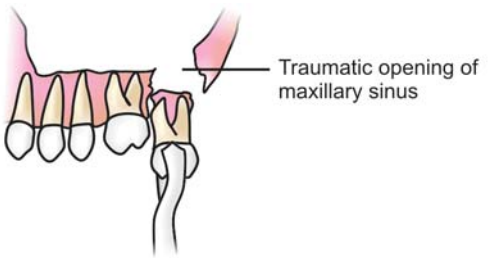
1. If there is injury to the alveolar nerve it will lead to prolonged numbness or parasthesia of the lip.
2. There may be severe trismus making mastication very difficult for the patient.
3. Due to injury of the palatal blood vessel the palatal flap may get necrosed.





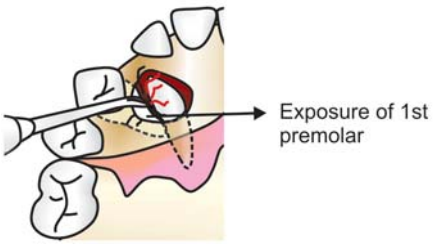
4. There may be ecchymosis leading to discoloration of the soft tissue overlying the mandible. This is due to postoperative bleeding.

5. Opening into maxillary sinus if not attended to will lead to oroantral fistula.

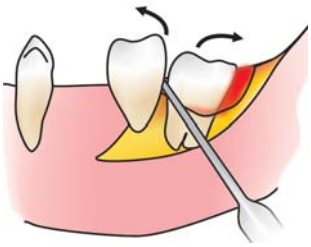


6. Postoperative dislodgement of clot will lead to dry-socket.

7. Sometimes, there is loss of a large section of alveolar process postoperatively, due to necrosis and sloughing because of improper planning of the technique. This is due to over traumatization of the bone by excessive elevator pressure, dull chisel, heated bone due to the burs being used with reduced saline irrigation.



8. Exposure of the roots of adjacent teeth may cause their premature loss.



9. Pain is normally expected but sometimes it is very severe.

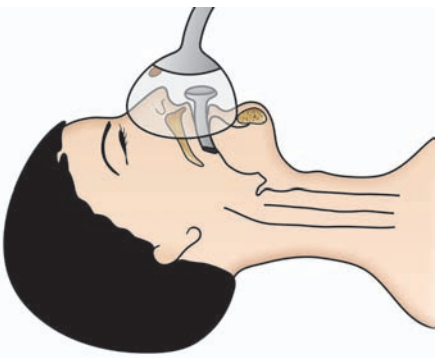
Chapter

5

Fracture of Mandible

Nowadays the patients of facial injuries have increased, this is because of the increase in number and speed of motor vehicles. We in India still do not like to follow all the safety precautions.

As soon as a patient of facial injuries is brought to the hospital he/she should be examined for:



A. Airway should be examined for its patency. If the patient is conscious he/she will manage to breath, but in case of unconsciousness it is important that the patency of the airway is maintained by clearing the saliva and other things, like dental or bone fragments from the mouth, nasal cavity and oropharynx patency is then maintained by putting an airway or endotracheal tube or if indicated by performing tracheostomy.

B. Breathing: This deals with the cardiovascular mechanism. It is very important to see that once patency of the airway is maintained, the patient is actually breathing, i.e. there is an exchange of gases at the level of the lungs. Therefore, care should be taken not to allow the build-up of abnormal pressure within the thoracic cavity, as it may deter venous return.

C. Circulation: Once the airway is secured, immediate attention should be given to bleeding. Any profuse bleeding, intraoral or extraoral should be stopped. Generally in LeFort II and LeFort III there is bleeding from the nasal region and therefore anterior and posterior nasal packs should be given. Most often temporary reduction of the fractured bones is enough to stop bleeding from the face.

Once the bleeding has been arrested it is important to see that the patient is not in a state of shock or hypovolemic condition. Immediately intravenous lines should be started and the required blood/fluid be transfused.

D. Deficit: The neurological evaluation of the patient should then be carefully done, and any deficit in the patients neurological condition carefully recorded. This then will

form the base line from which the patients condition can be evaluated. If he/she is improving or deteriorating can be assessed with regular neurological evaluations.

E. Examination: The whole body should be examined very carefully so as not to miss out on any other important injury (which could be intraoral or extraoral). If other body parts are injured the concerned specialist should be called for. Then in consultation final treatment planning should be done.

FRACTURE MANDIBLE

The mandible is a single largest bone forming the lower half of the face. It is also the bone receiving a large amount of traumatic impact, be it a vehicular accident, a fist fight, a fall or a bullet wound. As each of the causes and direction of the impact changes the sites through which the fracture line passes also changes.

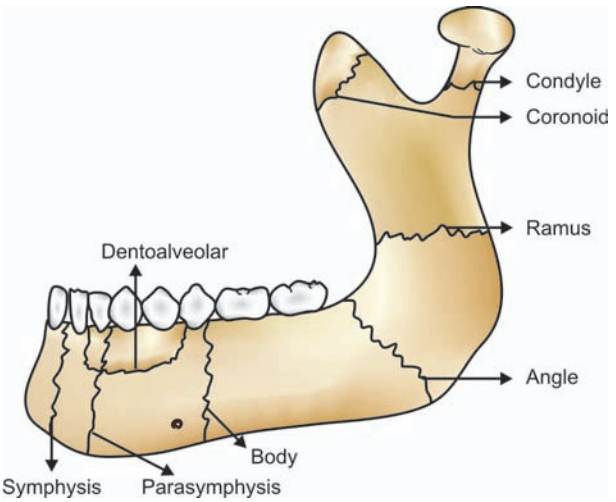
The chief causes of mandibular fractures are road traffic accidents. Other well known reasons for fracture of the mandible are fall from a height, sporting injuries, work related/industrial injuries. Violence that could be war or interpersonal.

Classifications

1. According to Anatomic Location

Most common classification describes the anatomic location of the fractured site. Therefore there is fracture at the region of:

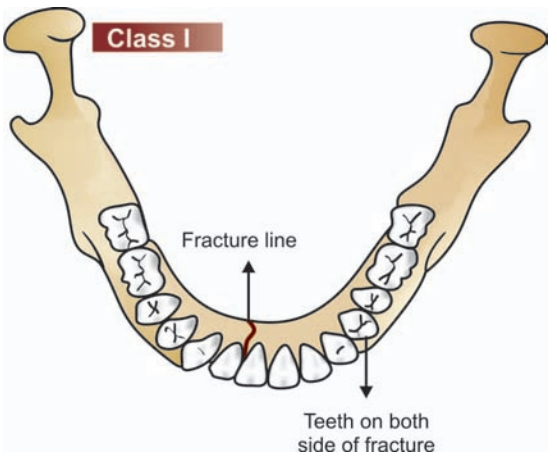
- Symphysis
- Parasymphysis
- Body
- Angle
- Ramus
- Condyle
- Coronoid
- Dentoalveolar fracture.

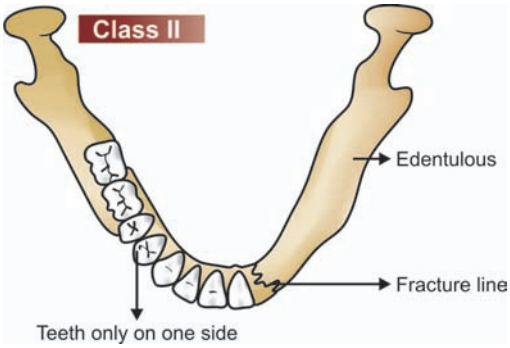


2. Kazanjian Classification

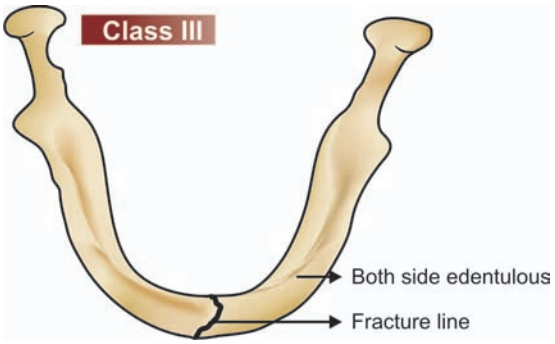
Fracture of the mandible according to the location of the fracture line to the existing teeth in the dental arch. This helps in treatment planning because if fracture is anterior to the last firm tooth; simple IMF can be done, but if fracture is behind the last permanent tooth; other forms of fixation are required.

- Class I: In which teeth are present on both sides of the fracture line.





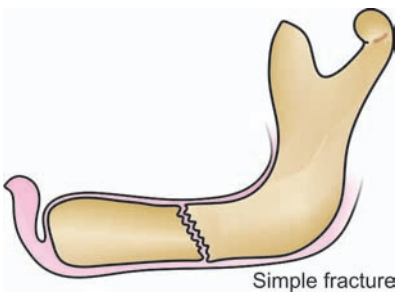
- Class II: In which teeth are present on one side of the fracture line.



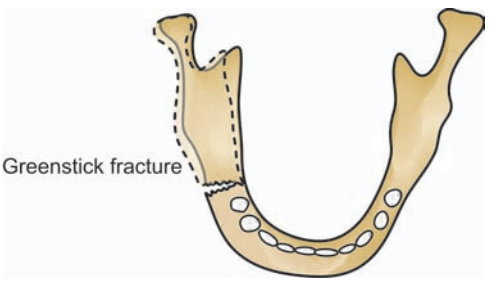
- CLASS III: In which tooth fragments are edentulous.

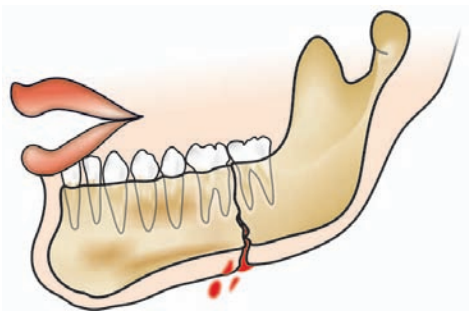
3. **Types of fracture**

- ***Simple fracture:*** In these fractures there is no tear in the soft tissues, e.g. fracture along the coronoid, ramus and edentulous body of mandible.



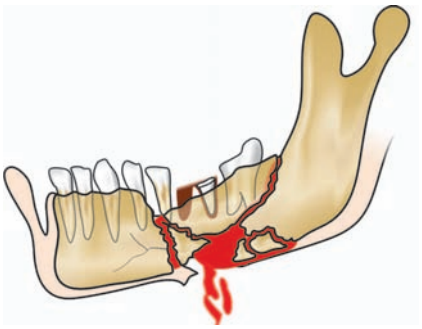
- ***Greenstick fracture*** is a variant of simple fracture seen in children in which only one cortical plate is fractured. This is due to elasticity of bone.

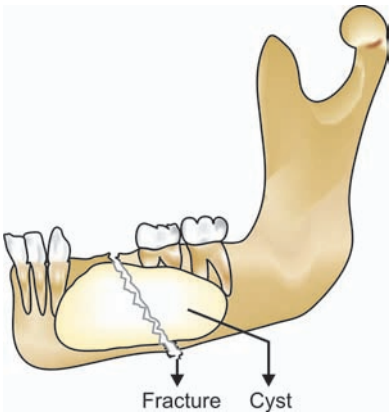




- ***Compound fracture:*** Where the fracture also involves break in the soft tissue. Tooth bearing portion nearly always compound into the mouth through the periodontal ligament, and also can compound over the skin.

- ***Comminuted fracture:*** Are caused by a penetrating sharp object, they are usually compound and may have associated loss of soft as well as hard tissue due to the heavy impact.





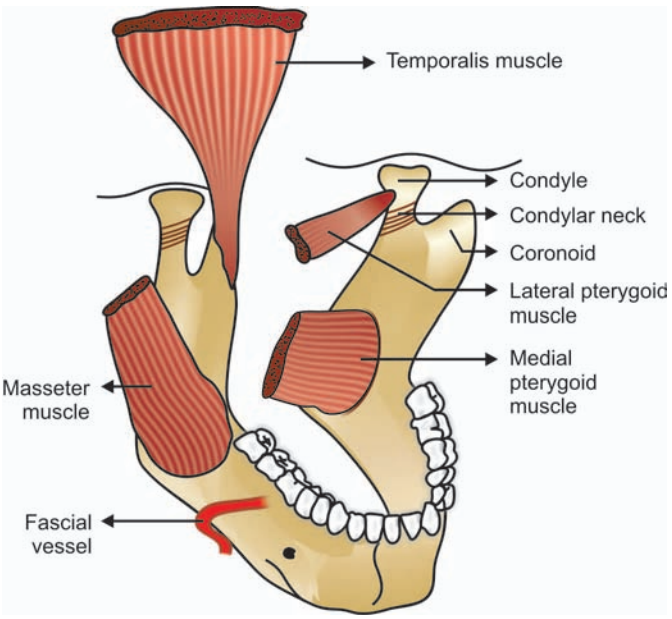
- ***Pathological fracture*** are those fractures which occur in that part of the mandible which is weakened by a pathology, e.g. cyst, tumor osteomyelitis, etc.

APPLIED ANATOMY

- The mandible is the single largest and strongest bone of the face, forming its lower one-third. It is a tubular bone which is bent in a 'V' shape at the center. It has two flat processes or rami which are at an angle to the mandible. Each ramus in turn has a condyle and a coronoid process.

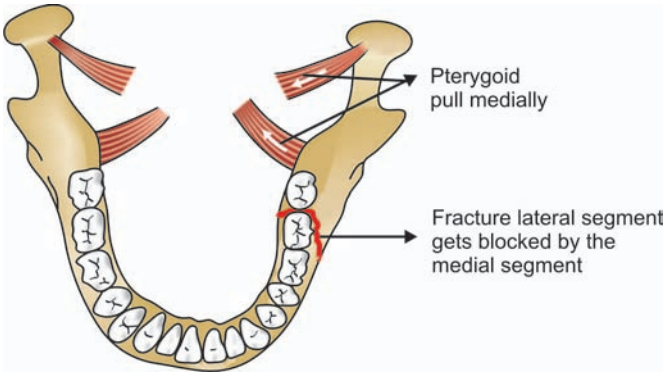
  Strong muscles of mastication are attached to the mandible:
- Lateral pterygoid at the condylar neck
- Temporalis at the coronoid
- Medial pterygoid on the inner part of ramus
- Masseter on the outer part of ramus.

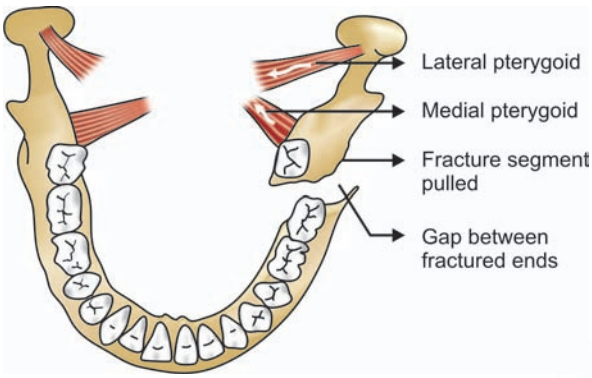
  All the muscles exert their own pull in particular direction thus making the fractured ends favorable or unfavorable. These words are for convenience of the surgeon and indicate the amount of displacement that will be caused due to the muscle pull.
- The **pterygomasseteric sling** has a strong effect if the fracture line is involving the angle of the mandible.



Effect of Pterygoid Muscles

A **vertically favorable** fracture runs from the buccal plate anteriorly and backward through the lingual plate posteriorly, while

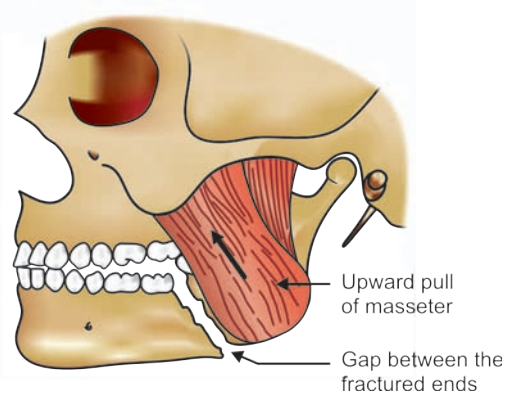


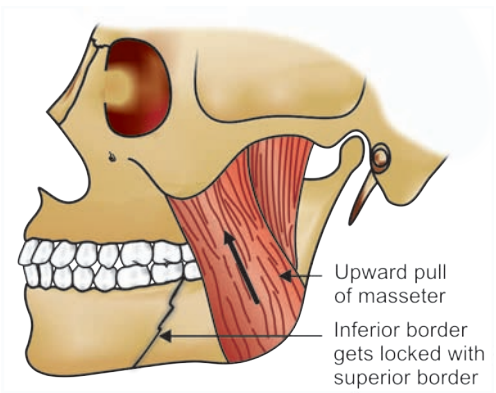


vertically unfavorable fracture runs from the lingual plate anteriorly backward through the buccal plate posteriorly.

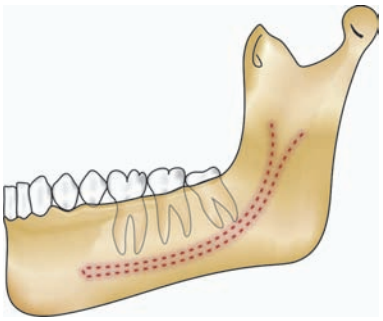
Effect of Masseter Muscle

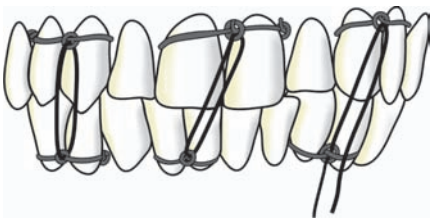
Horizontally unfavorable fracture extends from the upper border downwards and backwards, whereas





Horizontally favorable extend from upper border downwards and forwards.



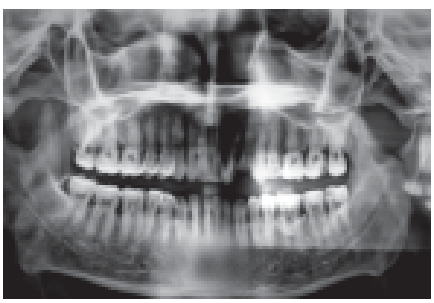


- The position of inferior alveolar canal and mental foramen changes with age. They being near the superior border of the mandible when neonates, then almost in the center with eruption of teeth; then again being near the superior border when edentulous.
- The presence of teeth is also an important factor when dealing with fractures of mandible. Unlike long bones where only the approximation of fractured ends and stabilization is enough. In the mandible the function will only be fully restored once the occlusion is correct.
- Further any movement inevitably causes both condyles to move with respect to the skull base. Also although anatomically the condyles are the articular surfaces, functionally the occlusal surfaces of the mandibular teeth behave like one. Therefore, the occlusion plays a very important role when dealing with the fracture mandible.

RADIOGRAPHIC EVALUATION

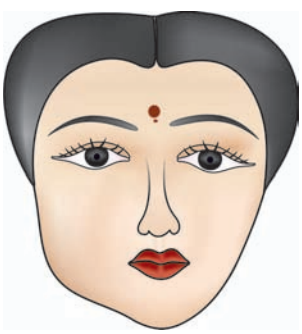
1. Orthopantomograph (OPG)—in this radiograph the whole mandible is unfolded on one film.
2. Posteroanterior 10°—it shows the whole mandible including the ascending ramus on each side without superimposition of the mastoid process.
3. Lateral oblique - both right and left—this will not be necessary if OPG is available.
4. Anterior-lateral oblique—to show the horizontal from canine to second molar.
5. Posterolateral oblique will show the condylar head, neck and ascending ramus and the posterior molar region of the mandible.
6. If required CT scan can be done.

OPG



SIGNS AND SYMPTOMS

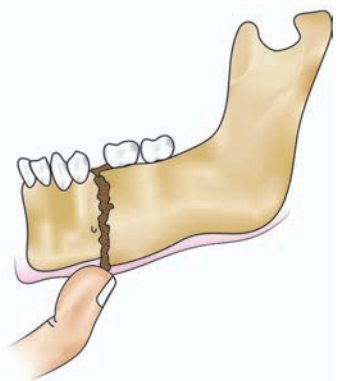
1. Generally mandibular fractures result in the rapid *swelling* around the fracture site. This may be associated with *skin ecchymosis*.



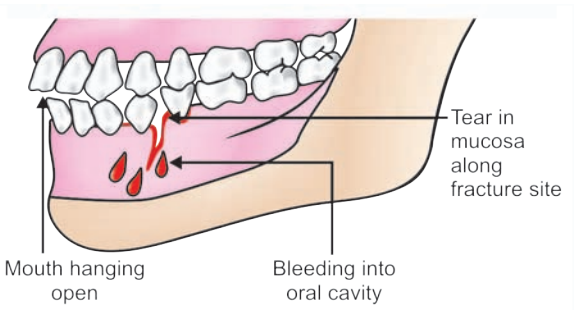
2. Mandibular fractures are usually compounded into the mouth through the periodontal membrane and therefore there is blood-stained saliva dripping from the corners of the mouth.

3. Due to the bleeding in the oral cavity there is marked foetor-oris when sufficient time has elapsed to allow the multiplication of pathogenic and saprophytic organisms.

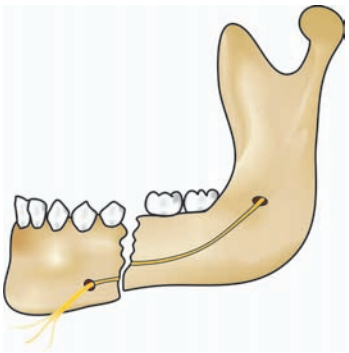
4. There may be obvious deformity of bony contour and if there is more displacement the deformity can be palpated and crepitus elicited.

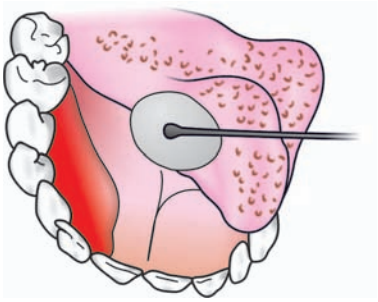


5. If displacement has occurred the patient is unable to close the anterior teeth together and the mouth hangs open.



6. The inferior alveolar nerve is usually injured causing reduced or absence of sensation on one or both sides of the lower lip (paresthesia).





7. The buccal and lingual sulci can show ecchymoses. Bleeding in the lingual submucosa is one of the most valuable signs of bony injury in the body of the mandible (Colman's sign).

8. Occlusal plane of the teeth will show step deformity and therefore there is deranged occlusion (step deformity).

TREATMENT PLANNING

Once fractures are diagnosed and evaluated it is to be decided what fixation method should be used after reduction as there are multiple choices available in each of the techniques of:

Closed Reduction and Fixation

In patients with teeth bearing fractured segments

- IVY loop or interdental eyelet wiring.
- Continuous multiple loop wiring.
- Direct wiring.
- Arch bar fixation.
- Risdon wiring.

In edentulous patients

- Circumferential wiring

Open Reduction and Fixation

- Plating.
- Direct osseous wiring.
- Lag screw.
- Intermedullary pinning.

External Pin Fixation

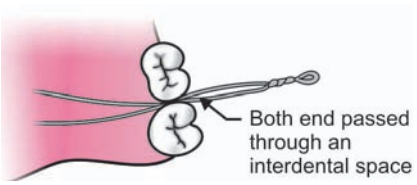
In patients with extensive comminution or infected fractures.

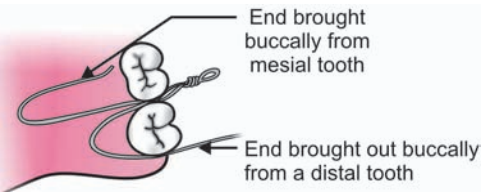
Closed Reduction and Fixation

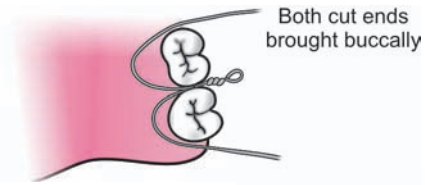
For inter maxillary fixation (IMF): It is accepted that when the teeth of a fractured jaw are fixed in correct occlusion, the bone fragments supporting them will be satisfactorily reduced.

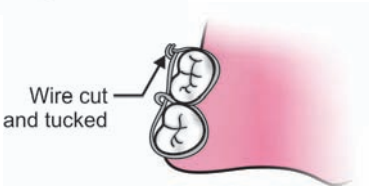
1. *IVY loop or interdental eyelet wiring:* Eyelets are prepared with the help of 24 gauge wire.

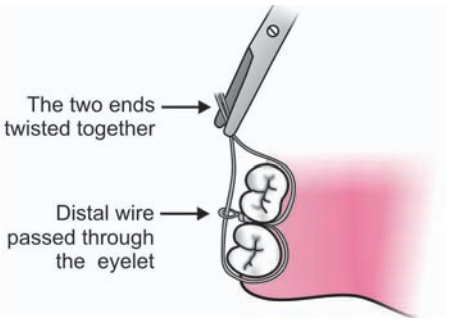
Both the free ends are passed through the interdental space of firm teeth from the buccal to the lingual/palatal aspect. Then the free ends are brought buccally, one from the distal side of the distal tooth and one from the mesial side of the mesial tooth. One of the free ends is then passed through the eyelet and twisted together with the other wire, cut and tucked away.





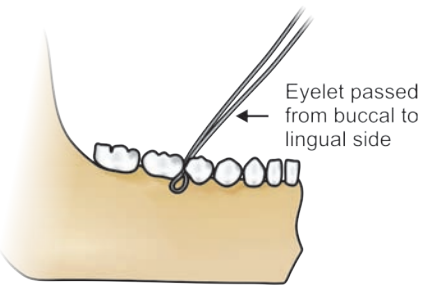


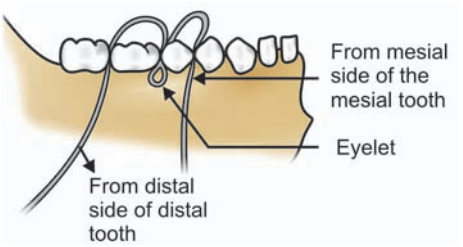




This way multiple eyelets are placed in the maxillary and mandibular teeth. These eyelets in turn are used for intermaxillary fixation.

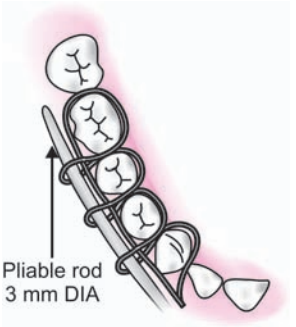
2. *Continuous or multiple loop:* An eyelet made of 24 gauge wire is passed through the interdental space from the buccal to the lingual/palatal side.

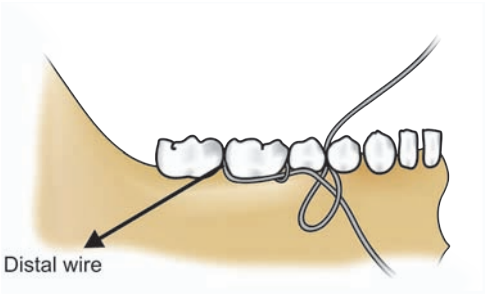




Then the free ends each is passed separately through the interdental spaces. One mesial to the mesial tooth and the other distal to the distal tooth.

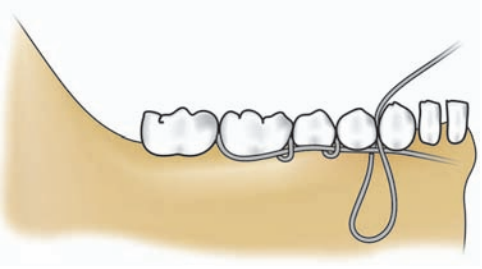
The distal wire is then passed through the eyelet and is laid along the buccal surface of the teeth (a pliable rod approx. 3 mm diameter is placed over the buccal wire).

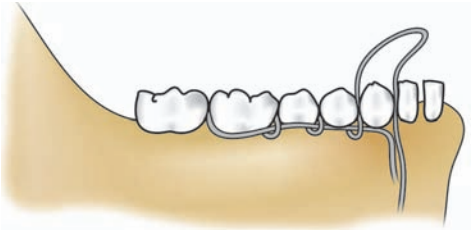




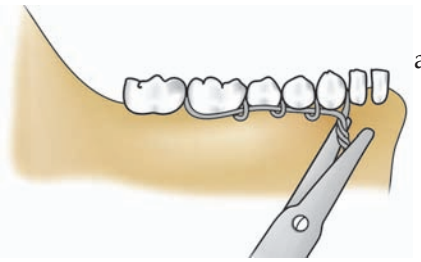
While the other is passed around the buccal wire and back through the same interdental space.

This wire is then passed similarly through other interdental spaces creating multiple loops.





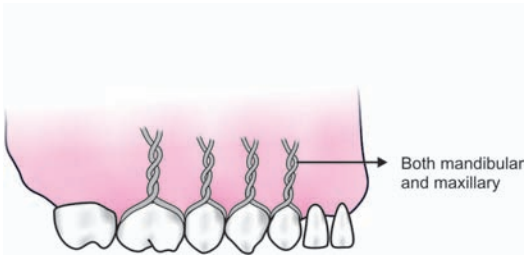
The rod is removed and the multiple loops are twisted each 2-3 times.

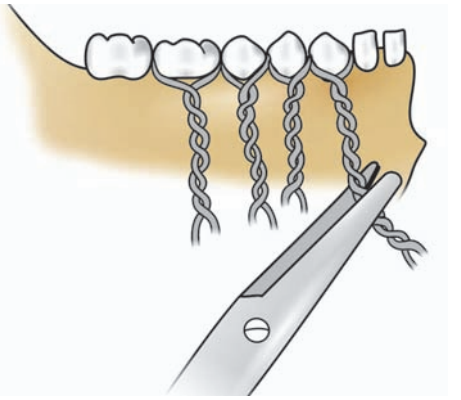


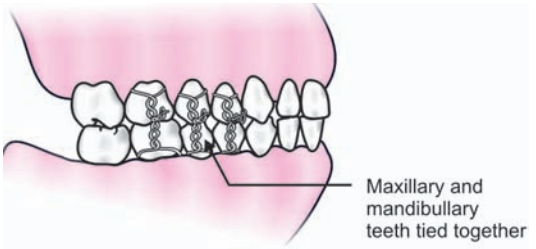
Both the wire ends are then twisted, cut and tucked away.

These multiple loops are then used for IMF.

3. *Direct wiring:* Wires are passed around the necks of teeth and the two ends twisted together.





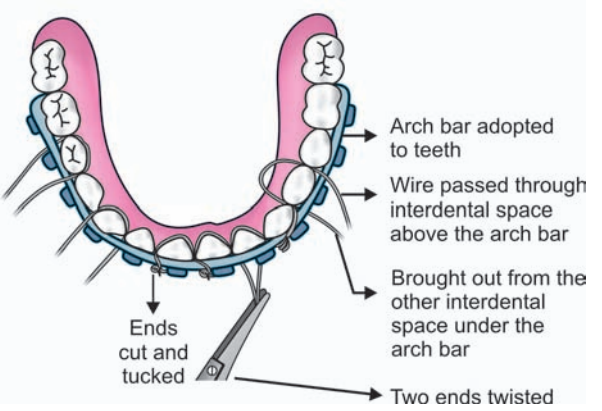


These in turn are twisted with those twisted wires of the opposing jaw, thus IMF is achieved.

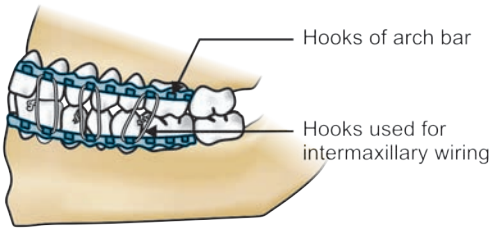
This is the simplest wiring technique but its disadvantage is that if for any reason IMF needs to be opened the whole wiring will have to be repeated.

4. *Arch bar:* This technique is well adapted even in those patients who have some missing teeth in the oral cavity.

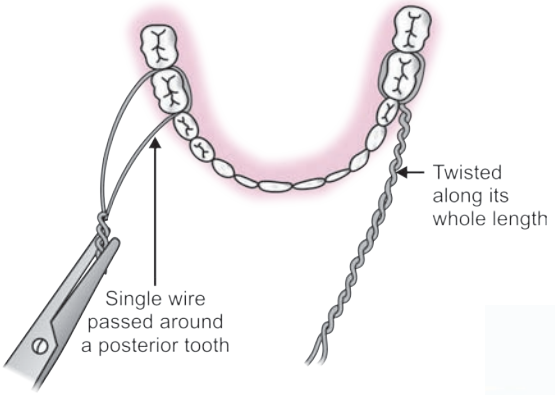
An arch bar (Erich's) cut to a suitable length extending distally to first molar on both the sides. The cut ends are bent into the interdental space. Care is to be taken that the hooks are facing upwards in the maxillary arch and downwards in the mandibular arch.



A 26 gauge wire is then taken and passed through the interdental space of a tooth from buccal to lingual side above the arch bar then circling the tooth it is brought out buccally from the other interdental space below the arch bar, the two ends are tightened, cut and tucked.

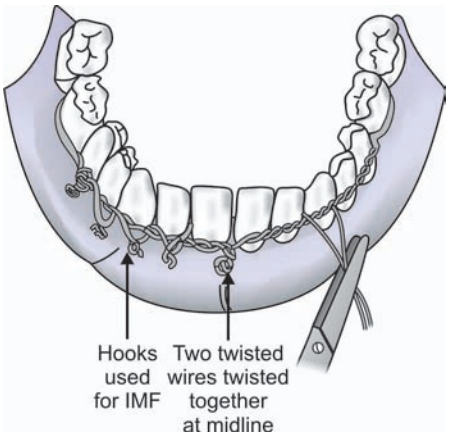


Care should be taken not to occupy the hooks of the arch bar. This way the arch bar is tied to all standing teeth. The hooks of the arch bar are used for intermaxillary fixation.

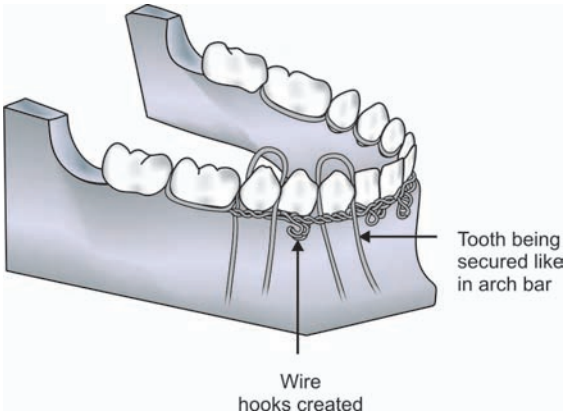


The ends of these wires are then twisted on the buccal side.

These twisted wires are brought in the midline, where they are in turn twisted together.



5. *Risdon wiring:* If an arch bar is unavailable a single suitable length of 1 mm soft stainless steel is passed around the posterior tooth on each side.



The teeth are then secured to this twisted arch bar and the cut ends of the securing wires tucked in a way that they form hooks. IMF is done with the help of the wire hooks.

Circumferential Wiring

This is a technique in which prestretched wires are passed around sound bone and also over the splint (that could be made of metal or acrylic) and tightened. Therefore, the fractured segment does not have any mobility during the period of healing, as it is tied to the firm splint. For fracture of the mandible circum-mandibular wiring is done.

Circum-mandibular Wiring

Splinting

This is a technique that is advocated in the young children and edentulous patients. In children below 12 years of age cap-splints are made and circumferential wiring done so that injury to the tooth buds can be avoided.

Similarly in edentulous patient, who also have a compromised blood supply, and no teeth to give a proper intermaxillary fixation, this technique is very helpful.

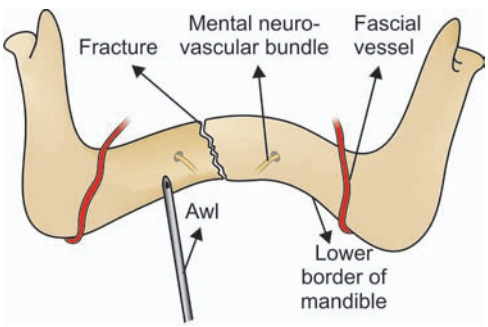
The procedure is the same weather using a cap splint in children or a gunning/ patients denture in older people.

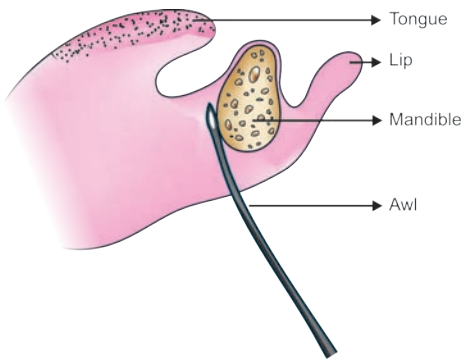
Gunning Type Splint

In case of edentulous mandibular fracture the reduction and fixation can be done by use of patients denture or by preparing a Gunning's splint secured to the mandible by circumferential wiring.

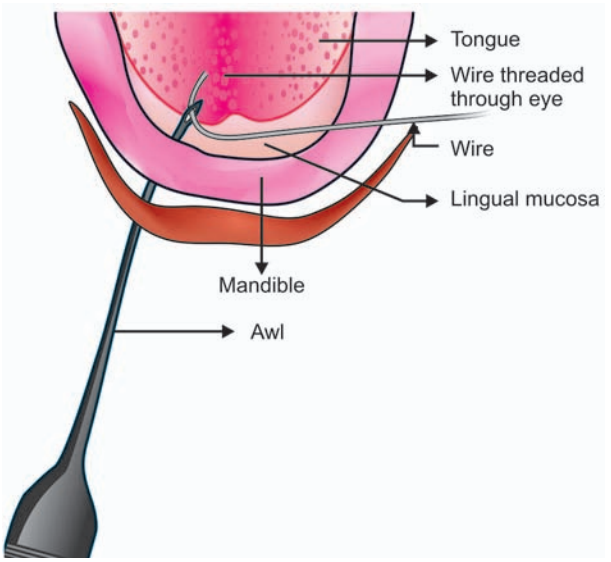
Once the splint/denture is correctly made the upper part is secured in position by circumzygomatic suspensions.

The mandibular denture is then fixed by applying circummandibular wiring. An awl (Obwegeser's or Kelseyfry's awl) is placed externally at the lower border of the mandible, away from the fractured site, the facial artery and the area of mental foramen.



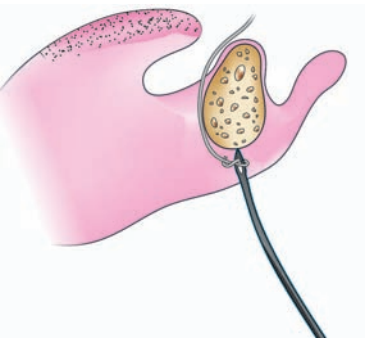


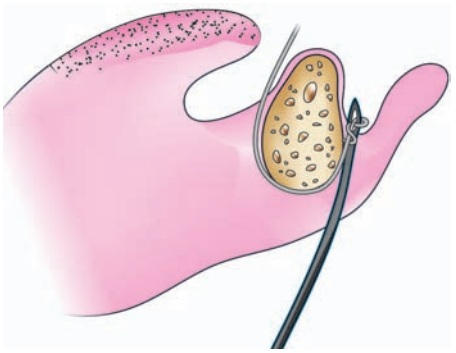
This awl is then inserted through the skin to reach the lower border of mandible. Remaining in contact with the mandible the awl is brought out through the lingual sulcus.



A long prestretched wire is then threaded through the eyelet of the awl.

The awl is then withdrawn up to the lower border of mandibular bone within the skin.

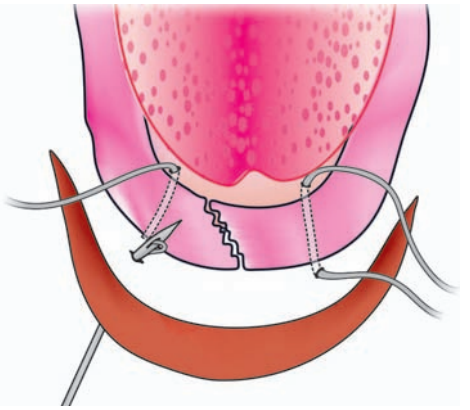


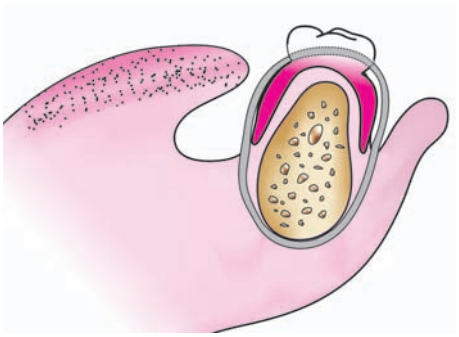


And pushed in the buccal sulcus where the end of the wire brought along with the awl is detached.

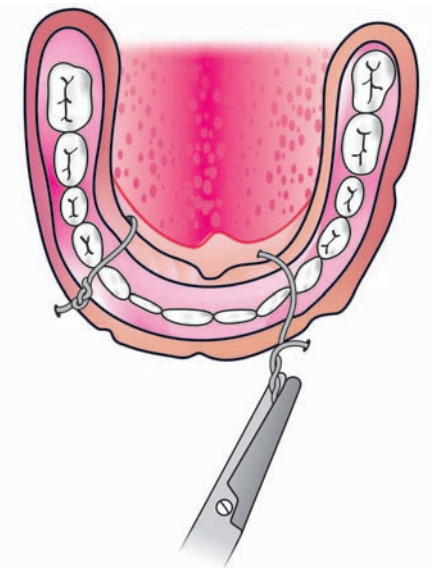
The awl is then withdrawn from the skin.

This is repeated in the other side of the mandible. Now we have two wires which have circumferentiated the mandible.





The gunning splint/denture is then placed over the mandibular ridge and the two wire ends are tied around the splint.



This IMF should be kept in place to a minimum of 3 weeks in children and young adults and average 4-5 weeks for the rest.

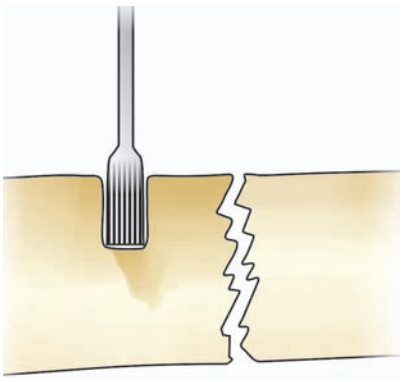
OPEN REDUCTION AND FIXATION

- Plating
- Wiring
- Lag screw
- Intermedullary pinning

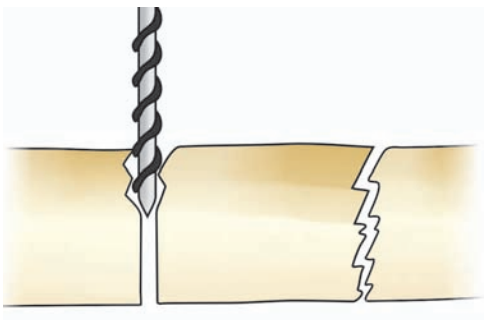
The advantages of open reduction are that the mouth does not require IMF for 5 weeks.

PLATING

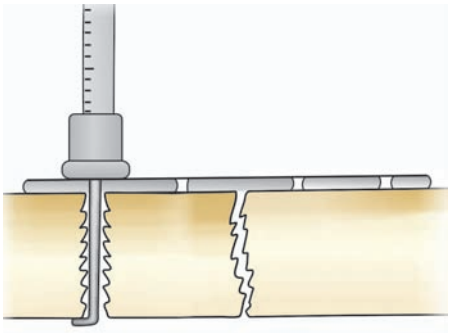
If teeth are present, IMF is done; then incision is made and bone is reached either extraorally or intraorally.



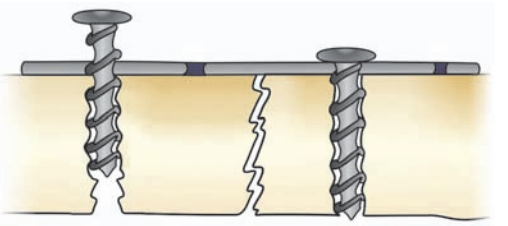
The fractured ends are approximated and screw holes are made such that atleast two screws can be placed on either side of the fracture.



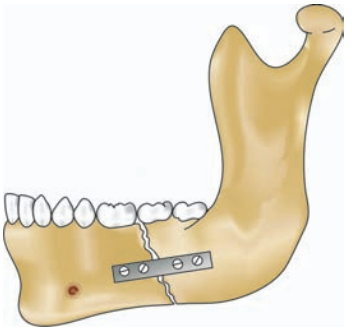
The screw hole is then tapped with a screw tap,



using a depth gauge the size of the screw is decided.



Then a corresponding screw is taken and placed over the tapped bur hole, it is then tightened.



Similarly all screws are fixed, this will rigidly fix the bone, sometimes more than one plate is required for rigidity. The surgical site is then sutured in multiple layers. Different kinds of plates are available:

- Compression plates

- Orthopedic plate

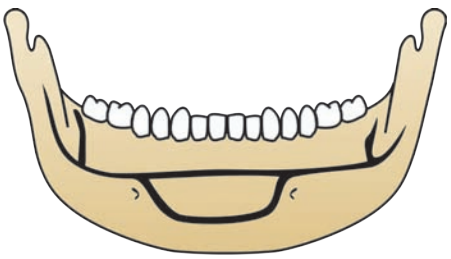
- Mini plates

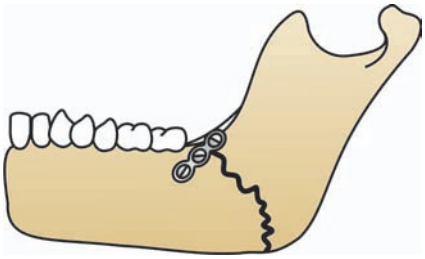
CHAMPY'S PRINCIPLE

Mini plates are applied using the Champy's principle that states—natural line of compression exists along the lower border of the mandible.

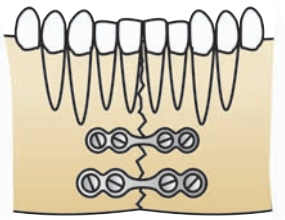
If plates are applied along this border then mini plates with self-tapping monocortical screws applied on the outer cortical plates after reduction will be enough for proper fixation of fracture of mandible.

Plates are fixed on the ideal line of osteosynthesis, known as Champy's line of osteosynthesis.

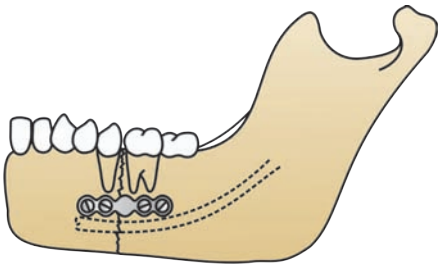




Therefore, the fractures of the angle of mandible can be secured using a single plate at the upper border on the external oblique ridge.



The fracture of the parasymphysis region require two plates just below the alveolus and the other at the lower border.



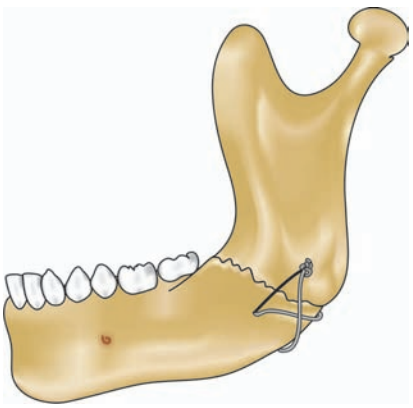
For fracture of the body behind the mental foramen, a single plate is fixed just below the roots of the teeth and above the inferior alveolar nerve.

Surgical Approach

Mini plates are applied using the intraoral or extraoral approach or a combination of both.

The reduction of the fractured ends is done. The miniplate is fixed using 4 monocortical screws (These screws engage only the outer cortical plate) placed 2 on each side of the fracture. The length of the screws should be at least 5 mm.

The surgical site is irrigated and closed using interrupted sutures.



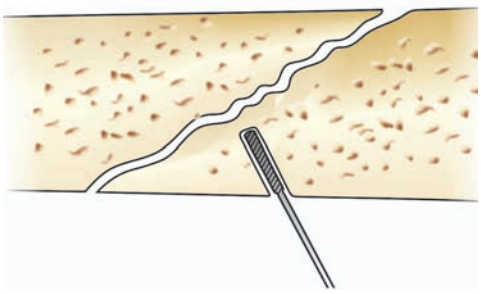
Wiring

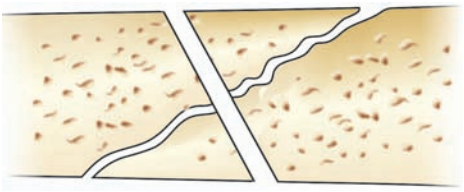
If teeth are present, IMF is done to correct occlusion. Mandible is opened, fractured ends are approximated. Decision is taken on the type of wiring. Bur holes are made which penetrate both the cortii. Wire is passed through and tightened. Once immobilization is satisfactory the incision is sutured and dressing done.

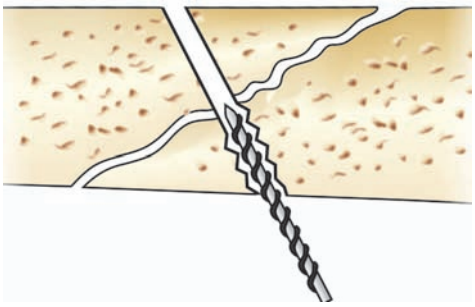
Lag Screw

This is specially indicated in oblique fracture. The lag screw is a special screw which has threads only on one half, the half near the head of the screw is smooth.

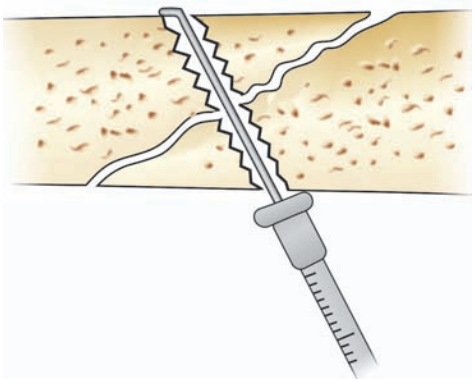
Once the fractured ends of the mandible are approximated a bur hole is made obliquely through both the cortii.



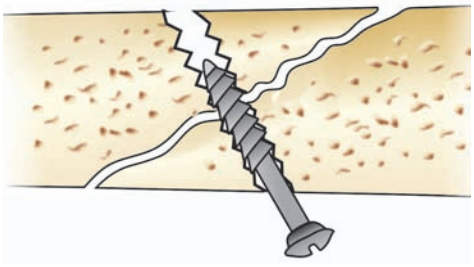




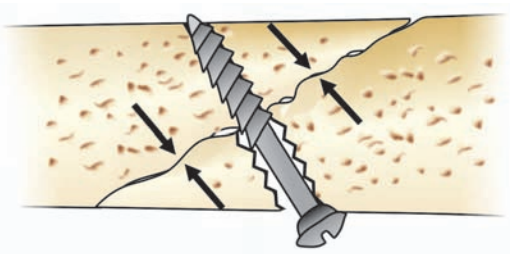
The hole is threaded with screw top.



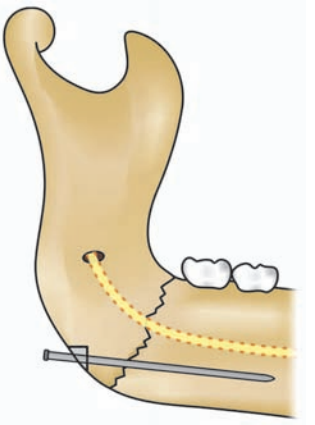
Depth of the screw is taken with the help of depth gauge.



Then a suitable size of lag screw is tightened. As it is screwed further the lingual cortex is



pulled towards the buccal cortex by further tightening as the screw has thread only in its first half. This tightening will compress the fractured ends against each other.



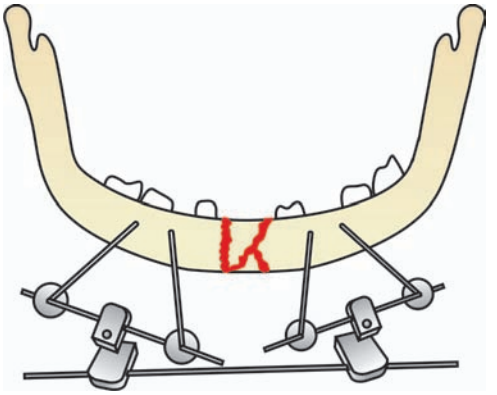
Intermedullary Pinning

A 2 mm diameter Kirschner wire or Steinmann's pin is used for intramedullary pinning. It is a useful method in certain cases, e.g.

1. Symphyseal fracture
2. In cases where IMF is contraindicated
3. Unstable fractures
4. Pathological fracture, etc.

External Pin Fixation

In patients that have sustained extensive comminution or there is infected fracture, sometimes the major fragments are maintained in their proper relationship by using external pin fixation. In this technique a pair of 3 mm titanium or stainless steel pins are inserted into each major bone fragment. These pins diverge from each other but are connected to a cross bar by means of universal joints.

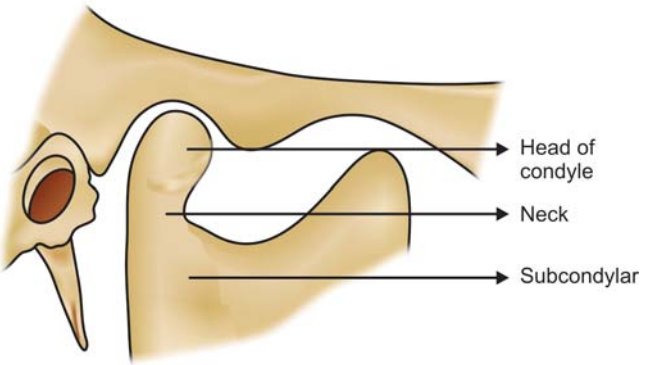


Chapter

6 Fracture of Temporomandibular Joint (TMJ)

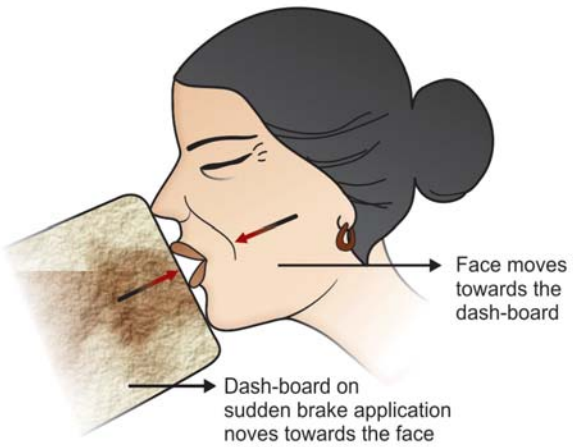
ANATOMY

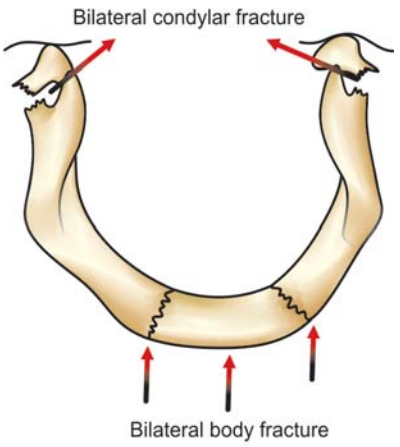
Anatomy of TMJ is in the chapter titled temporomandibular ankylosis.



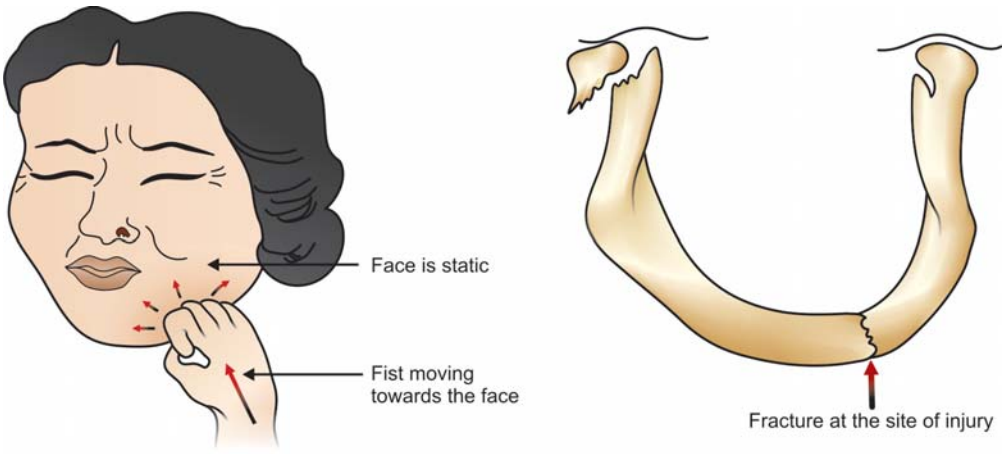
ETIOLOGY

i. In adults, motor vehicle accidents are the major cause of fracture of the condyle. As both the face and the dash-board of the vehicle move towards each other, causing a more grievous injury and generally sustaining bilateral condylar fractures with bilateral body fracture.



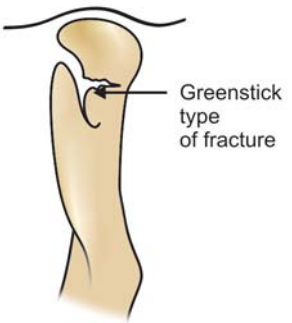


ii. Interpersonal violence, certain sporting accidents, fist fights, etc. in which the face of the patient is static and the striking object is in motion. These types of facial injuries will generally have fracture of the body of the mandible where the injury is sustained and the contralateral fractures of the condyle.



iii. Patient's fall as in fainting, tripping, etc. In this type of fracture the impacting object (ground) is static, the face is mobile, i.e. it is moving towards the ground. As the chin hits the ground there is symphysis fracture along with bilateral condylar fracture. These types of fracture are referred to as "guardsman fracture" or "parade-ground fracture".

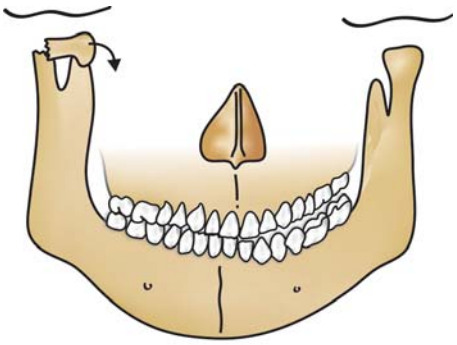
iv. Children, bones are more elastic and therefore a blow on the chin may result in a bilateral 'greenstick' fractures of the condyle such types of fractures should be carefully observed as they may lead to TMJ ankylosis.

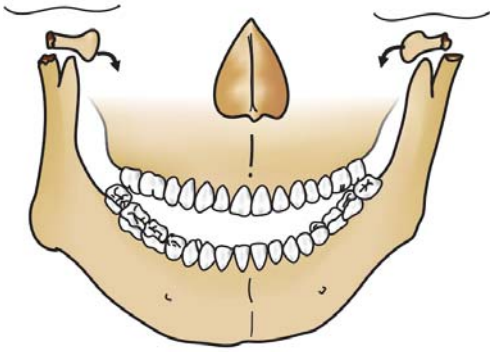


CLASSIFICATION

Classification of TMJ Fractures

I. Unilateral and Bilateral Fracture

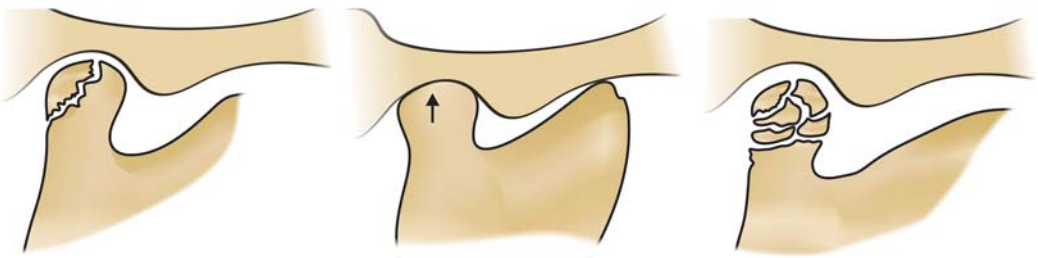

Unilateral fracture


Bilateral fracture

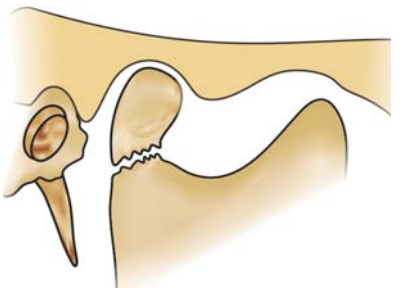
II. Lindahl's Classification

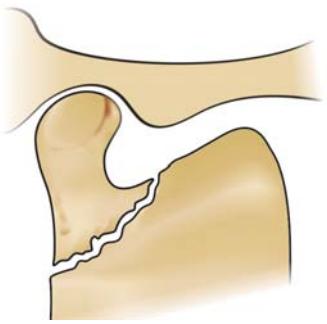
1. *Level of Condylar Fracture*

a. Condylar Head. These fractures are intracapsular. They are further classified as:
i. Vertical fracture, ii. Compression fracture, iii. Comminuted fracture.



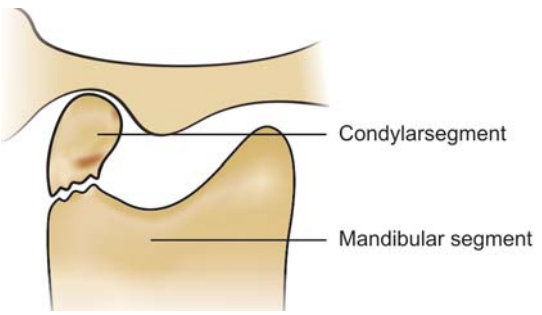
b. Condylar Neck. Which is the thin constricted area located immediately below the condylar head.



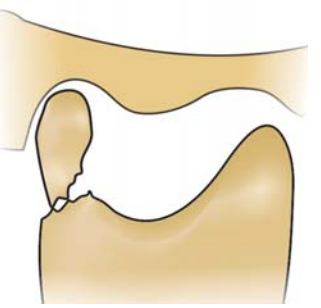


c. Subcondylar. The region below the neck.

2. *Relationship of the Condylar Segment to the Mandibular.*

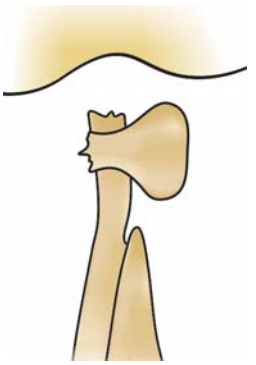


a. Nondisplaced

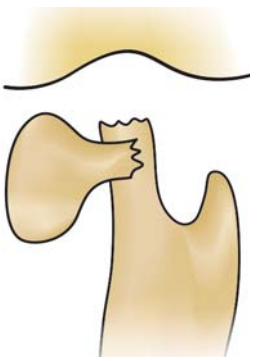


b. Deviated

c. Displacement with Medial or Lateral Overlap.

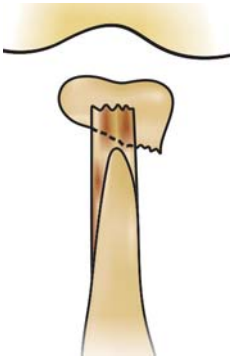


Medial displacement

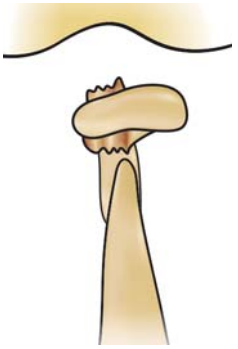


Lateral displacement

d. Displacement with Anterior or Posterior Overlap.

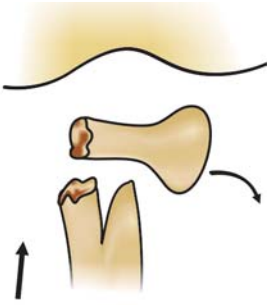


Posterior overlap

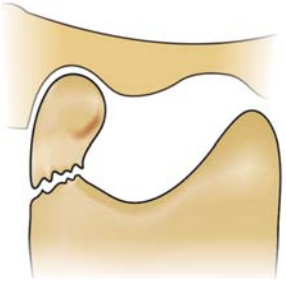


Anterior overlap

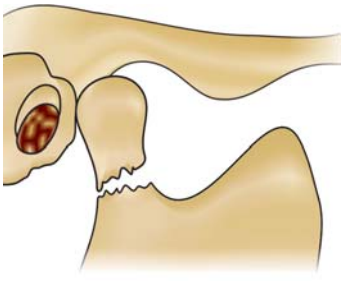
e. No Contact between the Fracture Segment.



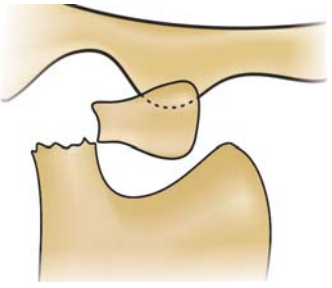
3. *Relationship between the Condylar Head and Glenoid Fossa.*



a. Nondisplaced



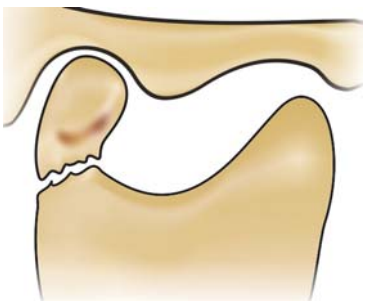
b. Displacement



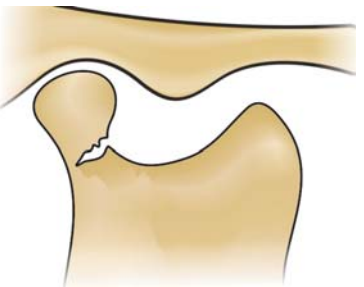
c. Dislocation

III. MacLennan's Classification

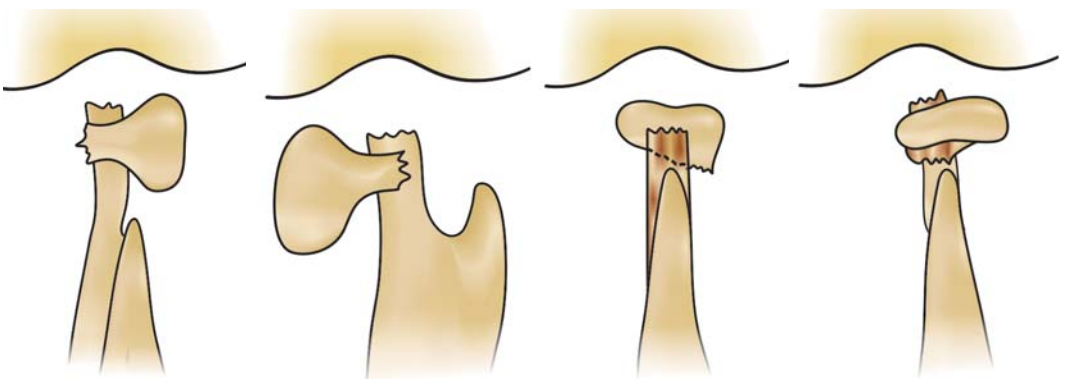
Type I, Nondisplaced



Type II, Fracture Deviation: seen in children of the 'greenstick' type

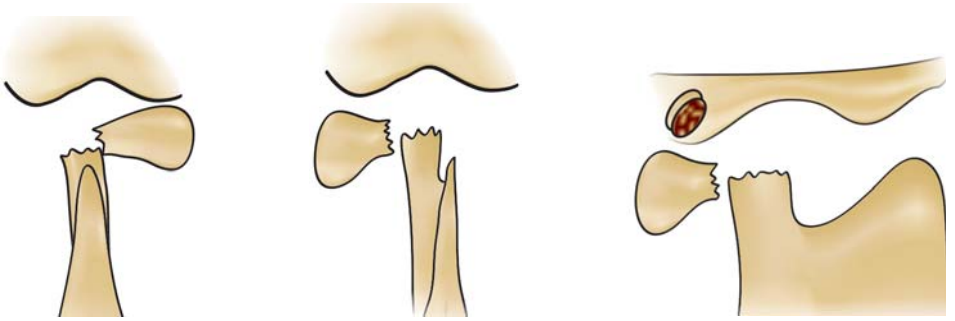


Type III, Fracture Displacement: Overlap of the fractured segment is seen. Overlap could be anterior, posterior, medial or lateral.



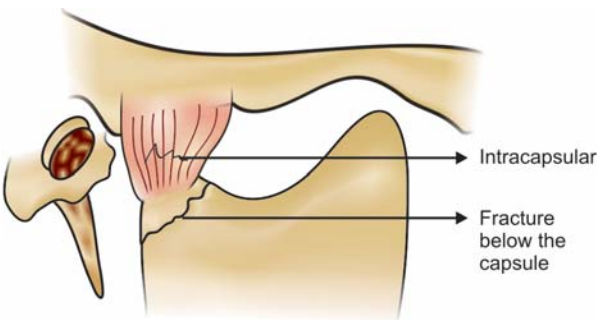
Medial displacement | Lateral displacement | Posterior overlap | Anterior overlap

Type IV, Fracture Dislocation: In this type of fractures the condylar head is completely outside the glenoid fossa, and the capsular confines. The condylar head can be displaced medially or laterally or rarely, anteriorly or posteriorly.



IV. Intracapsular or High Condylar Fracture

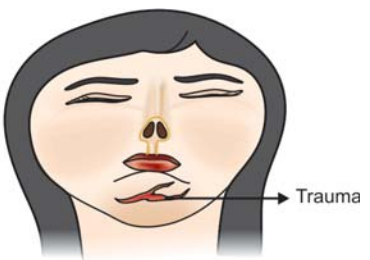
V. Extracapsular or Low Condylar Fracture.

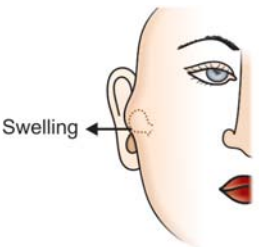


SIGNS AND SYMPTOMS

Unilateral Condylar Fracture

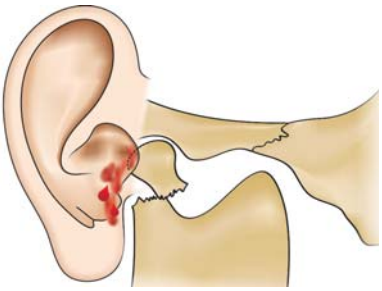
1. *Signs of trauma*, that could be lacerations, abrasion, over the chin with ecchymosis and/or hematoma over the TMJ region

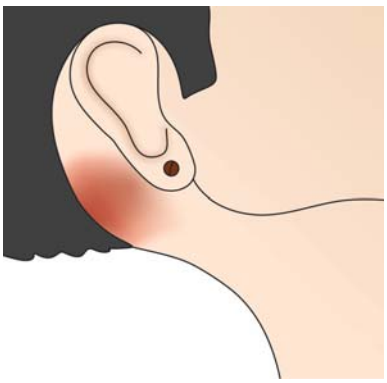




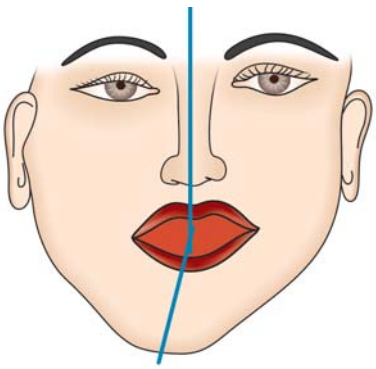
2. *Swelling over the temporomandibular region.* This could be due to edema, hematoma or due to the dislocated head of the condyle that is visible as well as palpable.

3. Bleeding from the external auditory canal. This is due to the laceration of the anterior wall of the external auditory canal.

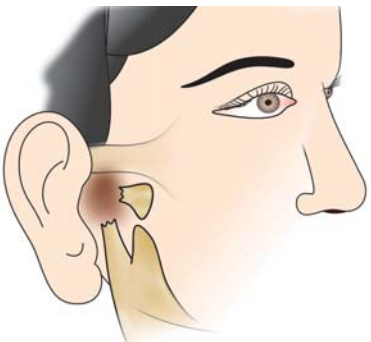




4. Ecchymosis of the skin below the mastoid process on the fractured side. This also occurs with fracture of base of skull known as 'Battle's sign'.



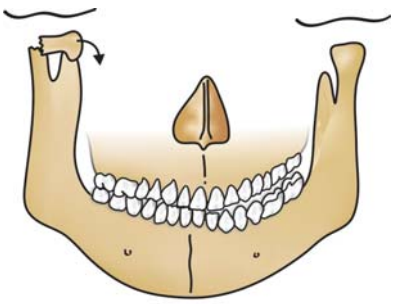
5. Deviation of the mandible towards the fractured side on opening the mouth.



6. A characteristic hollow is seen in the preauricular region if there has been a medial dislocation of the condylar head.

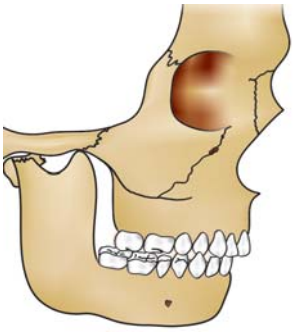
   However, this is felt after the swelling has subsided.

7. There is gagging of the occlusion on the ipsilateral side. This happens due to shortening of the ramus which is caused by displacement of fractured segment.



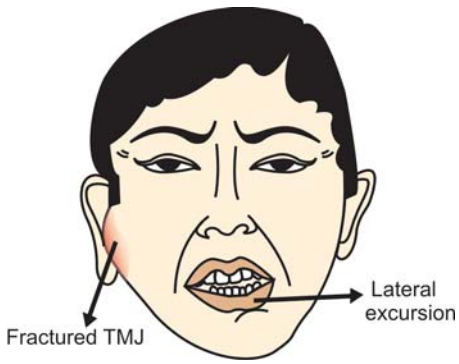
Unilateral fracture

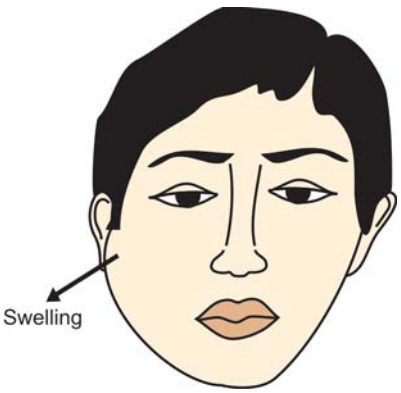
8. Unilateral posterior crossbite and retrognathic occlusion.



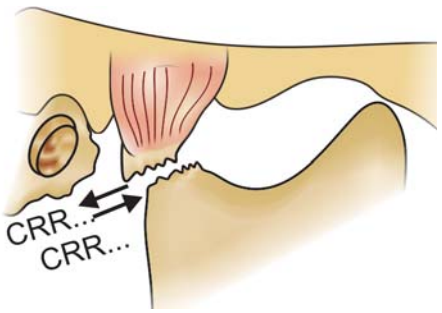
9. Pain and tenderness is felt over the temporomandibular region. There is pain even when patient or the surgeon tries to manipulate the joint.

10. Patient experiences pain during protrusive and lateral excursion to the opposite side.

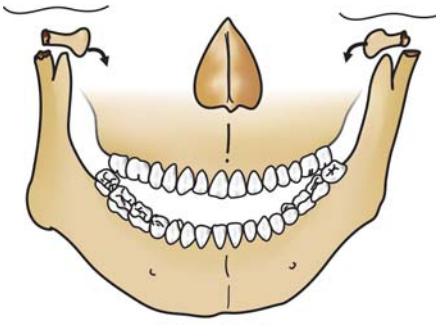




11. Facial asymmetry may be seen that could be due to swelling or due to shortening of the ramus height.
12. Crepitation over the fractured joint due to the irregular fracture ends sliding over one another.



Bilateral Condylar Fracture


Bilateral fracture

The signs are similar to those of the unilateral fracture except both the joints are involved and therefore there is:

1. Swelling over both the joints.
2. Mandibular movements restricted.
3. Generally an anterior open bite is seen.
4. Pain on palpation and movements in both joint seen.


Aha.. Aahaa Aaaa

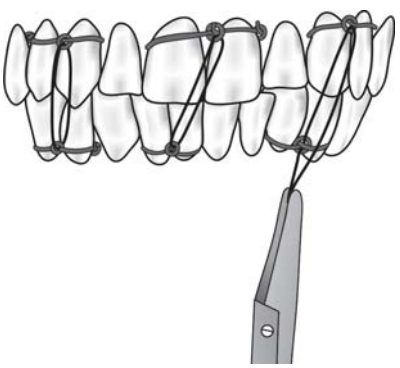
Investigations

1. Radiographs:
   i. OPG (Orthopantomogram)
   ii. Transcranial view of temporomandibular joints.
   iii. Reverse Towne's view.
2. CT scan
3. MRI

Treatment

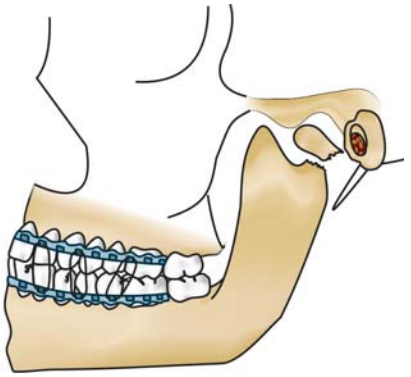
The general principle is to re-establish the preoperative function of the masticatory system. The exact anatomic re-approximation of the fracture segment may not be absolutely essential.

Treatment is divided into conservative and surgical.



Conservative Treatment

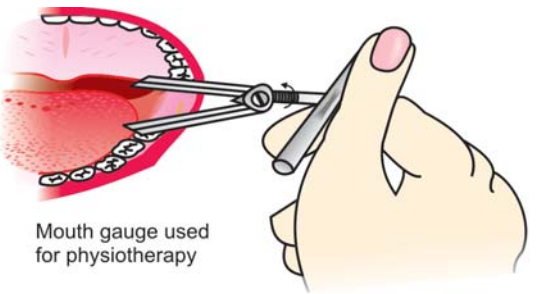
It may be simple observation and soft diet, or may include intermaxillary fixation (IMF) for a short period of time.



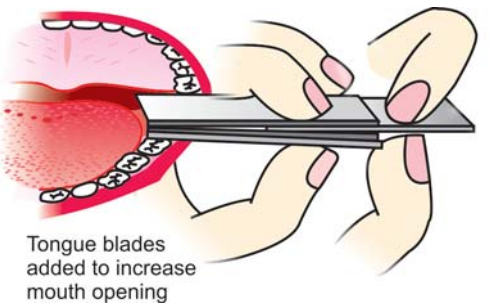
IMF can be done using arch bar, eyelet wiring or splints. This should always be followed by intensive physiotherapy regimen.

Treatment Post-intermaxillary Fixation

It is important to see that the intermaxillary fixation is not kept for a prolonged period. As there will not only be union of the fractured segment, there will also be the union of the glenoid fossa with the condyle (TMJ Ankylosis). The time of IMF should be approximately 7 to 21 days, with a shorter period for children. After removal of the intermaxillary fixation if the occlusion is stable, physical therapy should be started. If malocclusion or significant pain is present IMF should be redone for another short period of time. In case of deviation of the mandible during mouth opening, training or guiding elastics should be given for a short period of time. Once patient is comfortable and occlusion is maintained arch bar's can be removed. The physiotherapy is continued for a prolonged period of time.



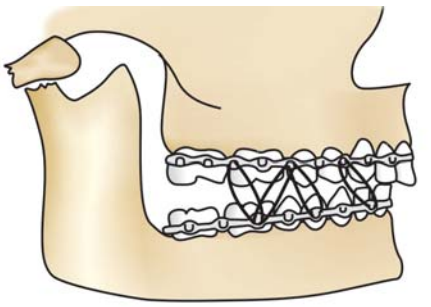
Mouth gauge used for physiotherapy



Tongue blades added to increase mouth opening

Surgical Treatment or Open Reduction

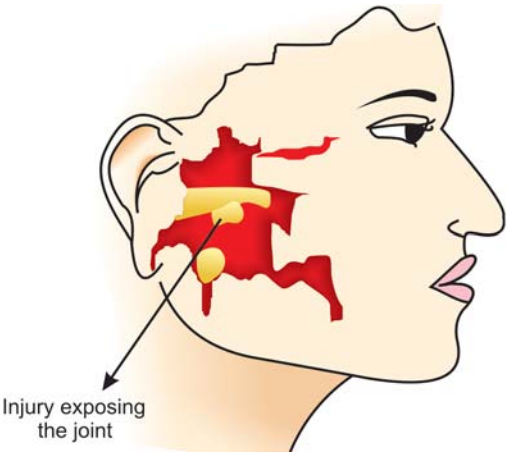
The joint space is surgically exposed and the condyle fixed in its original position using a variety of methods.



Occlusion not achieved

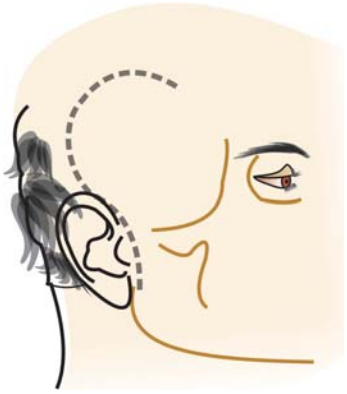
Indications (Absolute)

1. When it is not possible to achieve occlusion using the conservative treatment.
2. Fracture dislocation into the middle cranial fossa.
3. Lateral extracapsular dislocation of the condyle.
4. Compound fractures in whom the joint is exposed as in gun shot injury.



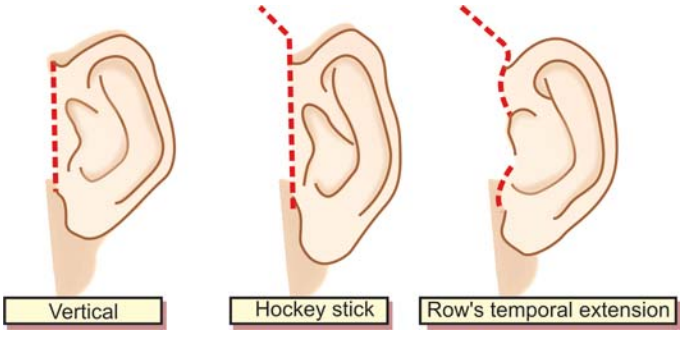
Indications (Relative)

5. Patients in whom IMF is not recommended. As patients with mental problems or those having severe respiratory disorder.
6. In patients with bilateral condylar fractures and other facial injuries that require the fixing of the condyle before the fixation of the other parts of facial skeleton.
7. In bilateral fractures of edentulous atrophic ridges in whom splinting is not recommended.

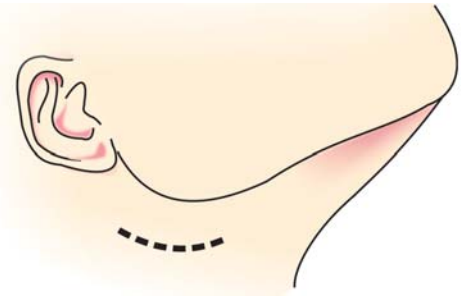


Surgical Approach (Incisions)

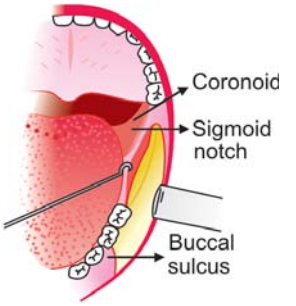
1. Preaurical approach commonly used
   i. Alkayat-Bramley incision
   ii. Rowe's temporal extension
   iii. Hockey stick incision, etc.



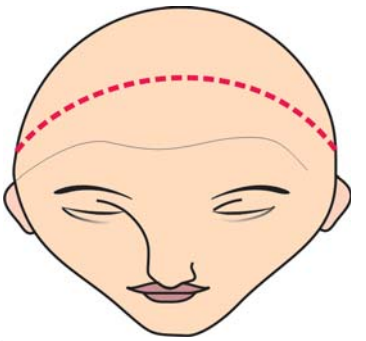
2. Submandibular approach



3. Intraoral approach



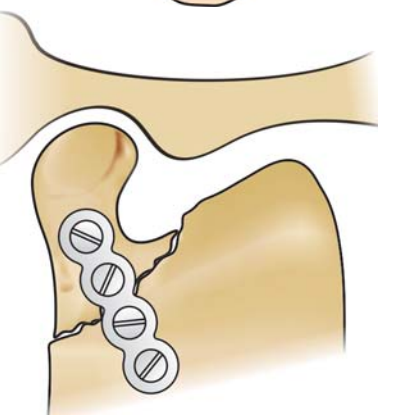
4. Bicoronal in patients with bilateral condylar fracture.

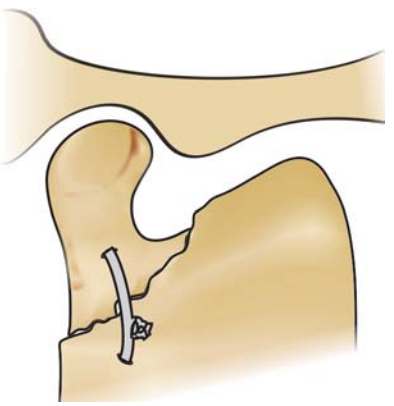


Surgical Technique

Different surgical techniques are available.

1. *Bone Plating:* These provide a rigid fixation. Bone plates are easy to fix. They can be fixed through an extraoral or an intraoral approach.

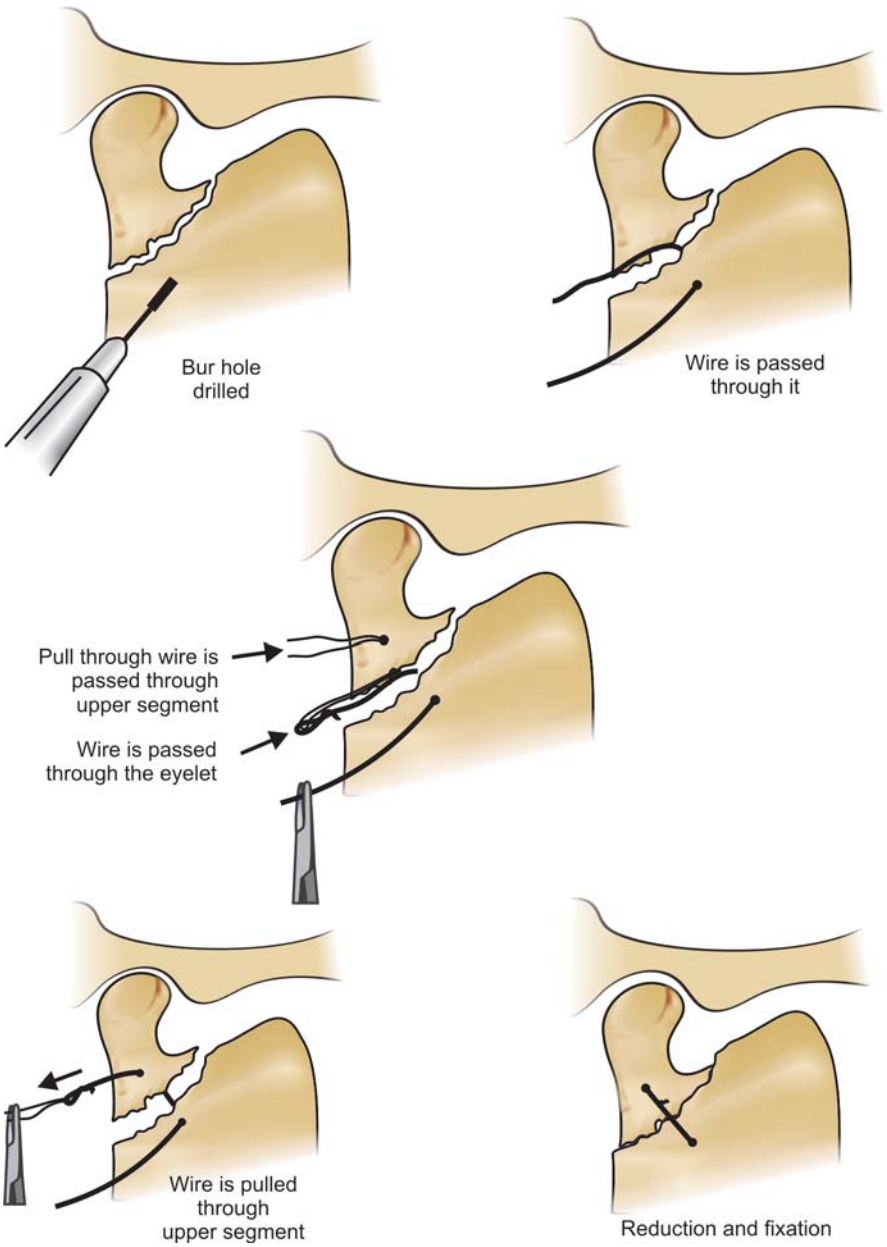




2. *Transosseous Wiring:* A *preauricular incision* is used to reduce and stabilize a high condylar fracture.

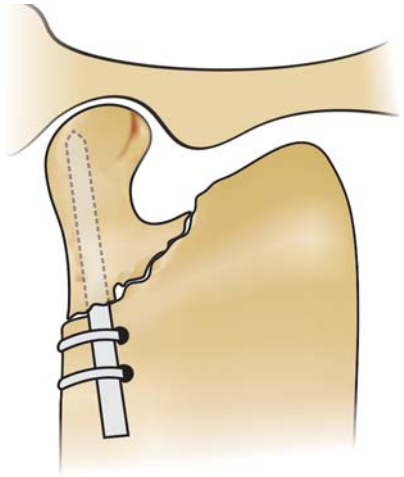
A *submandibular approach* can be used to do wiring of a low subcondylar fracture. In this approach a hole is drilled and a wire is passed through the lower segment.

Another hole is drilled in the condylar segment and a 'pull-through' wire is passed through it. Then the lower end of the main wire is threaded through the eyelet of the pullthrough wire. It is then pulled out of the condyle, bringing the main wire along with it. The two ends of the wire are twisted together. Make sure the fractured segments are reduced before they are fixed.

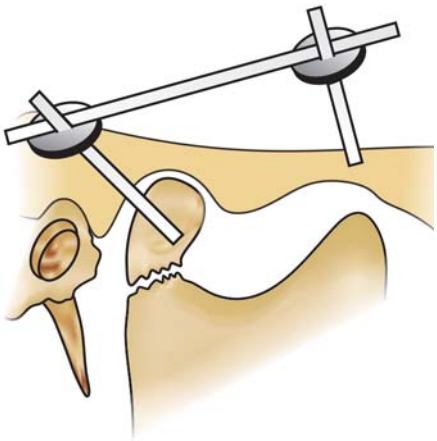


Some other methods of stabilizing the fractured condyle are:

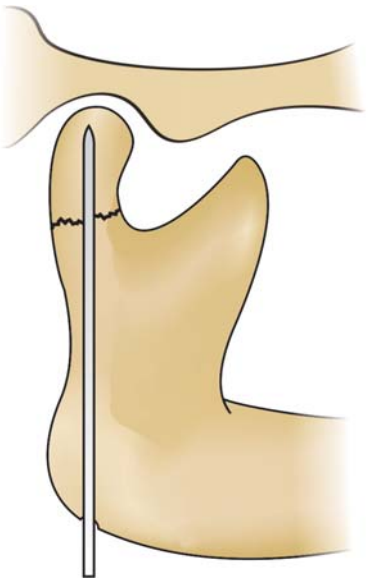
3. Kirschner wiring.
4. External pin fixation.
5. Intramedullary pins.



Kirschner wiring



External pin fixation



Intramedullary pin

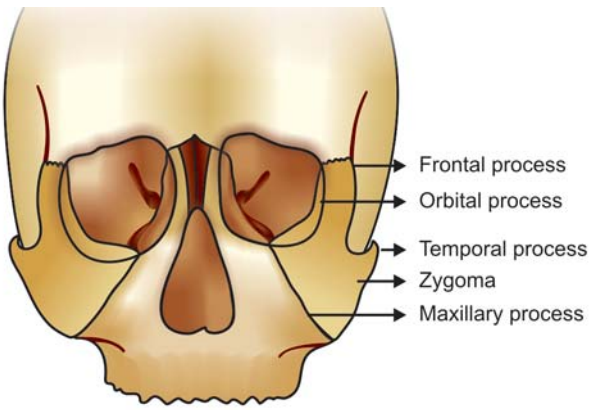
Chapter

7 Fracture of Zygoma

Applied Anatomy

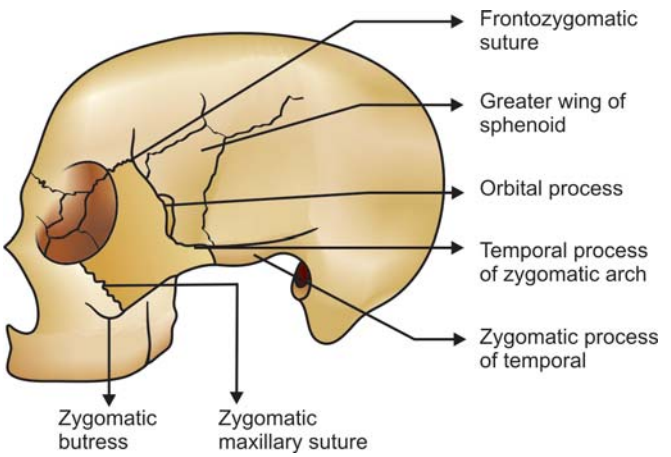
The zygoma is a strong bone with four processes, the frontal, orbital, maxillary and temporal.

This bone forms the cheek prominence and therefore plays an important role in facial appearance.



"The malar bone represents a strong bone on fragile supports and it is for this reason that though the body of the bone is rarely broken, the four processes the frontal, orbital, maxillary and frontal process of zygomatic arch are the frequent sites of fracture" (HD Gillies, TP Kilner, D Stone 1927).

The zygoma is attached to the frontal bone at the frontozygomatic suture (frontal process), the bone passes downwards along the greater wing of sphenoid to the anterior limit of the inferior orbital fissure (orbital process). The zygoma is attached to the maxilla at the zygomaticomaxillary suture and passes below the zygomatic process (maxillar process). The zygomatic arch is formed by two processes, the temporal process of the zygomatic bone and the zygomatic process of the temporal bone.

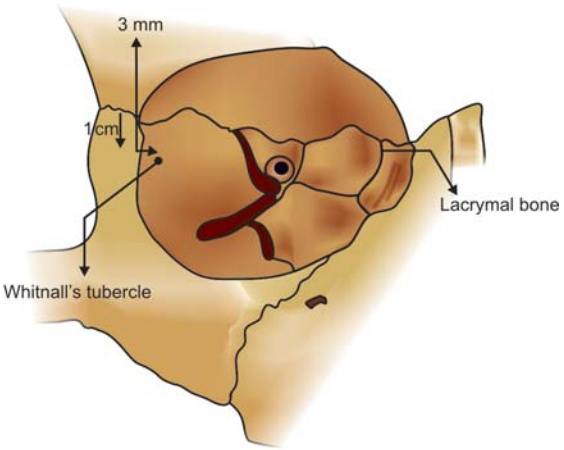


Fracture of the zygomatic complex can be regarded as "Tripod" having three legs being the:

i. Frontal process,
ii. The inferior orbital margins, and
iii. The zygomatic buttress with the seat being the zygomatic bone.

If one process is fractured, an active treatment is not required as the other processes give the stability.

The eyeball is held in position by Lockwood's suspensory ligament that is attached medially on the lacrimal bone and laterally onto the Whitnall's tubercle. This tubercle is situated approximately 1 cm below the frontozygomatic suture and 3 mm inside the orbital margin.



It is because of the Lockwood's ligament that sometimes when the trauma does not involve many fracture site still the patient will experience diplopia. This is so because the fracture line will be running above the Whitnall's tubercle and as there is a downward movement of the fractured bone, the Lockwood's ligament will also move down shifting the position of the eyeball causing diplopia.

On the other hand sometimes even though there is a lot of trauma to the skeletal structure of the orbit, still the patient does not experience diplopia, this is because the fracture lines are running below the Whitnall's tubercle thus not shifting the position of the Lockwood's ligament and consequently the position of the eyeball.

Radiological Evaluation

(In 1984 Johnson recommended)

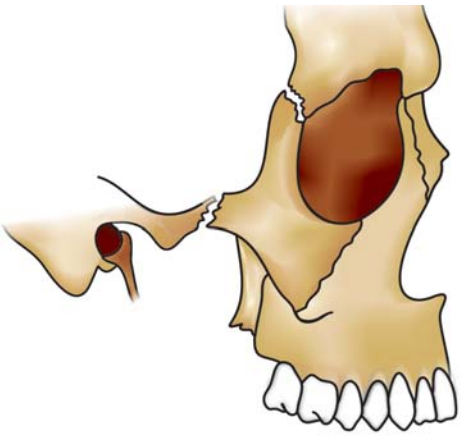
A single "Waters view" (PNS view) after a thorough clinical examination is enough. Only if further information is needed, a "CT Scan" is the procedure of choice.

Occipitomental radiograph (Jughandle view) is the choice for viewing zygomatic arch fractures.

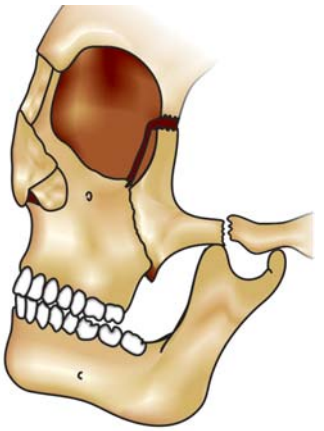
Classification of the Zygomatico-maxillary Complex Fracture

A. Fracture of the body of the zygomatic complex involving the orbit:

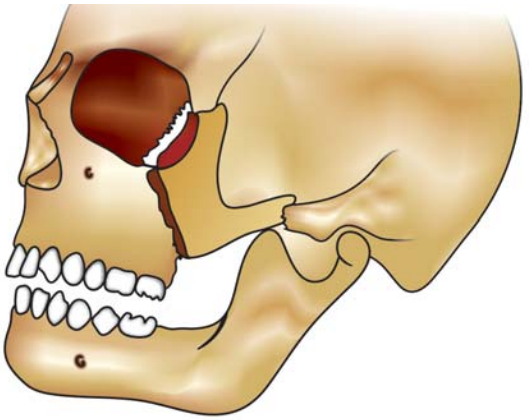
1. Minimal or no displacement



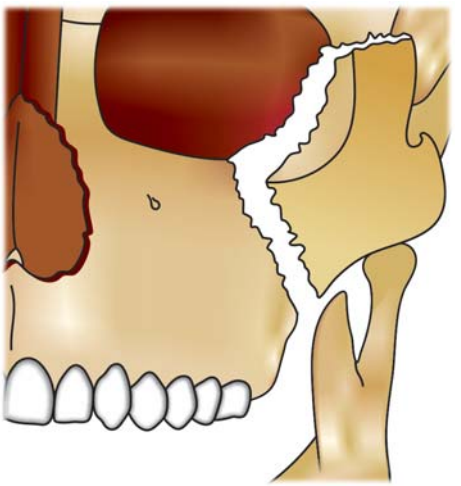
2. Inward and downward displacement



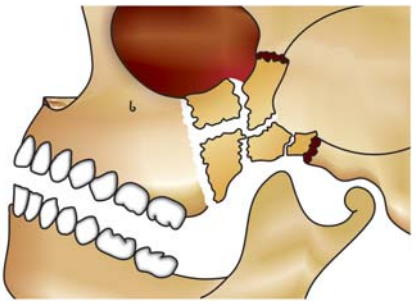
3. Inward and posterior displacement



4. Outward displacement

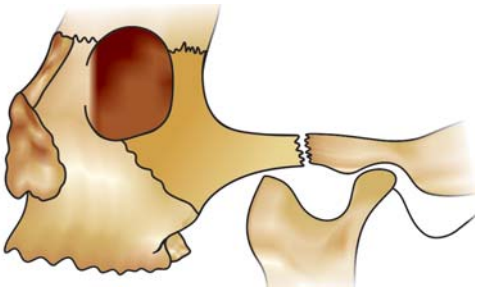


5. Comminution of the complex as a whole.

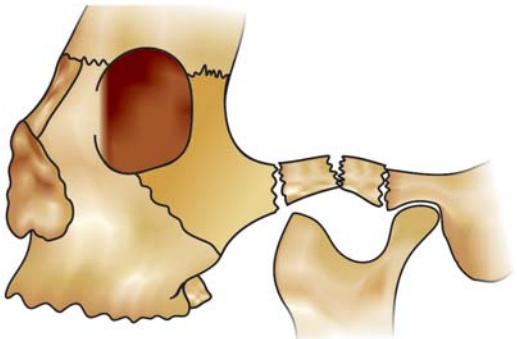


B. Fracture of the zygomatic arch alone, not involving the orbit:

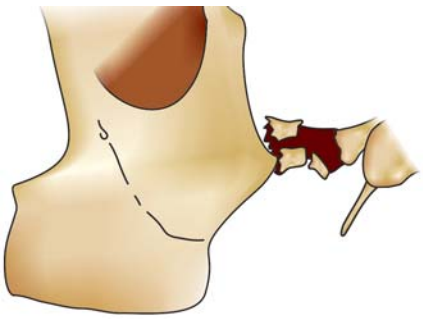
1. Minimal or no displacement



2. V-type in-fracture

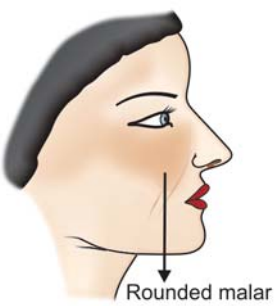


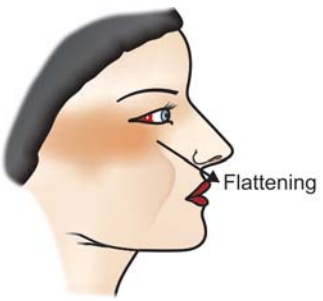
3. Comminuted.



Signs and Symptoms

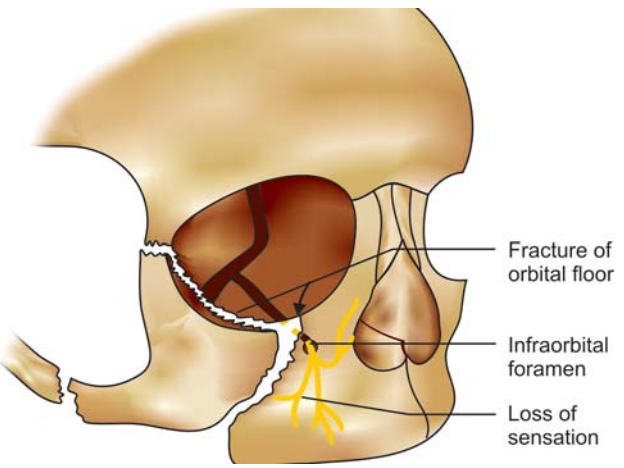
1. *Flattening of the malar prominence:* The most common and is specially seen in people with prominent cheek bones. This sign can be masked by swelling.





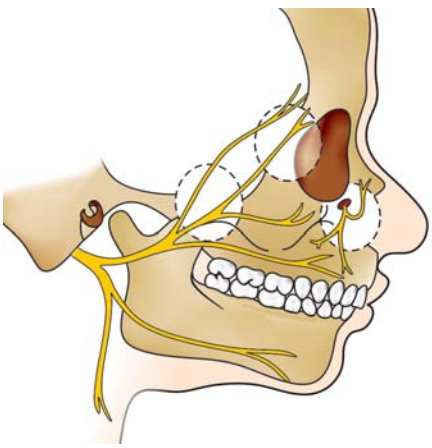
The best way to observe the flattening is to look at the patient either from the top of the patient's head or from the chin end when the patient is supine.

2. *Periorbital ecchymosis:* Edema and bleeding into the loose connective tissue of the eyelids and periorbital area is very common.

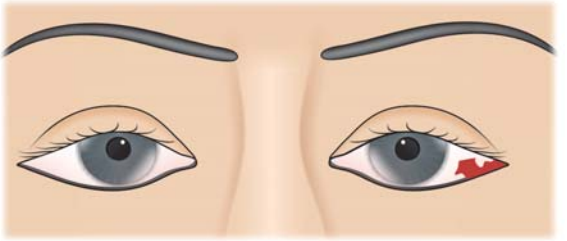


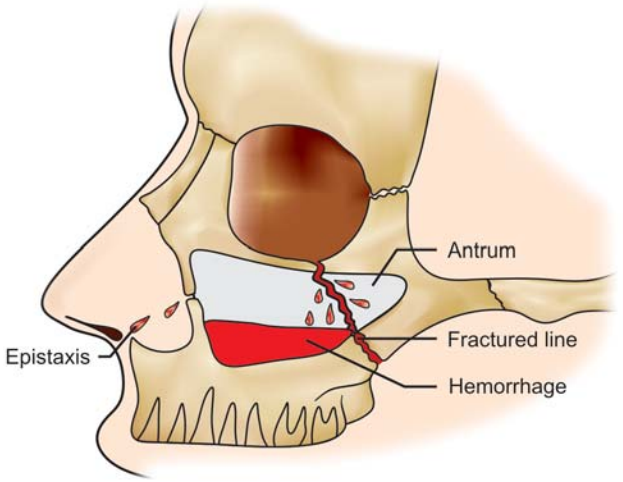
3. Infraorbital nerve damage is usually seen, when fracture occurs through the orbital floor and/or the anterior maxilla causing tearing, shearing or compression of the infraorbital nerve along its canal or foramen. This causes anesthesia of the lower eyelid, upper lip and lateral area of nose. There can also be altered sensitivity of maxillary teeth and gingiva.

4. *Zygomatic nerve damage:* This is usually associated with these fractures. There is parasthesia or anesthesia of zygomaticofacial and zygomaticotemporal branches, i.e. temple, cheek of the affected side.



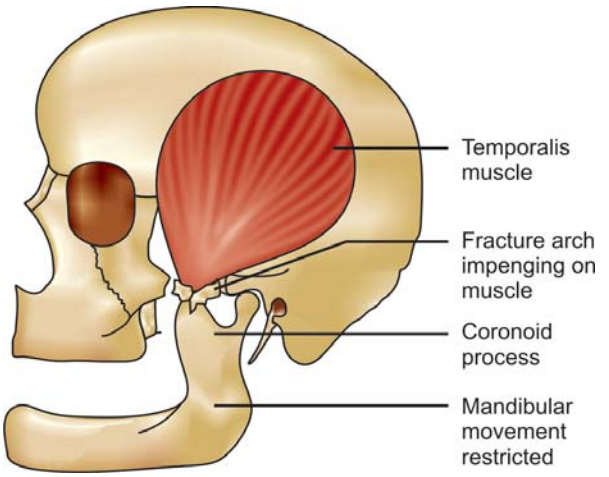
5. *Subconjunctival hemorrhage:* It is mostly seen with fractures that involve the orbital rim. The absence of ecchymosis does not rule out fracture orbital margin. For subconjunctival ecchymosis to occur, there has to be a break of the underlying periosteum, or else the bleeding is subperiosteal.





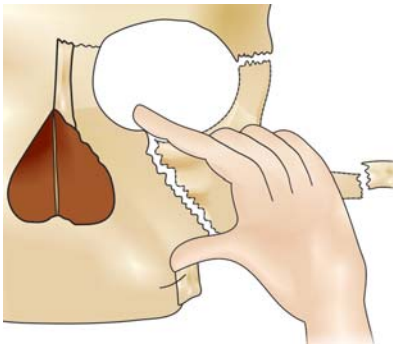
6. *Epistaxis:* Hemorrhage into the antrum takes place when sinus mucosa is torn causing unilateral epistaxis from the nostril of the trauma side.

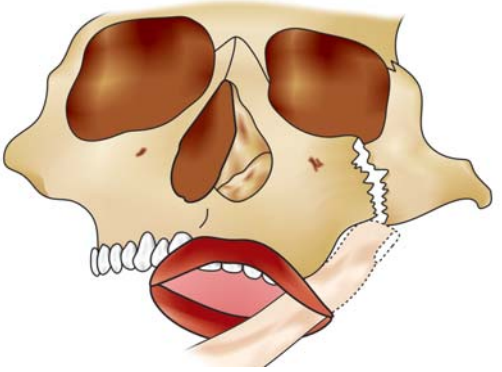
7. Restricted mandibular movements are seen in patients with fracture zygomatic arch, as the fractured bones impinge on the temporalis muscle and/or coronoid process. If the mouth is open at time of injury, closure is not possible as the zygomatic bone may be driven in to such an extent that it prevents closure of the mouth. Also associated lateral movements may be restricted.



8. Ecchymosis of the maxillary buccal sulcus is an important sign of zygomatic or maxillary fracture.

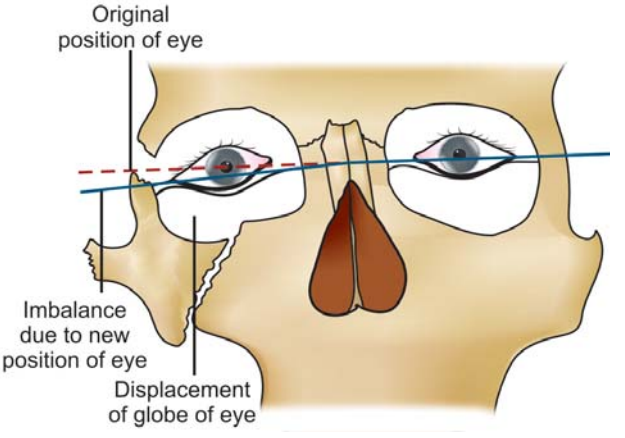
9. A gap or step deformity of the orbital margin is often seen at the infraorbital and lateral orbital rims at the fracture site.



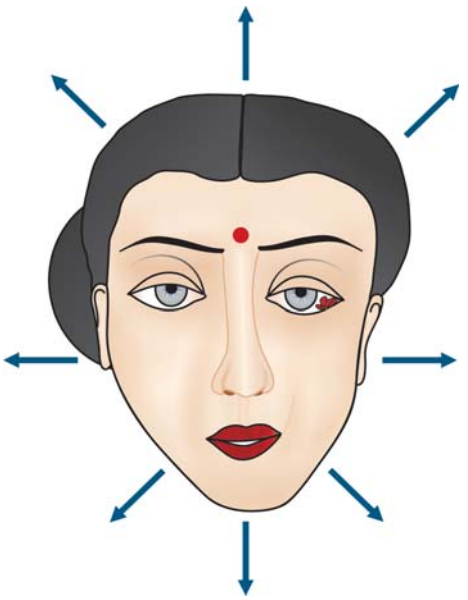


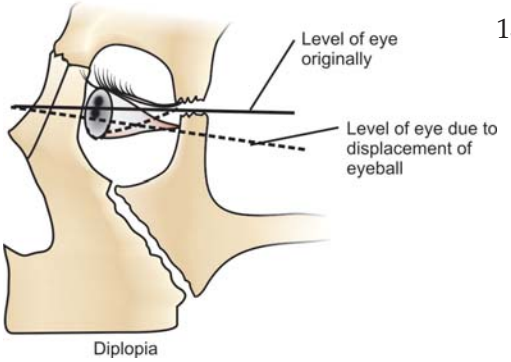
10. Deformity of the zygomatic buttress of the maxilla can be palpated intraorally.

11. Unequal pupillary levels: displacement of suspensory ligament of the globe due to fractured orbital rims causes clinically unequal pupillary levels.



12. Diplopia develops following trauma and is due to soft tissue entrapment, neuromuscular injury, infraorbital or intramuscular haematoma or oedema or a change in orbital shape with displacement of the globe causing a muscular imbalance. Diplopia can be tested by moving a finger at least an arms length away in all nine directions and to see if patient has double vision during any of these movements.





Diplopia

13. Enophthalmos is the condition when the eyeball moves inside, specially seen if the zygomatic injury has produced an increase in the orbital volume, or due to the herniation of orbital contents into the maxillary antrum in a blow-out fracture or when the Lockwood's ligament support is lost- enophthalmos can also cause post-healing due to scar contraction, fibrosis or fat atrophy.

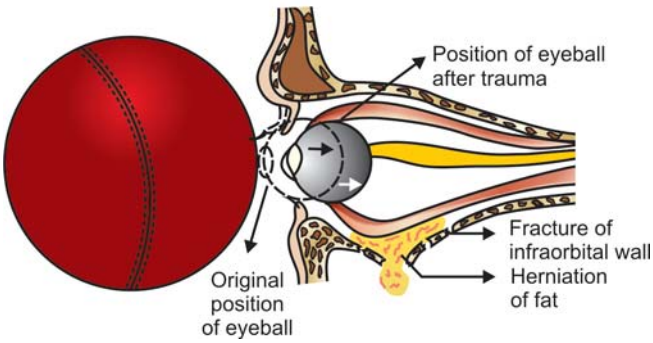
ORBITAL WALL FRACTURES

These fractures can be divided into anterior (orbital run) and posterior (thinner lateral walls, roof and floor). These thin walls fracture either outwards (blow out) or inwards (blow in) fracture.

Blow Out Fracture

It refers to fracture of the floor of the orbit. It is accompanied by displacement of orbital contents into maxillary sinus.

Normally, the eyeball projects slightly out of the orbital run. The orbital contents are the eyeball and fat. When there is direct trauma to the globe it causes an increase in infraorbital pressure and decompression via fracture of the orbital floor. Thus, causing herniation of fat into the maxillary sinus.



Blow in Fracture

It refers to inwards displacement of the orbital run or walls resulting in decreased orbital volume. Clinically, proptosis is seen because of decreased orbital volume restricted occular mobility and diplopia. No surgical treatment is required, excepting for the fractures of the lateral orbital wall, which is treated surgically.

Treatment

It is necessary to reduce and fix the fractures specially:

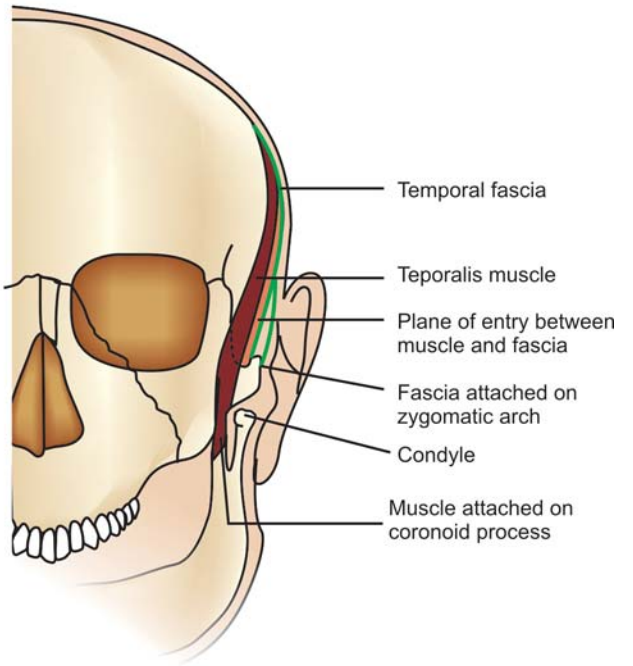
i. For cosmetic reasons—when there is a flattening of the zygoma, which gives the face an unsightly appearance.
ii. When there is impinging of extraocular muscles giving rise to diplopia, i.e. diplopia which does not resolve during the first 10 days after injury.
iii. To remove interference which is causing restricted mandibular movements.
iv. Enophthalmos greater than 3 mm.
v. An infraorbital fracture causing herniation into the antrum, etc.

The decision of surgery should be based on signs and symptoms and functional impairment. These fractures are not an emergency and treatment can be delayed for the edema to settle down and the defect to be reassessed if intervention is questionable.

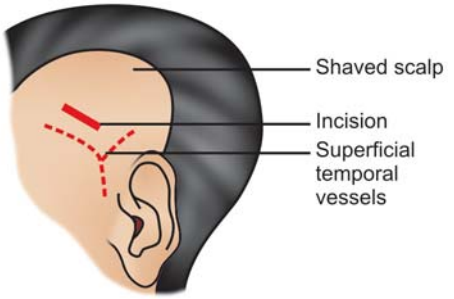
The fractured zygomaticomaxillary complex has four major processes that articulate with adjacent bones. Only when three are properly positioned can one be sure of an accurate reduction.

There are many surgical procedures available to do a proper reduction and fixation of the fracture zygoma with as many approaches.

A. For Reduction Only

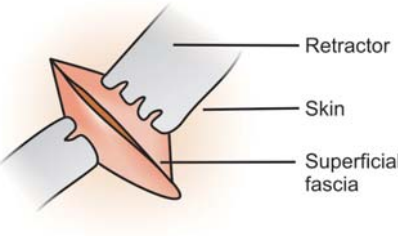


1. ***Temporal approach or Gillies' temporal approach***: In this approach, the space that is present between the temporalis muscle and temporal fascia is utilized. The temporalis muscle which is attached to the temporal region in the skull passes straight down under the zygomatic arch to get attached to the coronoid process of the mandible. The temporalis fascia which is just above the temporal muscle goes down to get attached to the superior aspect of the zygomatic arch. Thereby creating a plane in which, if a flat instrument is passed, it will move just under the temporal fascia and will run above the temporalis muscle to pass straight under the zygomatic arch. This instrument if correctly manipulated can elevate the zygomatic bone or its arch into correct position.

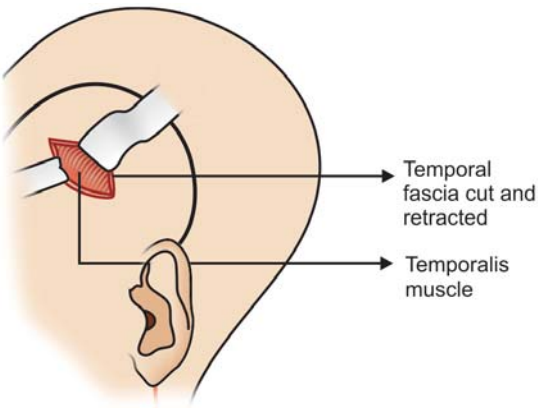


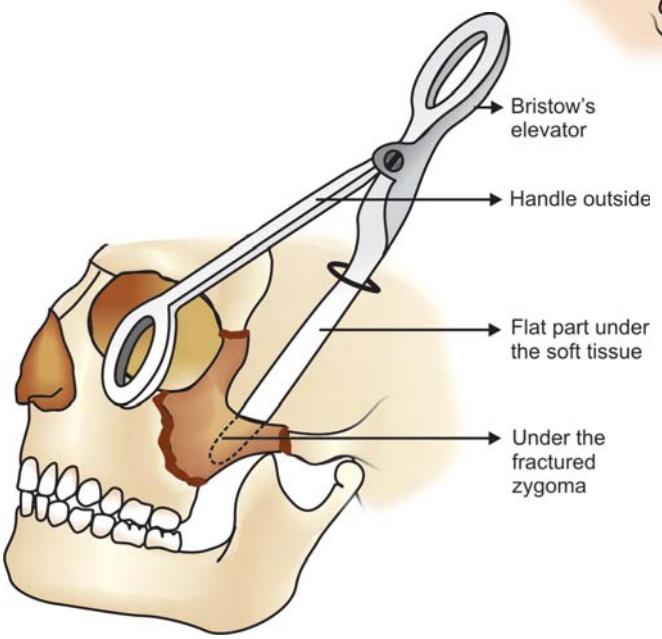
The scalp on the fracture side is shaved, an incision 2.5 cm is made in the temporal area between the two branches of the superficial temporal vessel parallel to the anterior division, so that the vessels remain safe.

This cut is made through the skin, superficial fascia and temporal fascia.



These layers are then carefully reflected to expose the temporalis muscle.

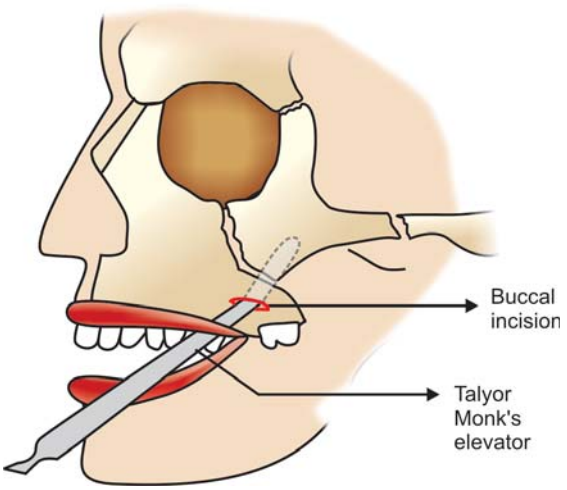




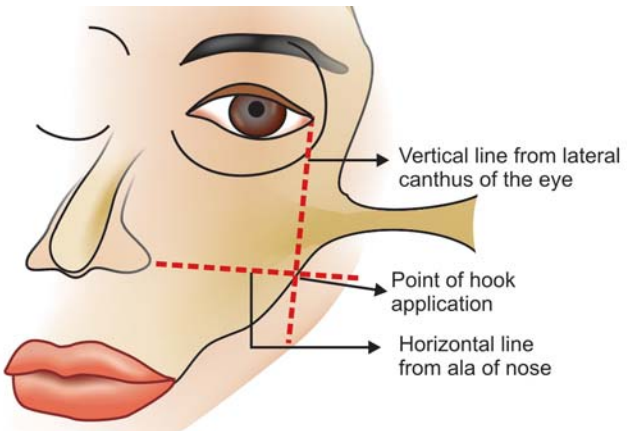
A flat instrument is passed between the temporal fascia and the underlying temporalis muscle.

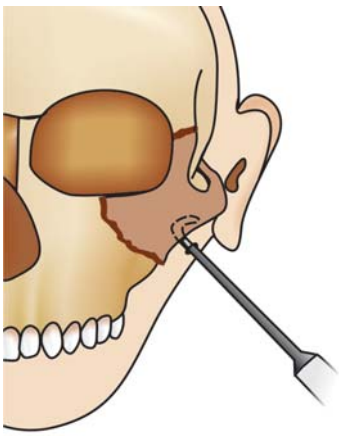
Once the instrument is under the fractured zygoma it can be elevated. The best instrument for this purpose is Rowe's modification of Bristow's elevator. After the reduction is completed incision can be sutured.

2. ***Buccal sulcus approach (Keen Technique)*:** A small incision approximately 1 cm is made in the mucobuccal fold, just beneath the zygomatic buttress of the maxilla. It should incise the mucosa, submucosa and any buccinator muscle fibers. An elevator is then passed into the incision, till it makes contact with, and is under the zygomatic arch, zygoma. Using superior, lateral and anterior force, the bone can be reduced.



3. ***Percutaneous approach***: A very direct route to elevation of the depressed zygoma is through the skin overlying the zygoma. This technique can produce forces in a very direct manner. Two intersecting lines, i.e. (i) a vertical line dropped from lateral canthus of the eye, and (ii) a horizontal line drawn laterally from the ala of the nose; determine the location of the hook application.

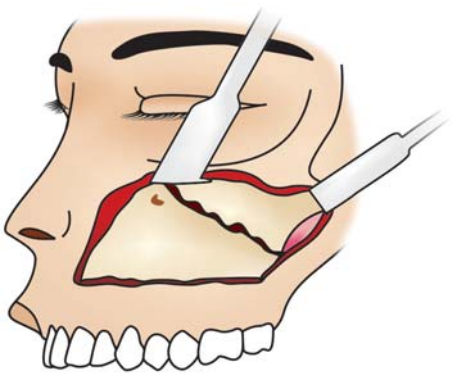




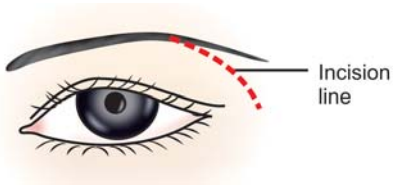
B. Open Reduction and Fixation

Existing lacerations are often used but in their absence properly placed incisions are excellent for access.

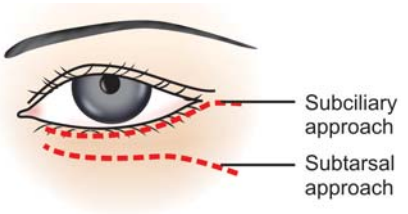
1. *Maxillary vestibular approach*: Access to the entire facial surface of the midfacial skeleton from the zygomatic arch to the infraorbital rim, to the frontal process of the maxilla can be achieved. The incision is placed approximately 3-5 mm superior to the mucogingival junction. It extends as far posteriorly as the first molar, once retracted the fracture can be identified and reduced.



2. *Supraorbital eyebrow approach:* This incision is made on the lateral side of the eyebrow over the superior-lateral area of the orbital rim, over the fractured site which is generally frontozygomatic suture area. The incision is approximately 2 cm in length and deep up to the periosteum. Once wiring or plating is done, sutures can be put in double layer.

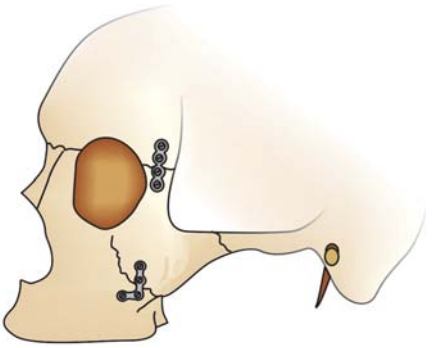


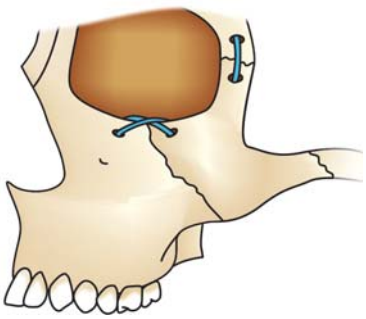
3. *Lower eyelid approach*: The subciliary approach is made 2 mm below the gray line of the lower eyelid. The subtarsal incision is made in the natural skin crease approximately half the distance between the lash margin and the orbital rim. These incisions are then deepened up to the infraorbital bone subperiosteally. The periosteum should be cut 3-4 mm below the orbital rim. Once the reduction and fixation is completed, the incision should be closed in two layers.



For Fixation

1. *Bone plating* systems can be used in which plate and screws are used, this gives the best form of rigid fixation.

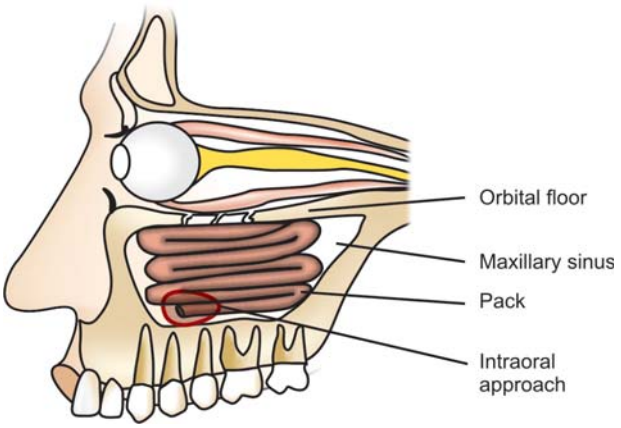




2. *Transosseous wiring* is another very often employed technique to fix the fractured ends.

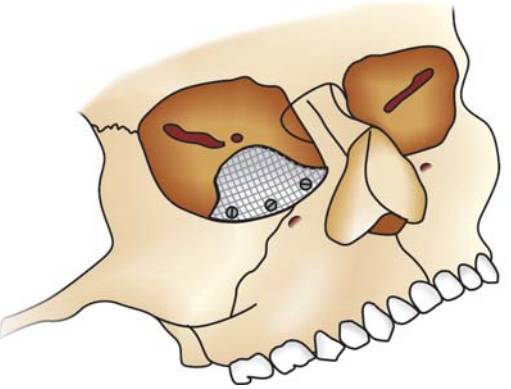
For Treatment of Blowout Fracture

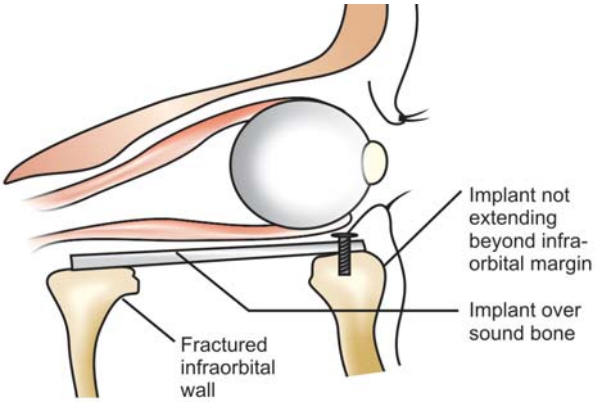
1. *Antral pack* is another technique in which the maxillary sinus is reached through the buccal approach and a pack applied in the antrum to support a reconstituted comminuted orbital floor.



2. *Orbital reconstruction*: It is a supplementary procedure that is performed using the lower eyelid approach. In this procedure an implant is placed such that the floor of the orbit is recreated which was lost due to trauma.

Some materials that can be used are autologous bone cartilage, methyl methacrylate silicon polymer, metal sheets or mesh, etc.



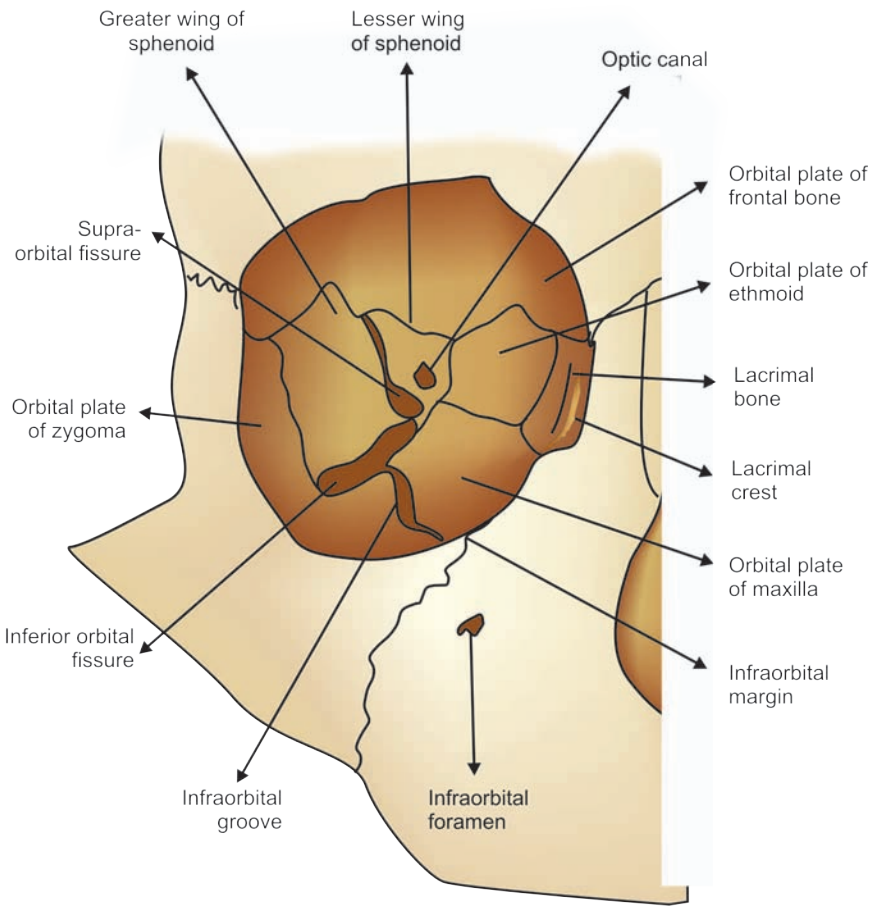


While placing the implant care should be taken that it is large enough to be placed on sound bone. Also the implant should not extend over the infraorbital margin.

Chapter

8

Fracture of Maxilla



The right orbit anterior view

The facial skeleton can be divided into three parts:

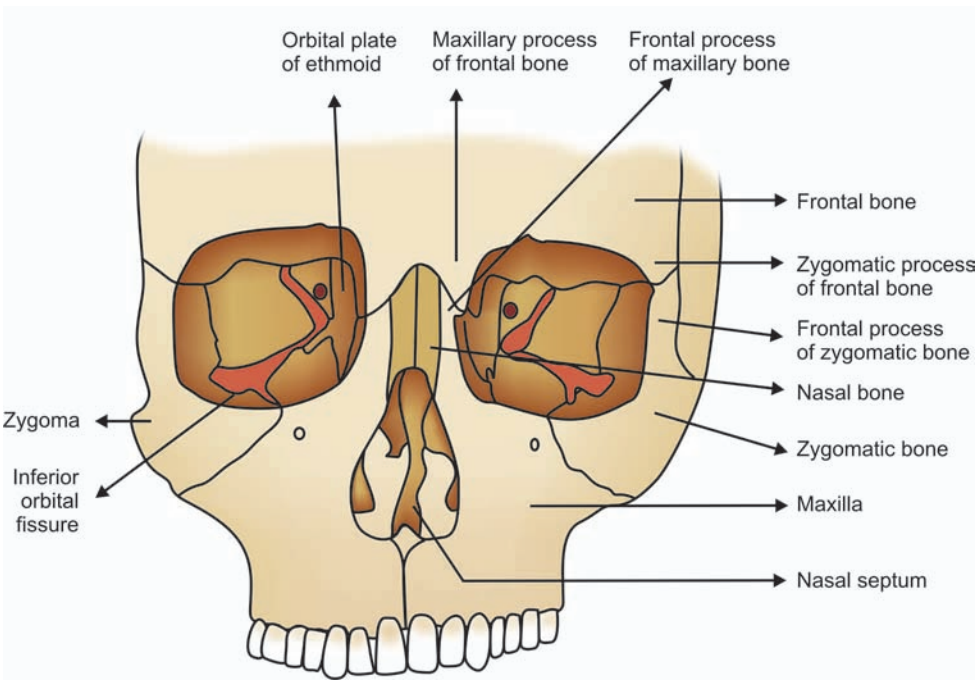
i. The upper part that is the forehead. It is formed by the frontal bone.
ii. The lower third of the face is formed by the mandible.
iii. The middle third that extends below the frontal bone. Superiorly, it is bounded from the frontozygomatic suture on one side to the frontonasal suture in the middle and across to the frontozygomatic suture of the other side.

Inferiorly it extends up to the occlusal surface of the maxillary teeth.

The middle third is made up of many bones. These bones are thin and also contain the air sinuses thus making the skeletal structure matchbox like.

The following bones form the middle third:

i. Two maxillae.
ii. Two zygomatic bones.
iii. Two zygomatic processes of the temporal bone.
iv. Two nasal bones.
v. Two lacrimal bones.
vi. The vomer.
vii. The ethmoid and its conchae.
viii. Two inferior conchae.
ix. Two palatine bones.
x. The pterygoid plates of the sphenoid.



Frontal view of the skull

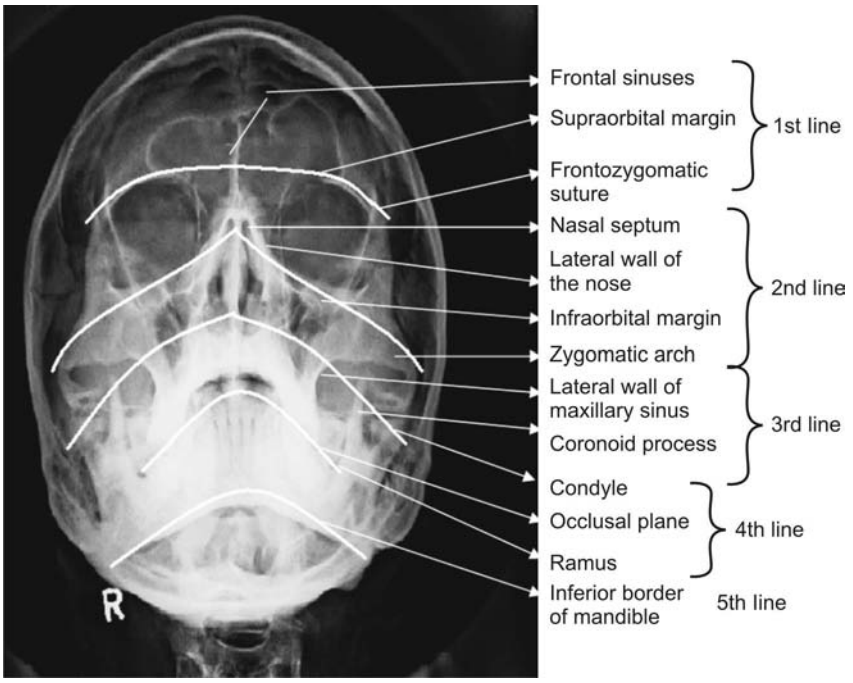
RADIOGRAPHIC EVALUATION

Some of the X-ray generally used for viewing the maxilla are the:

- Occipitomental or paranasal sinus view
- Occipitofrontal 25°
- Submentovertex
- Lateral nasal bones
- Intraoral occlusal view
- Computerized tomography, i.e. CT scan is also very useful in visualizing fractures of the middle third of the face.

The PNS view can be very well studied if the McGrigor and Campbells 5 lines are followed:

i. 1st line runs across zygomaticofrontal sutures, supraorbital margin and the frontal sinus.
ii. 2nd line runs across the zygomatic arches, the infraorbital margin and the nasal bones.
iii. 3rd line passes along the condyle coronoid process and the maxillary sinuses.
iv. 4th line runs across the ramus and the occlusal plane.
v. 5th runs along inferior mandibular border.



Classification

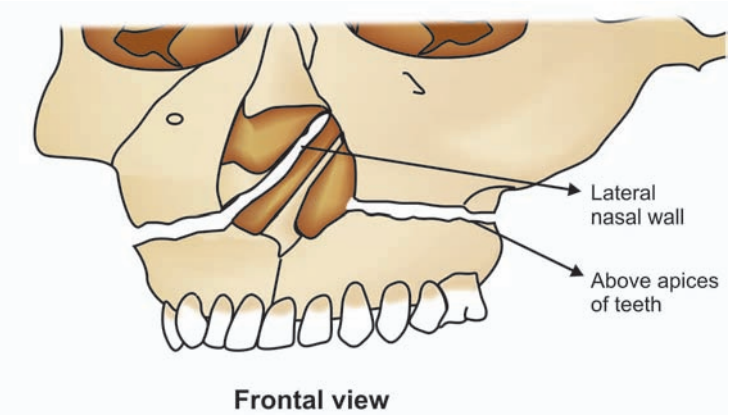
Maxillary fractures are classified into LeFort I, II and III (Ren'e LeFort 1901). The fracture lines described run bilaterally.

Salient Features

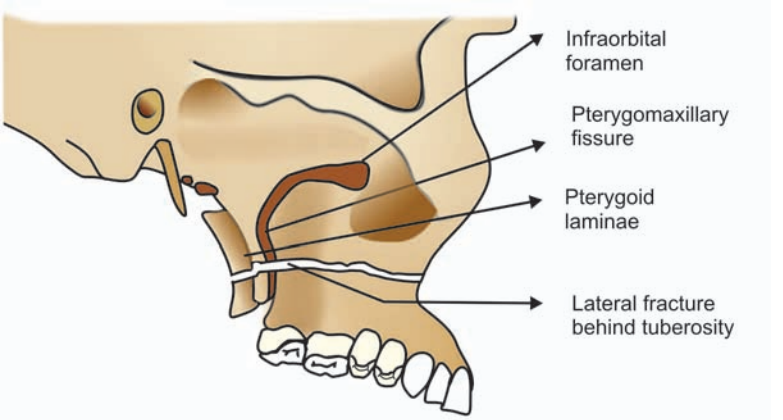
LeFort I or Low Level Fracture

It separates the palate and tooth bearing segment, bilaterally from the mid face.

- This horizontal fracture runs above the nasal floor.
- Along the lateral wall of the antrum from the anterior nasal aperture.
- Below the zygomatic buttress (behind the tuberosity).
- Across the lower 1/3 of pterygoid laminae.
- Then through lateral wall of nose.
- Lower 1/3 of nasal septum.
- To join the lateral fracture behind the tuberosity.



Frontal view



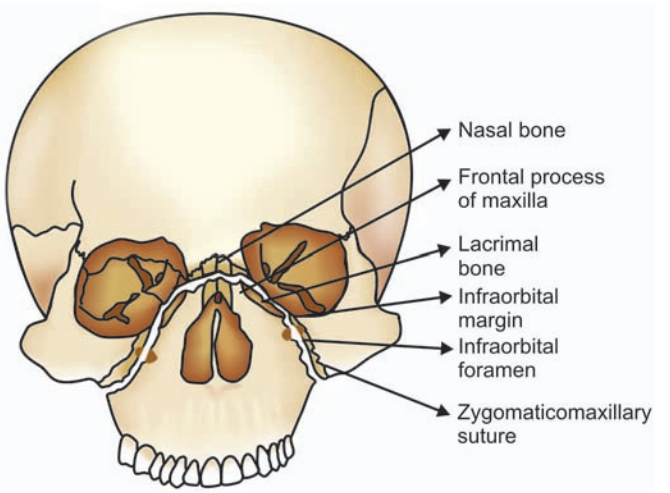
Posterolateral view

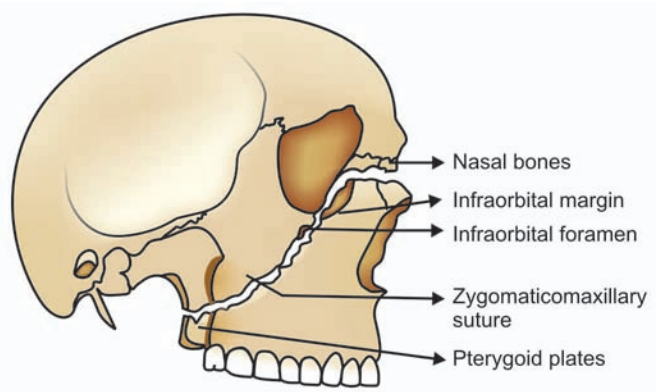
LeFort II or Pyramidal or Subzygomatic Fracture

As the fracture lines run below the zygoma, also these lines form a pyramidal shaped fractured portion, hence the names:

- The fracture runs through the mid portion of nasal bone.
- Frontal process of maxilla.
- Then into the orbit the lacrimal bone behind the lacrimal sac.
- On the floor to cross the infraorbital margins.
- Along anterior wall of antrum slightly medial or through the infraorbital foramen.
- Turns along lateral wall of antrum below the zygomaticomaxillary suture.
- Fracturing pterygoid laminae at middle third.
- Nasal septum.

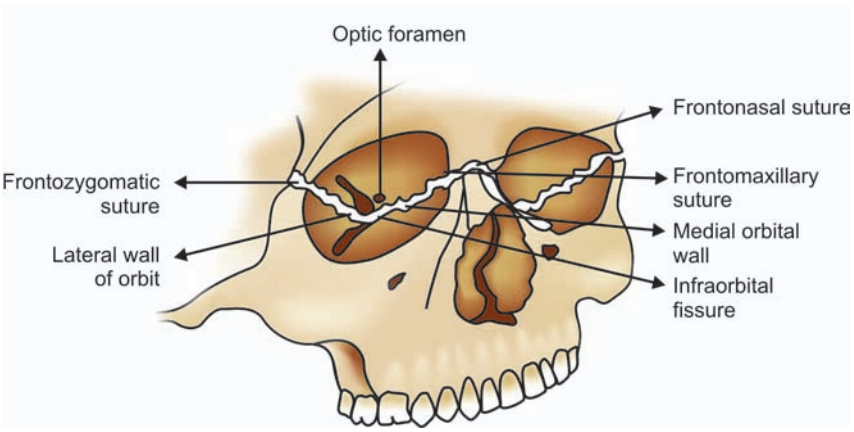
  This type of fracture separates the middle block from the base of the skull.

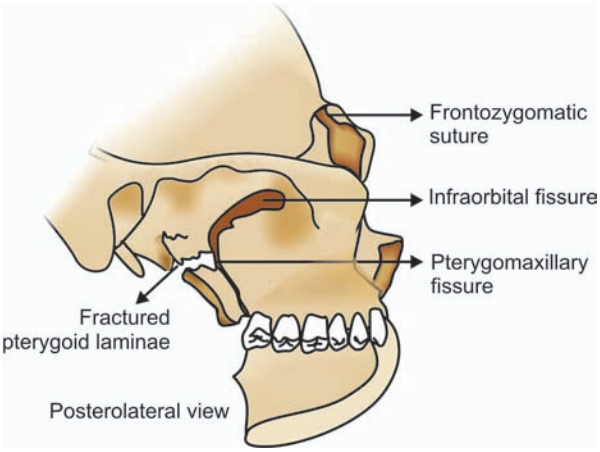




LeFort III or Suprazygomatic or High Transverse Fracture

- Fracture runs near frontonasal suture, then along frontomaxillary suture.
- Full depth of ethmoid bone, including cribriform plate is fractured.
- It runs along the medial wall of the orbit fracturing the orbital plate of ethmoid.
- Under the optic foramen.
- Up to infraorbital fissure.
- From its posterior limit it runs in two directions.
- Along the lateral wall of the orbit to fracture frontozygomatic suture.
- Backwards along the pterygomaxillary fissure (as infraorbital fissure is continues with pterygomaxillary fissure posteroinferiorly).
- To fracture the roots of pterygoid laminae.
- Separating middle third of face from base of skull.



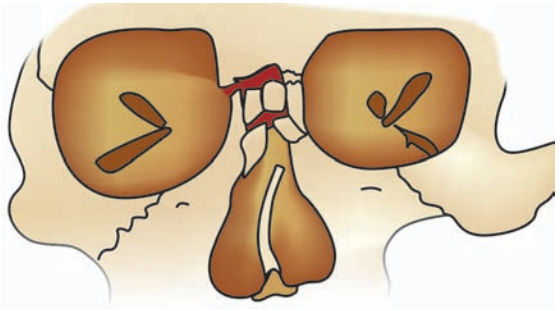


CLASSIFICATION BY ROWE AND WILLIAMS (1985)

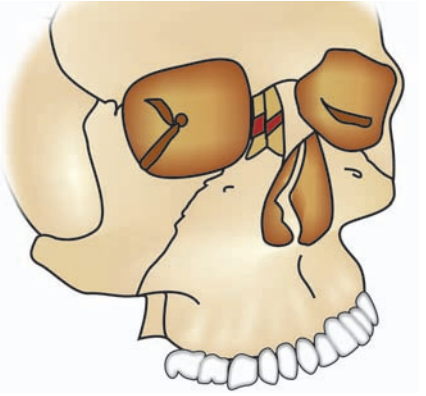
A. Fracture Not Involving the Occlusion

1. Central region

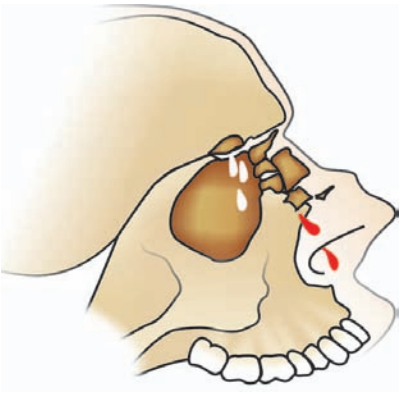
a. Fracture of the nasal bone or the nasal septum and/or nasal septum.
   i. Lateral nasal injuries
   ii. Anterior nasal injuries
b. Fracture of the frontal process of the maxilla.
c. Fracture of type (a) and (b) which extends into the ethmoid bone.
d. Fracture of type (a), (b) and (c) which extends into the frontal bone.



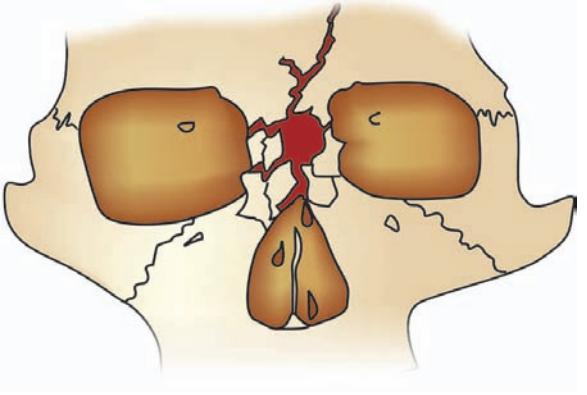
a. Fracture of nasal bone or/and nasal septum



b. Fracture of frontal process of the maxilla



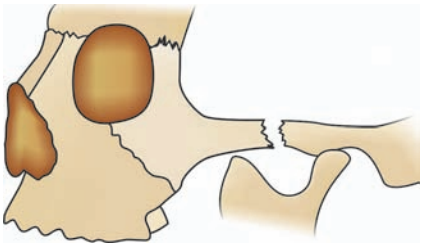
c. Fracture of (a) and (b) which extends into ethmoid

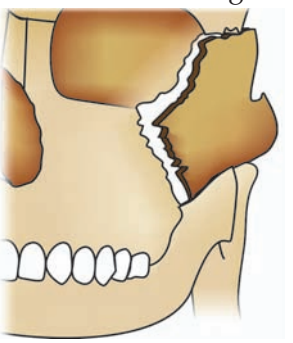


d. All the 3 with extension into the frontal bone

2. Lateral region

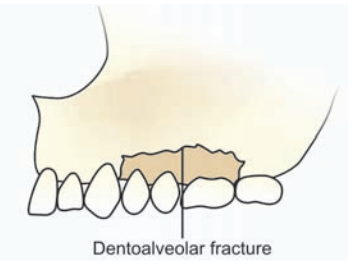
Fracture involving the zygomatic bone, arch and maxilla excluding the dento-alveolar component.





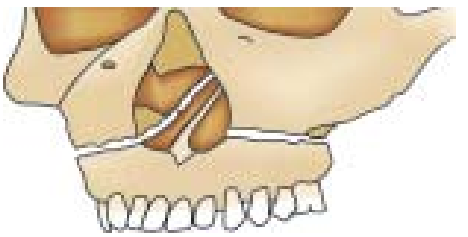
B. Fracture Involving the Occlusion

1. Dentoalveolar



2. Subzygomatic

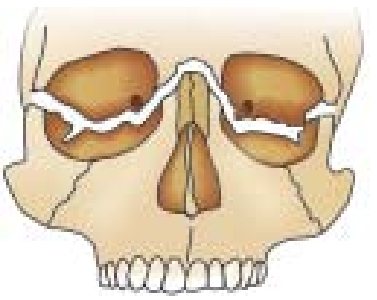
   a. LeFort I or low level or Guérin



   b. LeFort II or pyramidal

3. Suprazygomatic

   c. LeFort III or high level or craniofacial dysjunction.

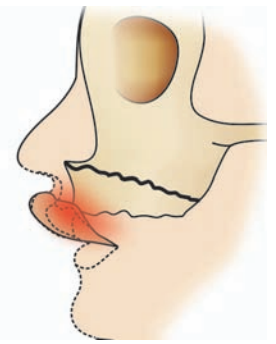


i. These fractures may occur unilaterally or be associated independently with a fracture of the zygomatic complex.
ii. There may be a midline separation of the maxilla and/or extension of the fracture into frontal or temporal bones.

SIGNS AND SYMPTOMS

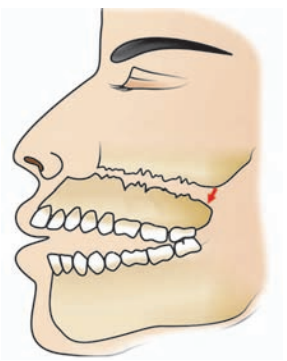
LeFort I

1. Slight swelling of the upper lip.



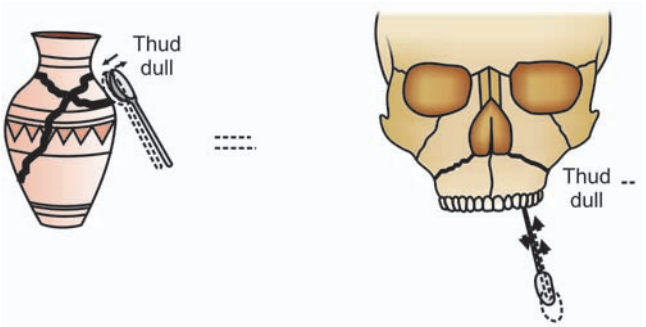
2. Ecchymosis is present in the buccal sulcus, beneath each zygomatic arch.

3. Occlusion is disturbed, with variable amount of mobility in the tooth bearing segment.



4. Sometimes the mouth remains open, because of the increased vertical dimension of the bite due to the fractured segment having dropped down.

5. Percussion of the upper teeth, will give a typical "CRACKED-POT" sound.



6. Some fractures are felt only by grasping the maxillary teeth, and applying slight but firm movement, a grating sound may be felt.

TREATMENT

- Plating
- Suspension

Plating

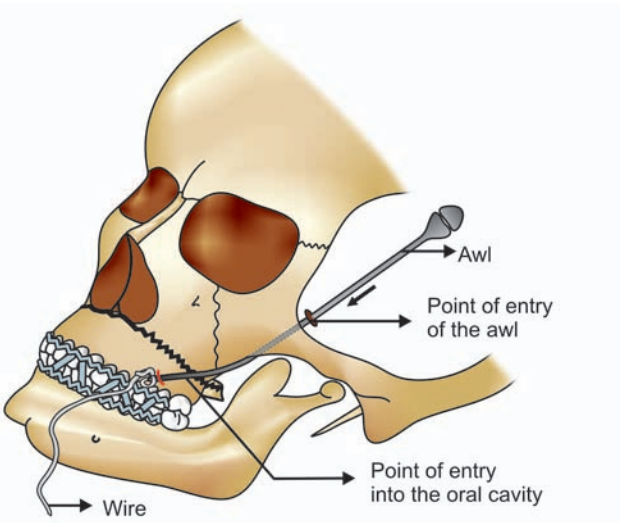
Mini plates can be applied through the intraoral approach. To position and immobilize the fractured segment, IMF is done. Then an incision is placed in the buccal sulcus. The mucoperiosteum is raised and miniplates fixed (plating is done as shown in fracture mandible).

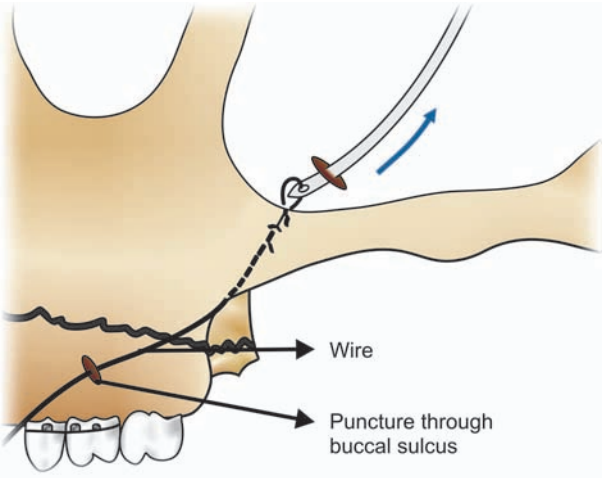
Suspension

i. Circumzygomatic Suspension

Internal Suspension: This is an indirect method of fixation in which the fractured segment of the midface is sandwiched between the skull and the mandible that is fixed by intermaxillary fixation.

A nick is made just above the angle formed by the frontal process of the zygoma and the temporal process of the zygoma. The tip of the awl is then inserted to pass under the zygoma and brought out into the oral-cavity above the premolars.

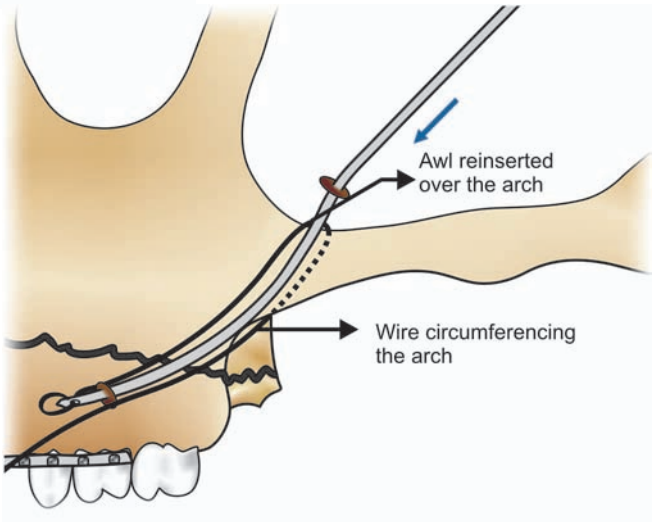




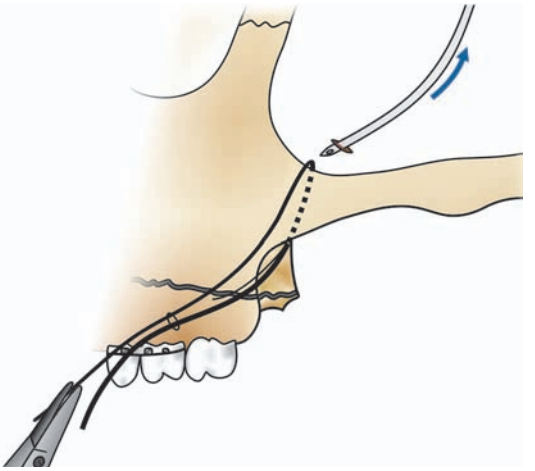
A pre-stretched wire is then threaded through the eye of the awl and twisted such that it does not come out of the awl unless desired.

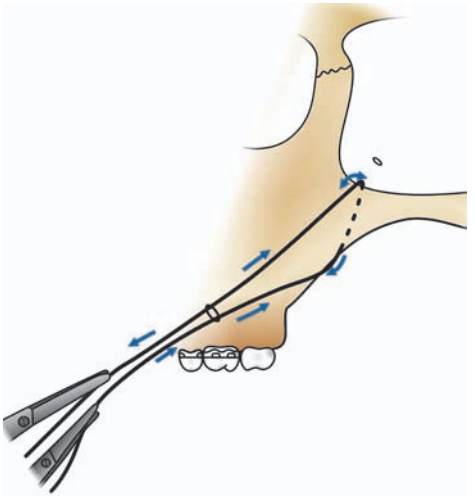
This awl is then withdrawn, to lie just above the zygoma but still under the skin. It will take the suspension wire along with it, under the arch to lie just above the arch.

The awl is then passed above the arch and pushed down to be brought out into the oral cavity, as far as possible, through the earlier puncture point. The awl will pull the wire along with it into the oral cavity.



This wire is then removed from the awl and held by artery forceps. The awl is then carefully withdrawn leaving the suspension wire around the zygomatic arch, with both the ends into the oral cavity.



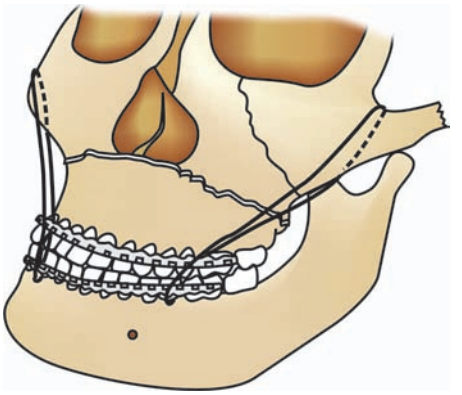


The two ends of the wire are then held and a sawing movement is done such that the wire comes to lie just above the arch.

One end of this wire is then inserted through the prefixed arch-bar. And the two ends of the wire are twisted together such that the wire gets tightened between the zygomatic arch and the arch-bar.

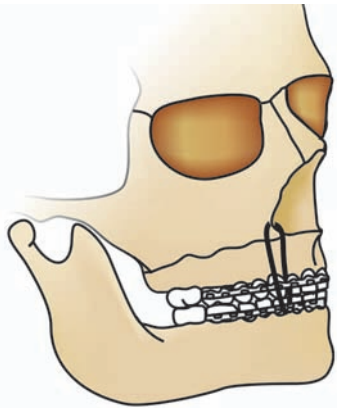
This procedure is repeated on the other side as well.

Thus, sandwiching any fractured segment of bone between the zygoma and the mandible once the intermaxillary fixation is done.



ii. From the Pyriform Aperture

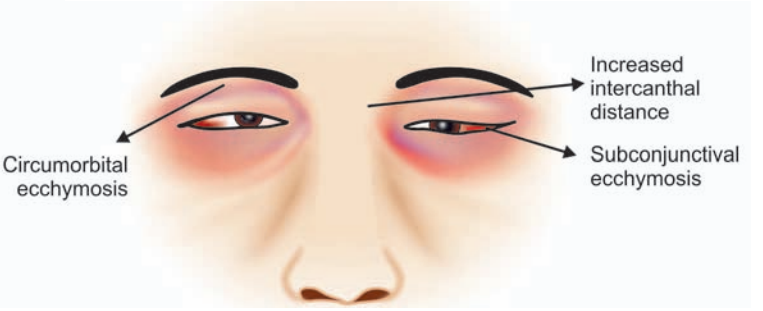
A suspension is applied from the rim of the pyriform aperture. In doing so, an intraoral incision is made and the lateral wall of the nasal aperture is exposed, in which a bur hole is made. A prestretched wire is passed through. This in turn is tied around the arch bar, thus fixing the fractured segment between the skull and the mandible.

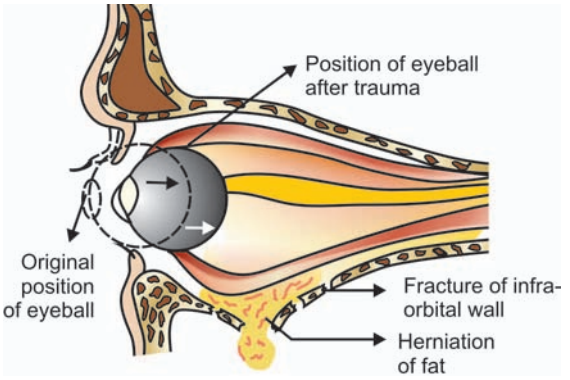


LeFort II

1. Bilateral circumorbital ecchymosis, associated with rapid swelling of the eyelids, making their examination difficult.

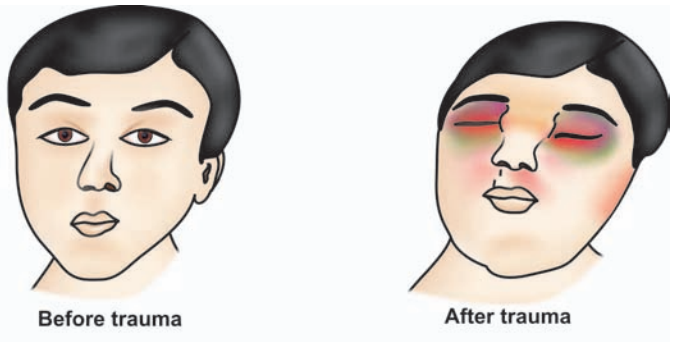
2. Subconjunctival ecchymosis generally occurs associated with the fractured site, but patterns can be variable.



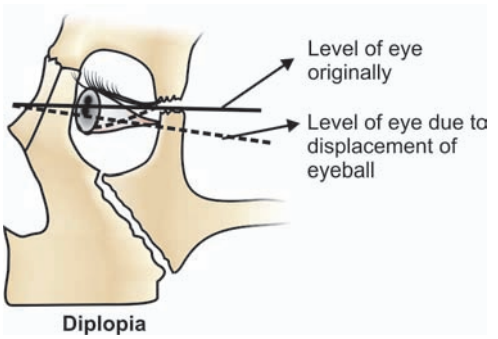


3. Due to increase in the size of the orbit, either due to herniation of its contents or because of separation of fractured bones, there can be enophthalmos.

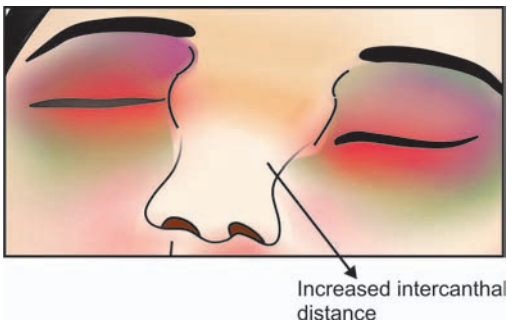
4. There is development of gross edema of the face giving "moon-face" appearance.



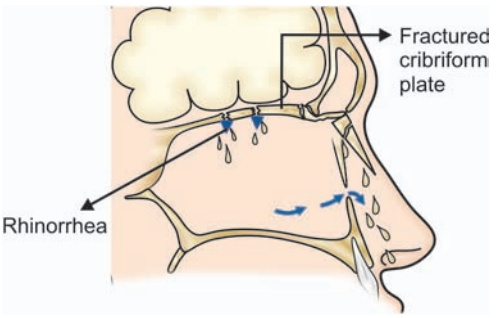
5. There is damage to the orbit, therefore vision and eye movements should be tested as soon as possible. Diplopia is usually present and ocular movements may be limited.



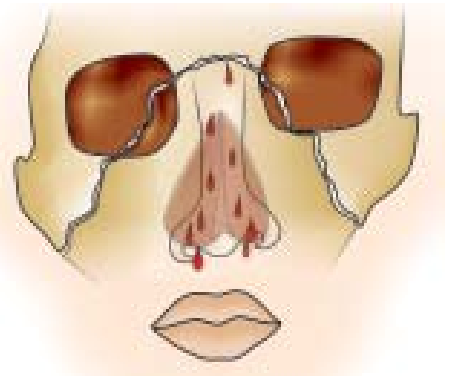
6. Fracture of the nasal bone, causes increase in the intercanthal distance.



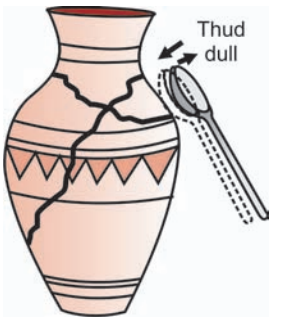
7. If fracture involves cribriform plate there will be cerebrospinal rhinorrhea.



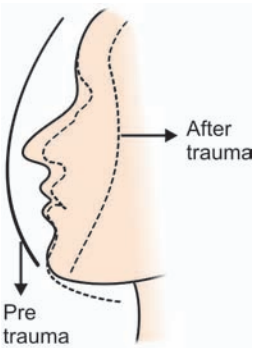
8. Fracture of the nasal bones will cause nasal bleeding.



9. Tapping of the teeth will give a typical "cracked-pot" sound.

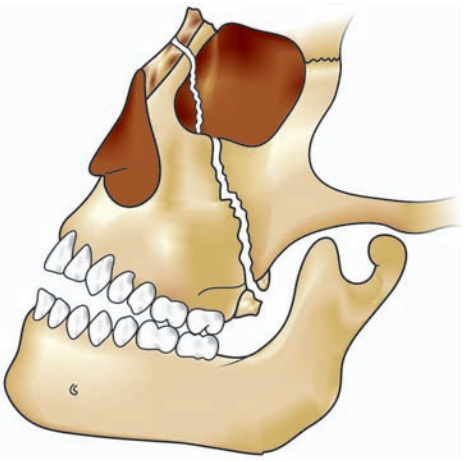


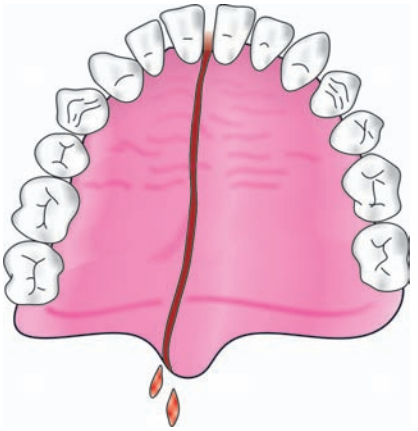
10. Occasionally there may be a dish-face deformity, caused by lengthening of the nose due to the dropping of the middle third of the face away from the skull.



11. Holding the anterior teeth and moving them with one hand, while placing the thumb and finger of the other hand over the nasion region will elicit movement over the bridge of the nose.

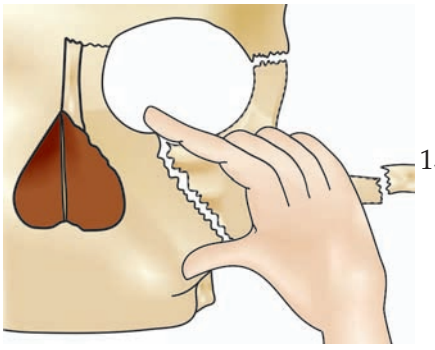
12. If there is a postero-downward displacement of the maxilla there will be posterior gagging, as the molars will come in premature contact, keeping the anterior portion of mouth open.





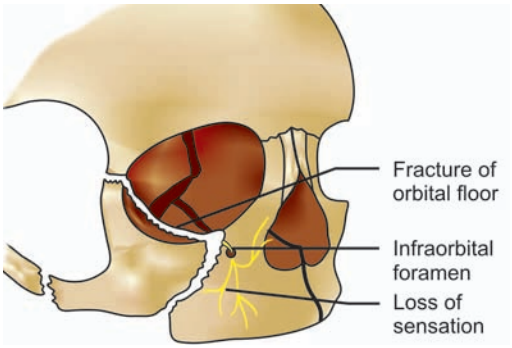
13. There may be an associated fracture of the palate, generally midline, blood clot and occasional hematoma.

14. Considerable foetor-oris is present.



15. Step deformity can be felt at the infraorbital margin.

16. The infraorbital nerve is usually injured, leading to parasthesia or anesthesia of the cheek.

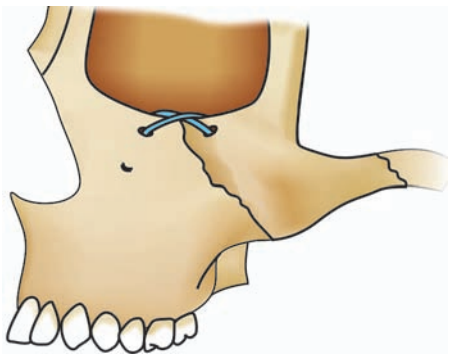


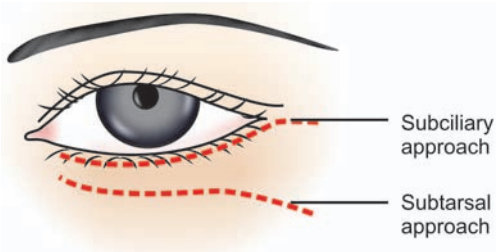
Treatment

- Wiring
- Plating
- Internal suspension
- Antral pack
- Orbital plate reconstruction

Wiring

Wiring is done infraorbitally as it is easy to get a contour of this margin.

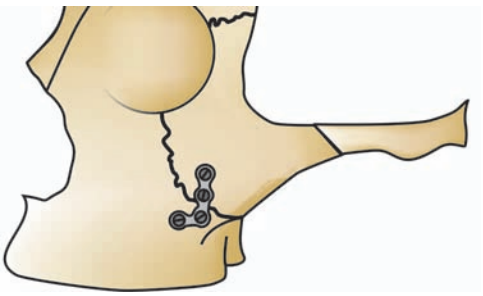


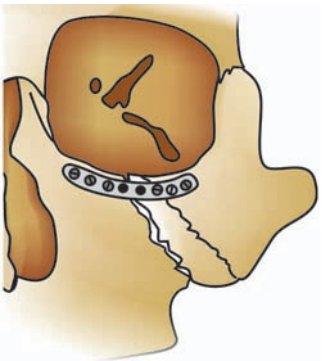


The lower eyelid approach can be employed making a subciliary incision or a subtarsal incision for reaching the infra-orbital margin.

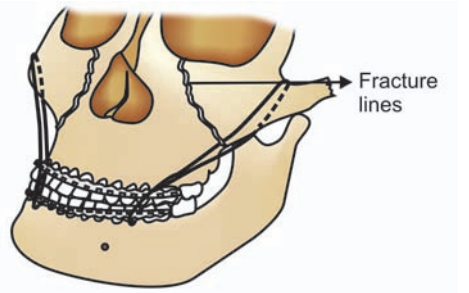
Plating

Mini plates also can be employed. For this, intraoral incisions in the upper buccal sulcus can be made and plates are applied at the zygomatic buttress



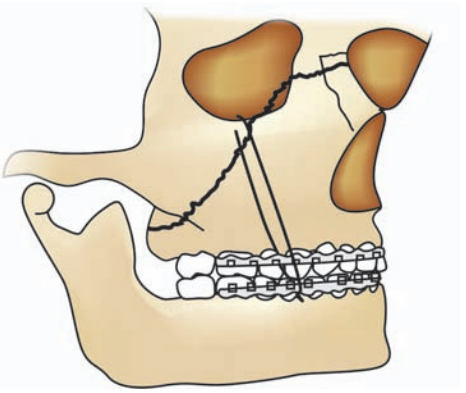


or by the lower eyelid incisions



Internal Suspensions

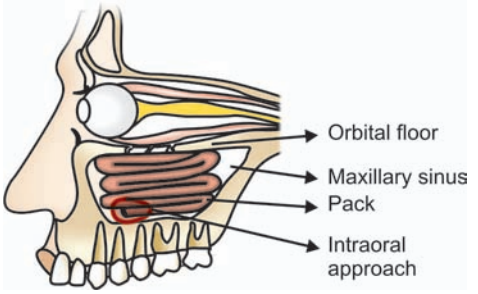
i. *Circumzygomatic wiring:* It is a technique that is used where suspension is done from the zygomatic arch. Care being taken that the arch is intact (given in detail with LeFort I fracture).



ii. *Infraorbital Suspension*

Antral Pack

The roof of the antrum is raised and maintained in position by the application of a pack which is applied into the antrum through the Cald-Well luc surgery. The pack is made by a long ribbon gauze which is dipped in white-head varnish and applied in layers.



The oral mucosa is then sutured and the pack allowed to remain there for a period of two weeks.

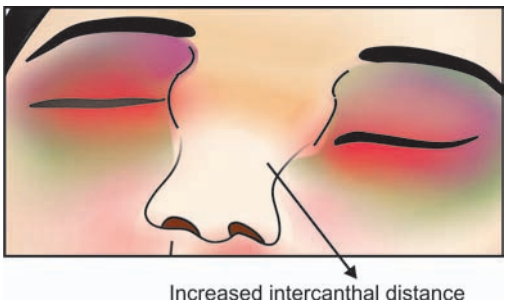
Sometimes an inflatable balloon can be used for the same purpose.

LeFort III

Some differences that make the injuries of a LeFort III more grievous from LeFort II are, that the LeFort III is a high level fracture, generally associated with other facial fractures, like that of the frontal bone or associated LeFort II or I type. The injuries are more grievous.

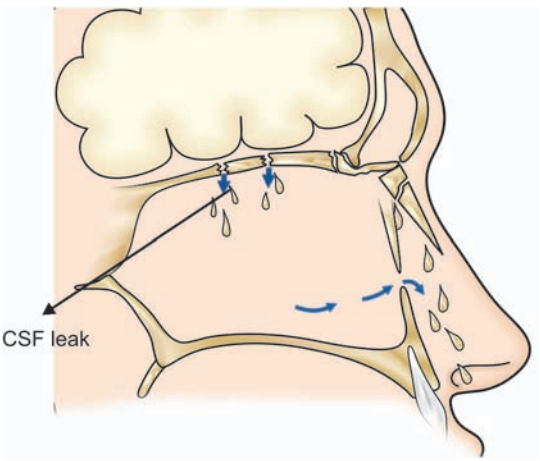
Signs and Symptoms

1. As there is a fracture line running between the frontal and nasal bones, also there is fracture of the ethmoid bone there is flattening of the nose. With extreme disorganization of the nasal skeleton.

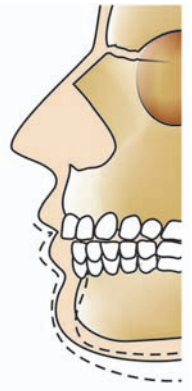


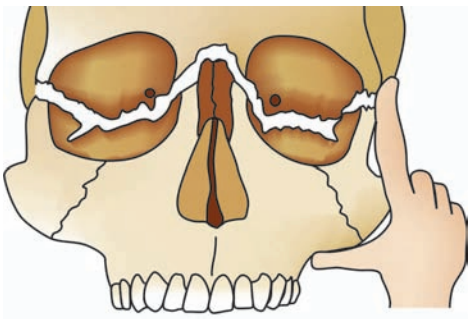
2. As there is an associated fracture of the frontal process of maxilla which runs into the medial walls of both the orbits there is an increase in the intercanthal distance.

3. In these types of fractures there is fracture of the ethmoid bone including the cribriform plate that causes cerebrospinal rhinorrhea.



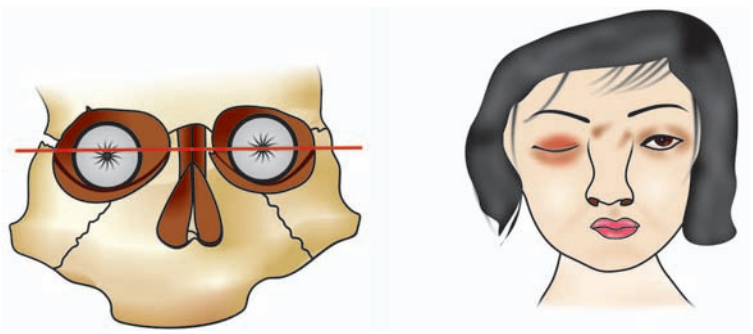
4. All the fracture lines separate the mid face from the base of the skull, causing the downward movement of the mid face, resulting in the lengthening of the face.



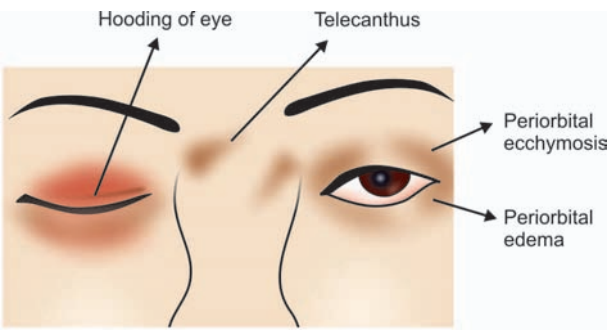


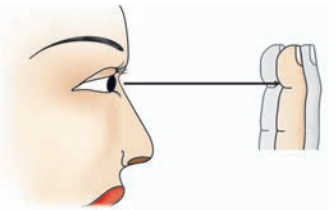
5. On palpation a step deformity and tenderness is felt at the superolateral margin of the orbit.

6. With the fracture of the lateral orbital wall bilaterally and the movement of the mid face downward, the Lockwood's suspensory ligament, which supports the eyeball, also moves downwards as it is attached to the Whitnall's tubercle. As the globe drops, the upper lid follows the globe down, thus there is 'hooding' of one or both the eyes.

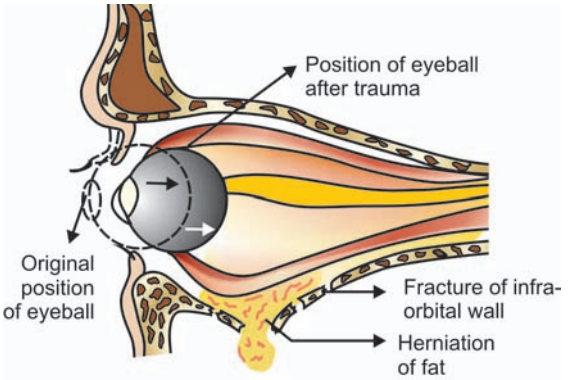


7. Because of the fracture of the orbital walls there is a break in the periosteum with a varied degree of bilateral subconjunctival hemorrhage.
8. Also there will be periorbital ecchymosis and periorbital edema that cause the opening of the eyes with difficulty.

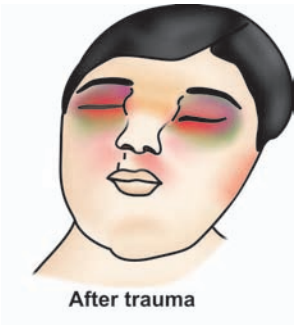




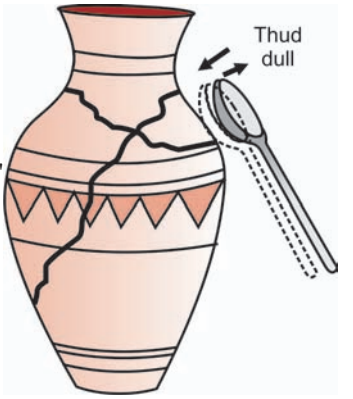
9. These fractures also cause an increase of the orbital volume that leads to diplopia as the eye level are different of both the eyes.



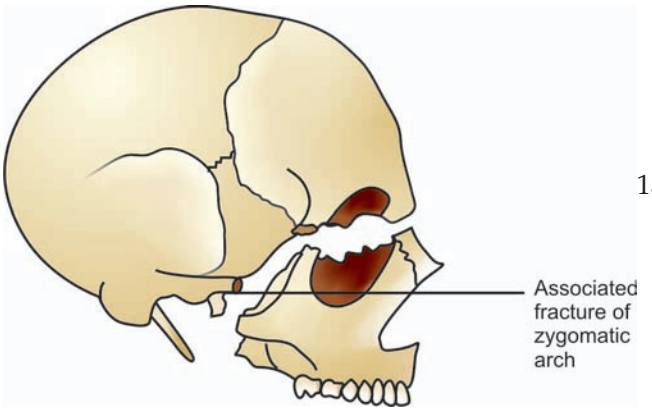
10. The fractures of the orbital walls cause an increase in the orbital volume, resulting into enophthalmos.



11. The fractures of the facial skeleton lead to a lot of edema that cause ballooning of the face causing moon-shaped face.



12. Tapping of teeth gives a characteristic 'cracked-pot' sound.



13. These fractures are generally associated with fracture of zygomatic arches.

14. Movement of the entire face can be felt when a finger and thumb of one hand are placed on the frontonasal suture region and the other hand grasps and moves the upper anterior teeth.

15. Intraorally there is gagging of occlusion posteriorly, as the middle third of the facial skeleton moves down and the molar teeth occlude causing an anterior open bite.

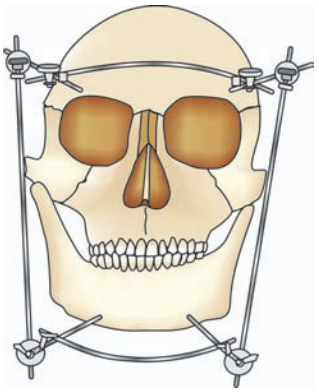
Treatment

Internal Fixation

1. Transosseous wiring at fracture sites
   i. Frontozygomatic
   ii. Frontonasal
2. Miniplates
3. Transfixation with Kirschner's wire or Steinmann's pin
   i. Transfacial
   ii. Zygomatic-septal

Suspension:

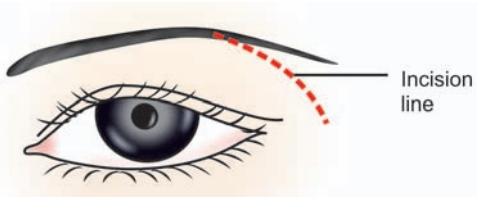
Frontal suspension
i. Central or
ii. Lateral



Box-frame

External Fixation

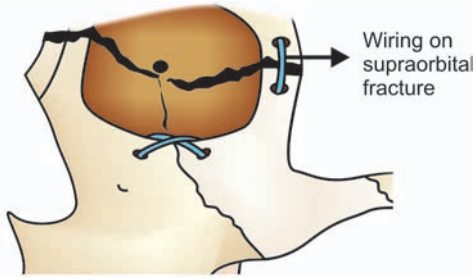
1. Craniomandibular
   i. Box-frame
   ii. Halo-frame
   iii. Plaster of Paris headcap
2. Craniomaxillary
   i. Supraorbital pins
   ii. Zygomatic pins
   iii. Halo-frame

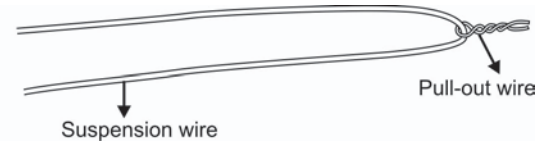


Frontal Suspension

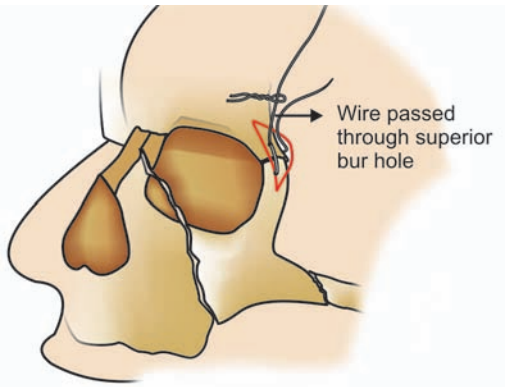
An incision is made on lateral third of the eyebrow and the soft tissue reflected.

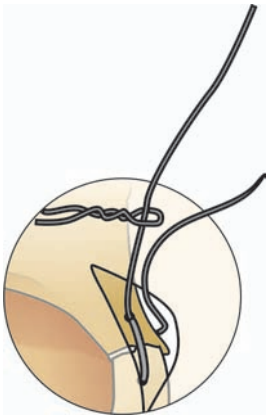
Bur holes are made approximately 3 mm away from the fracture site or fronto-zygomatic suture. In case of a supraorbital fracture wiring is done.





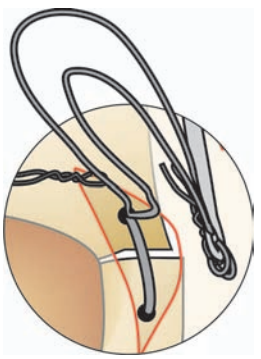
Then using the superior bur hole a 40 cm length of prestreatched soft stainless-steel wire, through which a pull-out wire is threaded, is passed and brought out on the infratemporal fossa aspect.

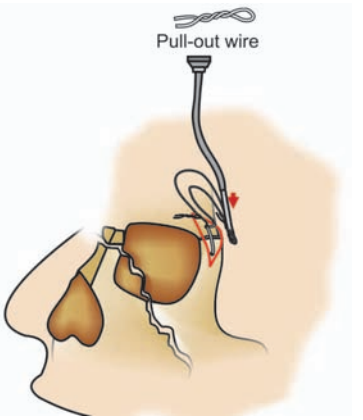




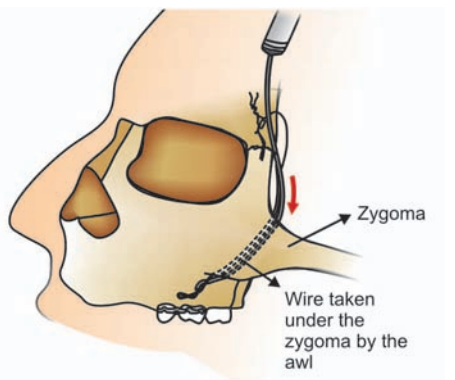
An awl

The two ends of the wire are threaded through the eye of a Rowe zygomatic awl and twisted.



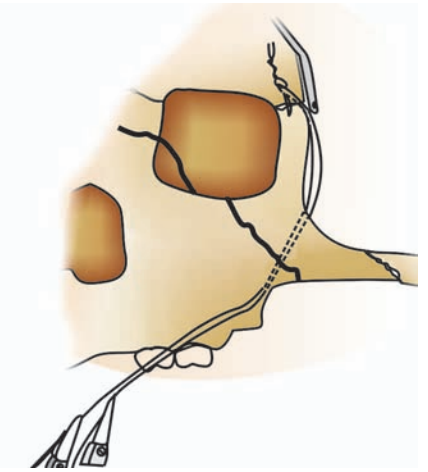


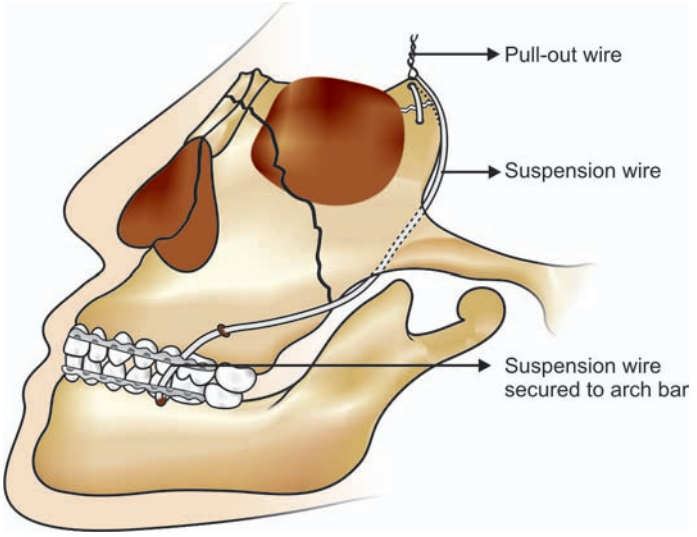
The awl is then passed downwards and forwards behind the frontal process of the zygomatic bone, under the zygomatic arch to pierce the oral mucosa adjacent to the upper molar teeth.



The wire ends are detached from the awl and are secured with artery forceps before the awl is withdrawn.

Tension is applied to the wire ends to remove any slack these are then secured to the arch-bar that had been previously placed. Once reduction of the fractured maxilla is done these wire ends are twisted together to provide stabilization.





The eyebrow incision is sutured in layers making sure to keep the pull-out wire to lie over the skin surface. This is then covered by adhesive tape.

Chapter

9 Hemorrhage

The constant movements of the musculature during talking, eating, swallowing, etc. also the wide space left after extraction should be making bleeding a constant problem, but this is not the case.

Any injury that continues to bleed after its normal bleeding time has lapsed, should be looked into for its cause. The causative factor should be removed and the bleeding arrested.

Causes of Bleeding

1. Systemic factors (biomechanical)
2. Local factors (mechanical)

Systemic Causes

i. Hereditary - Hemophilia
ii. Acquired
- Hypertension
- Vitamin K deficiency
- Liver disorders
- Patient on anticoagulant therapy, e.g. patient with history of a heart attack.
- Liver disorders.

A patient that reports for surgery should be evaluated for any bleeding tendencies, systemic disorders, etc. also, if the patient has had any past experience of prolonged bleeding after extraction. He/she should be asked for:

Laboratory investigations	*Normal values*
Prothrombin time (PT)	12-14 sec
Partial thromboplastin time (PTT)	Less than 45 sec
Bleeding time	3-6 minutes
Clotting time	3-8 minutes
Platelet count	1,50,000 to 4,50,000/µl patients with count below 20,000/µl can have spontaneous bleeding
Tests for detection of clotting factors	

Local Causes

A patient who bleeds for more than the expected 4 to 5 min is generally having a cause for it, therefore, the area of surgery should be revisited, the reason for the bleeding identified and taken care of:

Bleeding due to local causes can be divided into:

i. Primary hemorrhage
ii. Intermediate hemorrhage
iii. Reactionary hemorrhage or secondary hemorrhage

Primary hemorrhage: It is the bleeding that takes place immediately at the site of injury, surgery, extraction. Lasts for a few minutes, till the process of platelet plug formation. It is seen that bleeding stops spontaneously in most situations except where there is rupture of a major vessel.

Intermediate hemorrhage: It is the bleeding that occurs within eight hours after the primary bleeding has been arrested. It is loose foreign body in the wound like broken bone, tooth pieces that are considered the cause of bleeding.

Secondary hemorrhage: Sometimes, due to dislodgement of the clot, infection, increase in blood pressure sufficient to dislodge the clot or trauma to the healing site may cause recurrence of bleeding. This bleeding that occurs from 24 hrs to several days after the primary hemostasis has taken place is called secondary hemorrhage.

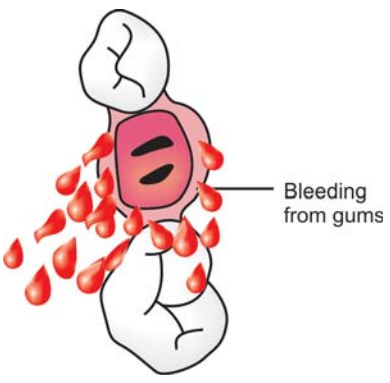
If the patient reports to you bleeding, clean the area by using suction and wiping off the blood. Then the exact area of bleeding is located.

The dental surgeon generally encounters bleeding from the socket.

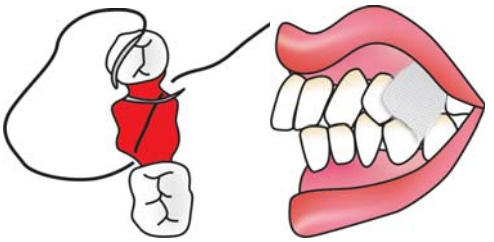
- Surgical site
- Trauma.

The Socket

It is essential to clean the area and then apply a pressure with a gauze, remove the gauze and check whether the bleeding is from the gums or the bony socket.

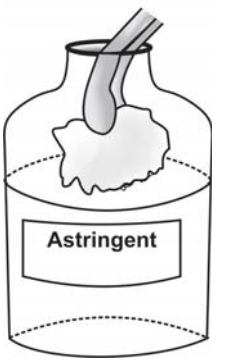


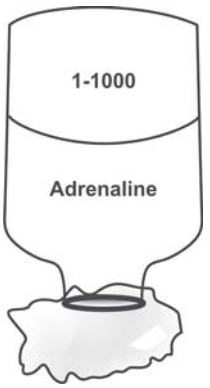
Pressure pack: The first step that should be taken is to apply pressure pack on to the bleeding socket, such that it counteracts the hydrostatic pressure within the bleeding vessels and allows clot to be formed that occludes the bleeding orifice. The pressure can be removed after 5 min to check. Or



Sutures can be given around the socket, this will approximate the mucosa on to the bone and aid in hemostasis along with the pressure pack.

Astringents can be applied to the gauze as they will help to arrest the bleeding. A pack can be dipped in a solution of Monsel's solution that contains ferric subsulphate. Or



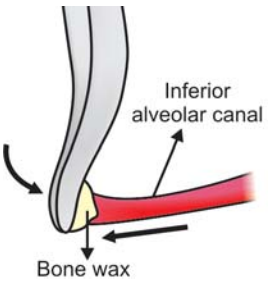


Adrenaline or epinephrine can be applied in the pressure pack gauze as it causes vasoconstriction. Care should be taken as injudicious use can cause systemic effects. It should be avoided in patients with a history of hypertension and cardiac diseases.

Adrenaline can be applied on a gauze pack in a concentration of 1:1000 or can be injected mixed with local anesthetic in a concentration of 1:80,000 to 1:2,00,000. The wound should be watched for recurrence of bleeding once its effect wears off.

As a home remedy patient can be asked to bite on a tea bag, so that the tannic acid from the tea acts as an astringent and helps in clot formation.

If the bleeding is from the bony canal and does not get arrested by the primary measures a small amount of bone wax can be applied on to the bleeding bone. It acts as a mechanical obstruction. Sometimes a blunt instrument can be used to crush fine pieces of the cancellous bone into the bleeding canal.



These will also act as mechanical obstructors.

Other *agents* like:

- Thrombin,
- Gelfoam,
- Oxygel,
- Surgicel,
- Fibrin glue can all be used to help control the bleeding.

Using these measures, bleeding is bound to get arrested but if it persists patient should be hospitalized, supported systemically by:

- Commercially available non-specific coagulants like
  - Vitamin 'K'
  - Calcium gluconate,
  - Fluids,
  - Haemolock, Bortopase, Unipamba, etc.

The blood sample of the patient should be sent in the mean time for investigations. Then as the need be patient can be transfused with:

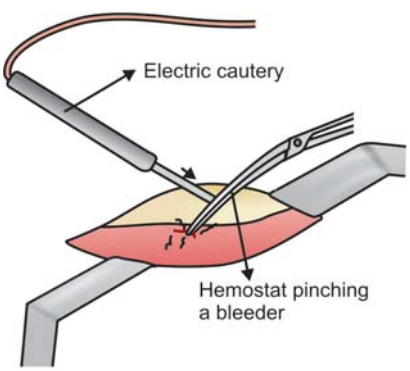
- Whole blood,
- Platelet rich plasma,
- Fresh frozen plasma,
- Cryoprecipitate.

This will serve as a definite form of treatment.

Surgical Site

While performing a surgery, if small vessels are cut, pressure packs are very effective.

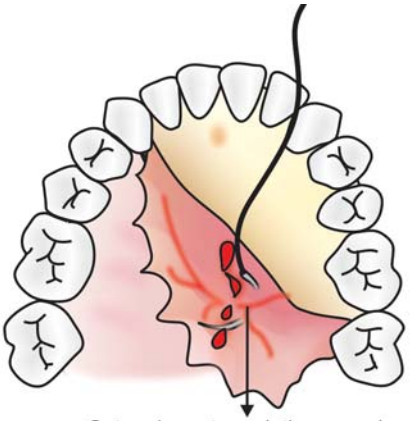
Hemostats, i.e. mosquito and artery forceps can be used to catch the bleeding points. Usually electrosurgical thermocoagulation is done after catching the bleeder. The electrocautery can also be applied directly to the bleeding vessels also.



The larger vessels: That are accidentally or intentionally severed by the oral surgeon can be vessels like the greater palatine vessels, facial vessels, inferior alveolar, etc.

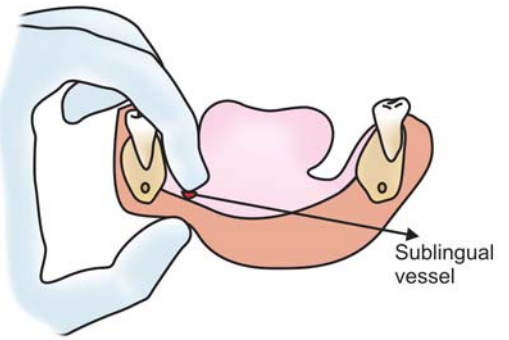
These are ligated with suture materials. Black silk is used for the larger vessels while on the smaller ones catgut or polygalactin suture material can be used.

Greater palatine vessels: This vessel runs on both the sides of the palate in the groove between the horizontal palatine process and alveolar process. Therefore, the incision on the palate should be made parallel to the vessel. If accidentally injured, this vessel is difficult to clamp. Palatal pressure, great enough to stop the bleeding, should be applied along the course of the vessel posterior to the point of bleeding. The pressure pack can be secured and left in place for 24 to 48 hrs. Or

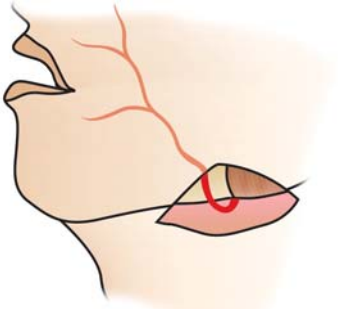


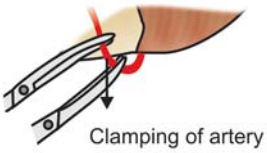
The pack can be pressed for 5 to 10 min and if bleeding resumes on release of pressure, the palatal mucoperiosteal is reflected, the anterior palatine vessels are then ligated posterior to the bleeding point through the entire thickness of the mucoperiosteum around the vessel.

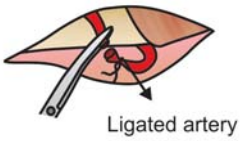
Sublingual artery: In the floor of the mouth may be severed. It is extremely difficult vessel to ligate. Bimanual pressure with one hand inside and one hand outside the mouth for 5 to 10 min can stop the bleeding or else hold it until proper ligation is done of the lingual vessel.

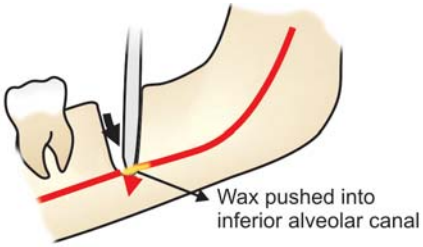


Facial artery: It is a branch of the external carotid artery and crosses the mandible just anterior to the attachment of masseter muscle. It therefore can be ligated when it crosses the lower border of the mandible. The incision is made 2 cm below the lower border of mandible.







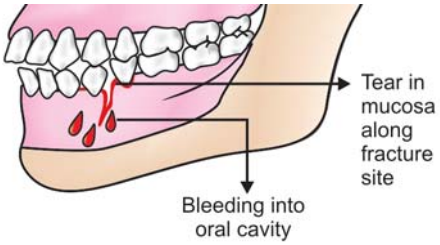


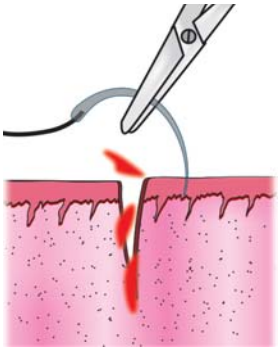
Inferior alveolar: It can be damaged during surgical removal of impacted molar.

Or during surgeries like sagittal split osteotomies. The bleeding can be controlled by pressure pack or application of bone wax.

Trauma

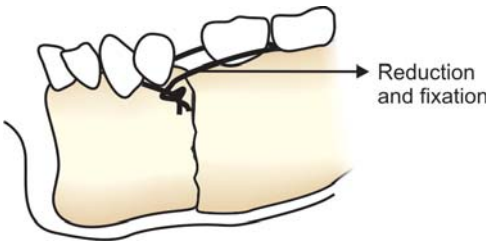
Depending on whether the patient has sustained soft tissue or hard tissue injury.

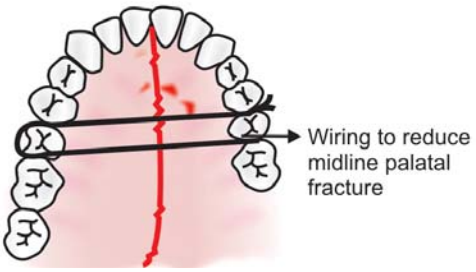




If the patient has only suffered soft tissue injury without involvement of any major vessels, simple cleaning of the wound followed by suturing will achieve hemostasis.

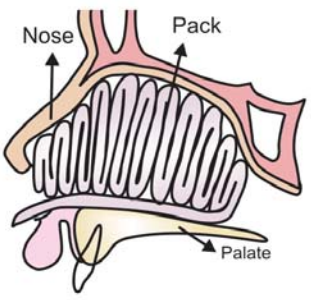
If one of the major vessel has been cut, it should be clamped and ligated. If it is not possible to do so at the site of the injury, then the vessel should be surgically intercepted along its path.



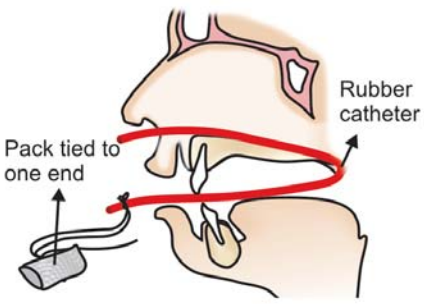


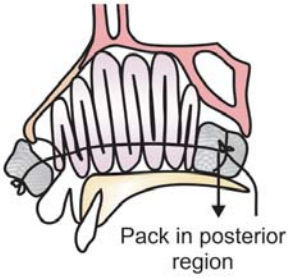
Whereas if the bleeding is due to the fracture of the facial skeleton, most of the time simple reduction and fixation will suffice in arresting the bleeding.

If the bleeding is from the nasopharyngeal or pharyngeal region, it can be controlled by nasal packing and if required nasopharyngeal pack.



Anterior nasal pack



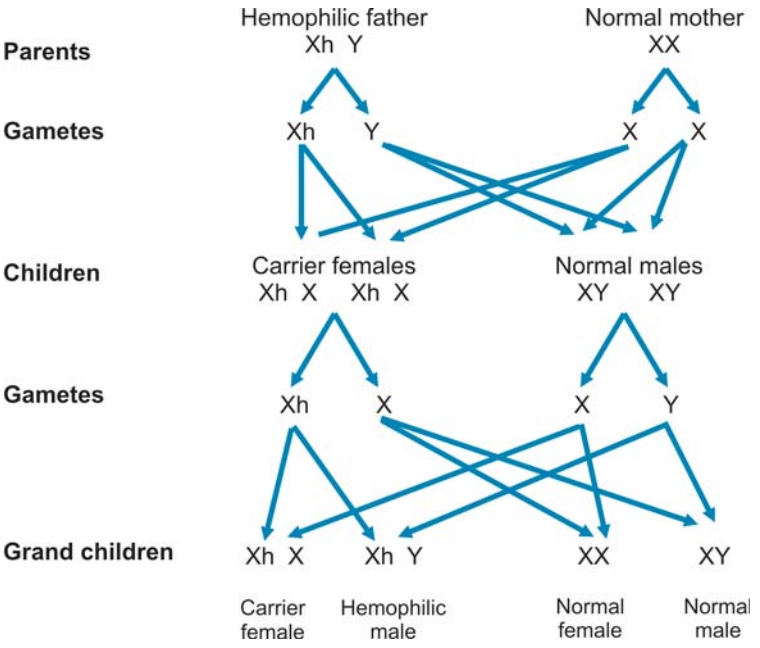


Tech. for posterior nasal pack

HEMOPHILIA OR DISEASE OF KINGS OR BLEEDERS DISEASE

It is a blood disorder, characterized by prolonged coagulation time and hemorrhagic tendencies. It is a hereditary disease, the defect being carried by the X chromosome and is transmitted as a sex-linked Mendelian recessive trait. Thus, hemophilia occurs only in males, but is transmitted through an unaffected daughter to her grandson.

The sons of the hemophiliac are normal and are not carriers of the trait. The heterozygous daughters carry the defect to ½ their sons and as a recessive trait to ½ their daughters.



Clinical Features

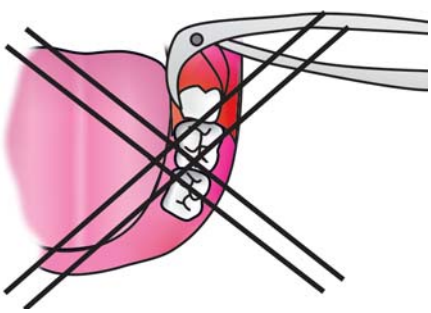
These patients exhibit persistent bleeding, either spontaneous or following the slightest of trauma like abrasion, small cuts, etc.

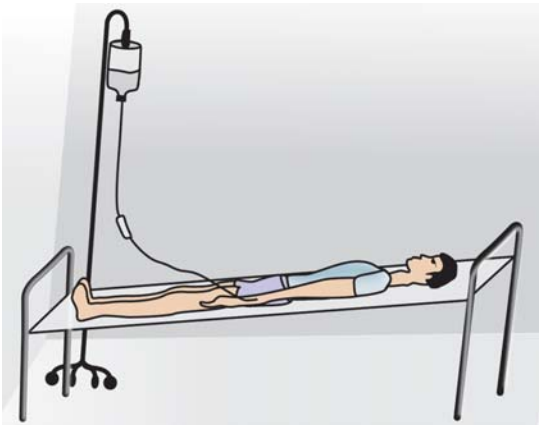
Hematomas are formed due to hemorrhage into the subcutaneous tissues, internal organs, joints.

There may be bleeding from gingiva which could be massive and prolonged.

Dental Extractions

- Dental extractions are difficult in hemophilic patients. Any oral surgery is a dangerous procedure and must be avoided whenever possible.
- The greatest number of fatalities in hemophilic patients have resulted from surgical procedures including tooth extractions.
- Tooth extraction must be carried out after hospitalizing the patient.





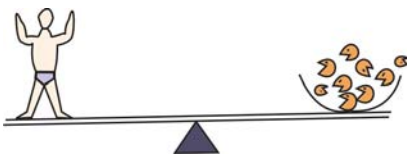
- Preoperative transfusion of whole blood and the administration of antihemophilic factor concentrate are recommended. Also administration of antifibrinolytic agent, such as aminocarproic acid (Amicar). This should be administered by the 'physician', who has to decide regarding these transfusions, based on the degree of factor deficiency and on the patients history of factor replacement.
- Patients who receive factor replacement sometimes contract hepatitis or HIV (Human Immunodeficiency Virus). Therefore, appropriate staff protection measures, should be taken during surgical procedure.
- Tooth extraction by means of a rubber- band has been described in literature. In it the rubber-band is placed around the cervix of the tooth and allowed to migrate apically, causing exfoliation of the tooth through pressure necrosis of the periodontal ligament.

Chapter

10

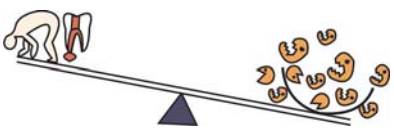
Odontogenic Infection

Most of the infections of the head and neck region are odontogenic infections.



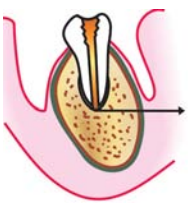
Many patients continue to live an infection free life for many years inspite of having caries and broken teeth in their mouths.

This is due to the fact that there is a balance between the resistance of the patient and the virulence of the microorganism.

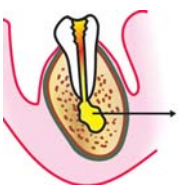


But once this balance is disturbed, that is there is either a decrease in the resistance/health of the patient or there is an increase in the virulence of the microorganism the infection spreads rapidly.

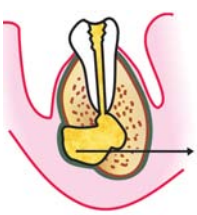
i. The infection that was kept under control at the level of the apex of the tooth.



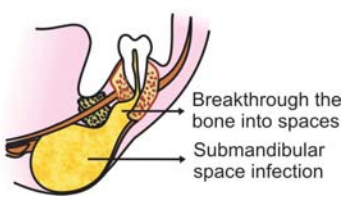
ii. Once the resistance falls, spreads to the bone.



iii. It further spreads to the periosteum.



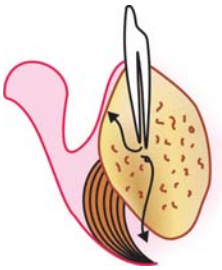
iv. Finally it spreads into the soft tissue space.



All the teeth have their roots ending at different levels in the mandible and the maxilla, also there are many different muscles attached at different positions onto the facial skeleton. These two direct the spread of infection into different tissue spaces.

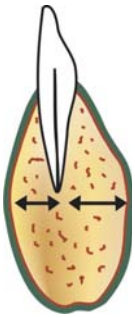
SOME SITES OF LOCALIZATION OF INFECTION CAUSED BY TEETH

This localization takes place



in relation to the muscle attachments

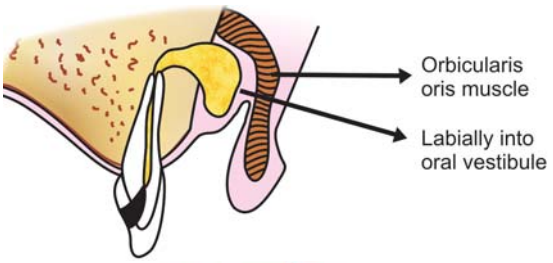
and the tilt of the root tips.

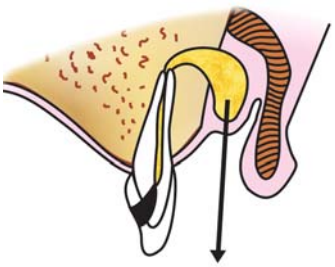


Maxillary Teeth

1. ***Central incisor:*** Labially into oral cavity, below the muscle attachment.

2. ***Lateral incisor:*** Into the oral cavity.





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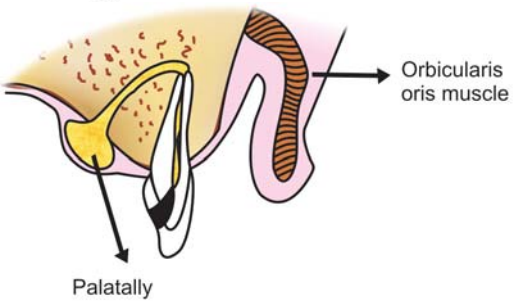
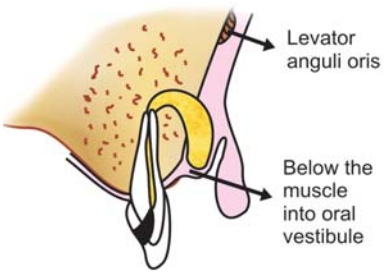


3. ***Canine:***



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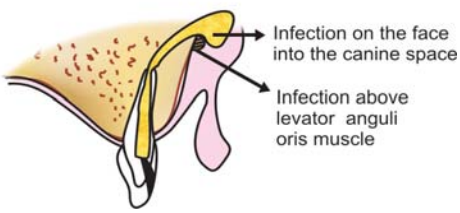
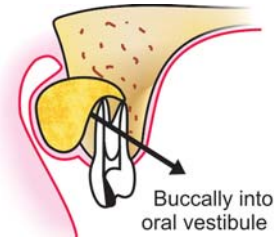


4. ***Premolars:***



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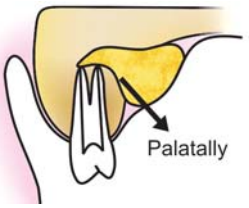
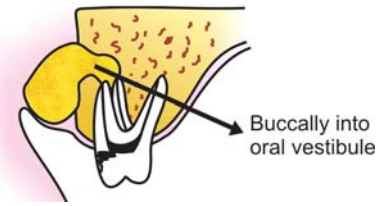


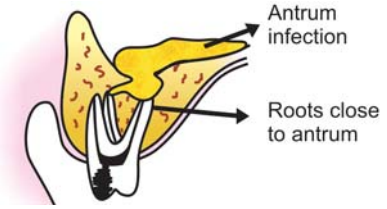
5. ***Molars:***



OR

Oral vestibule

Palate



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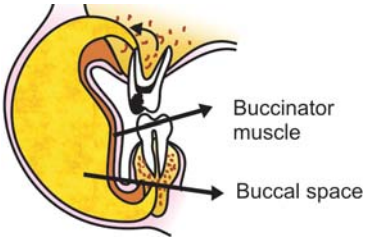
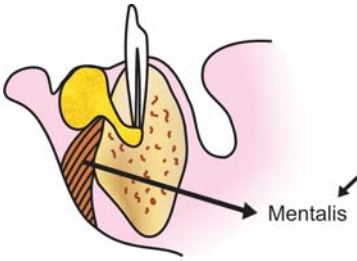


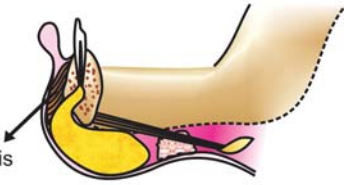
Antrum

Buccal space

Mandibular Teeth

1. ***Incisors:***

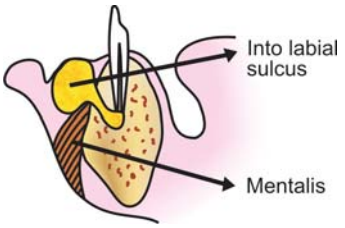




Above the muscle into oral vestibule.

Below the muscle into submental space.

2. ***Canine:***

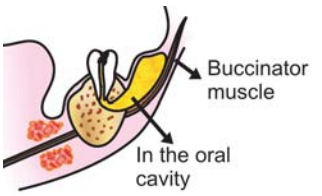


Into the oral vestibule.

3. ***Premolar:***

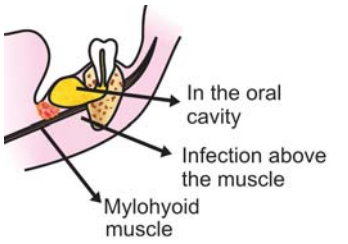
Into the oral vestibule.

4. ***First molar:***



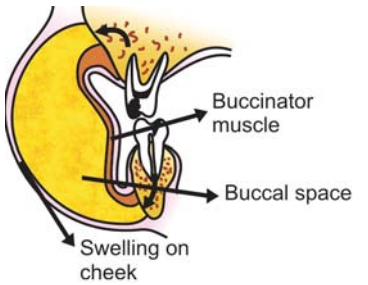
Oral vestibule

OR

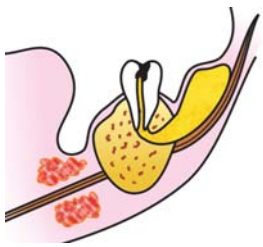


Sublingual space

OR Buccal space.



5. ***Second molar:***

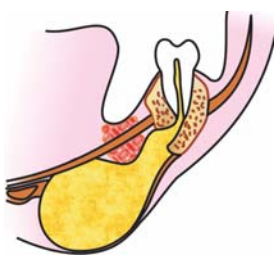


Oral vestibule

Sublingual space

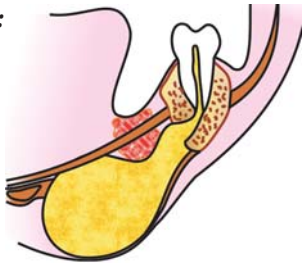
OR

Buccal space



Submandibular space

6. ***Third molar:***



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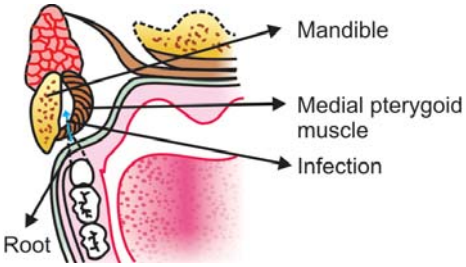


Submandibular space | Pterygomandibular space

ANATOMY

Anatomical Considerations

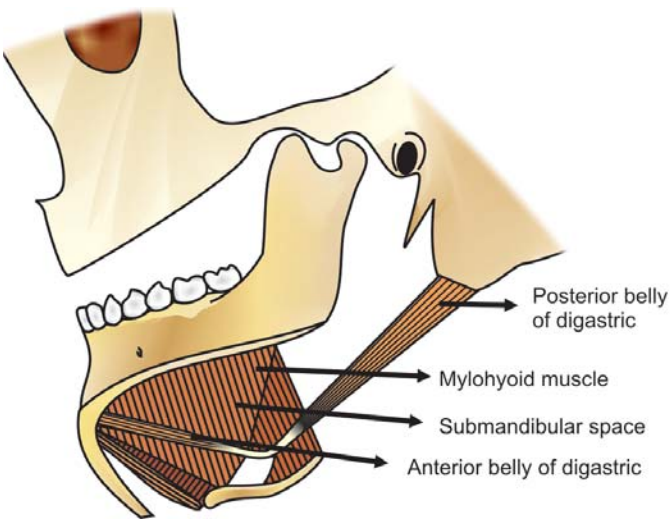
Muscle attachments to the body of the maxilla and mandible make for the potential spaces, as it is easier for the fluids to collect between these muscles and not within the muscles. Therefore, it is easy to understand these potential spaces in infection and its control.

Some of the Muscles Attached to the Mandible

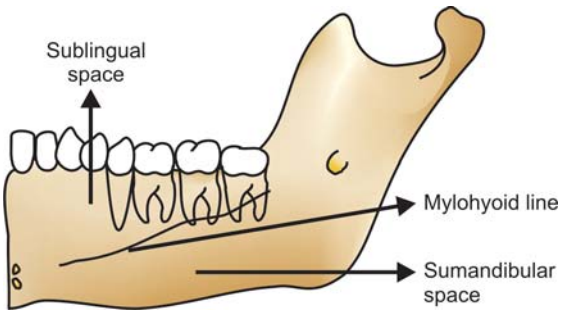
Mylohyoid Muscle: It is the muscle which is major to three spaces:

i. the submandibular space,
ii. the sublingual space, and
iii. the submental space.

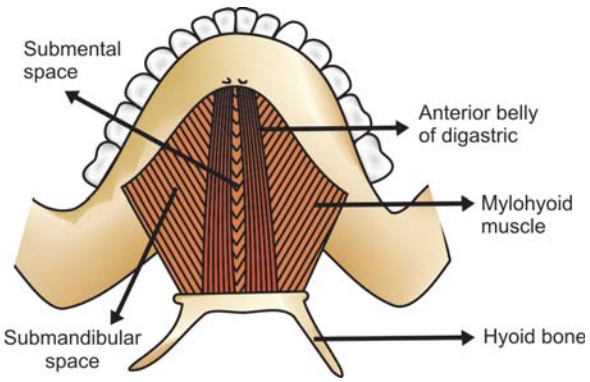
It is a flat triangular muscle, the right and the left forming the floor of the mouth. It originates from the mylohyoid line on the lingual aspect of the mandible. Gets its insertion in the midline median raphe and the posterior fibers from hyoid bone.



This muscle originates from the mylohyoid line on the lingual aspect of the mandible. This line runs obliquely, downwards and forwards. The apices of the premolars and first molar are almost always above the attachment of this muscle.

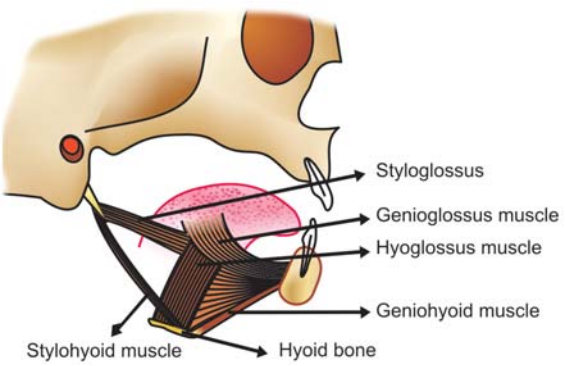


Therefore, if there is lingual perforation due to these teeth, there will be sublingual space infection. Whereas the second and third molars root apices lie below the mylohyoid line and therefore infection through these teeth causes submandibular space infection.

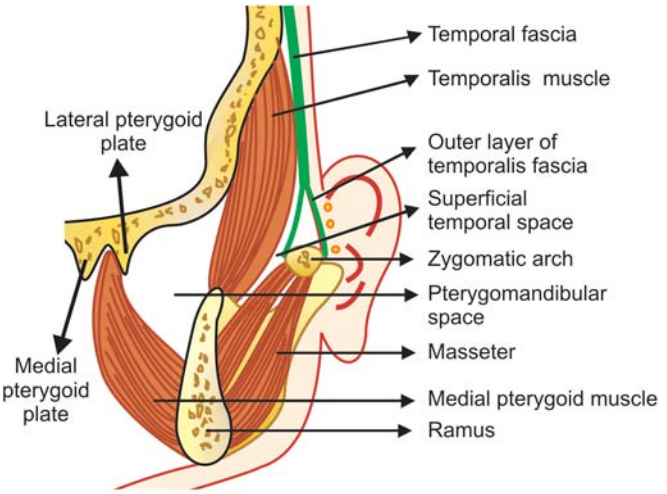


Anterior belly of the digastric muscle: It is the muscle that separates the submental and the submandibular spaces. It originates from the digastric fossa, present anteriorly on lingual aspect of the mandible. Runs downwards and backwards to meet the posterior belly of the digastric muscle, at the fibrous pulley held by the hyoid bone.

Geniohyoid muscle: A pair present in the midline, above the mylohyoid muscle. They originate from the lower pair of the genial tubercle, present on the lingual surface of the anterior part of the mandible. They run backwards and downwards to get inserted onto the body of the hyoid bone. With other muscles of the tongue to form the medial boundary of the sublingual space.

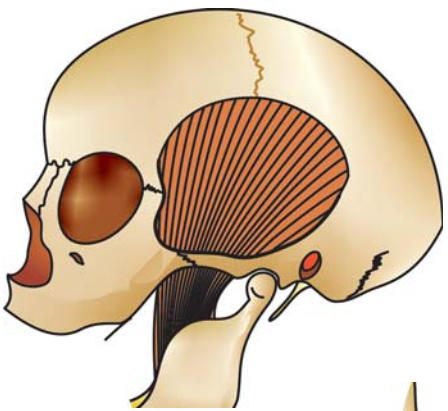


Genioglossus muscle: It is a fan-shaped muscle that originates from the upper two genial tubercles. Being the intrinsic muscle of the tongue, its fibers are inserted from the tip of the tongue, to the dorsum of the tongue to the hyoid bone.

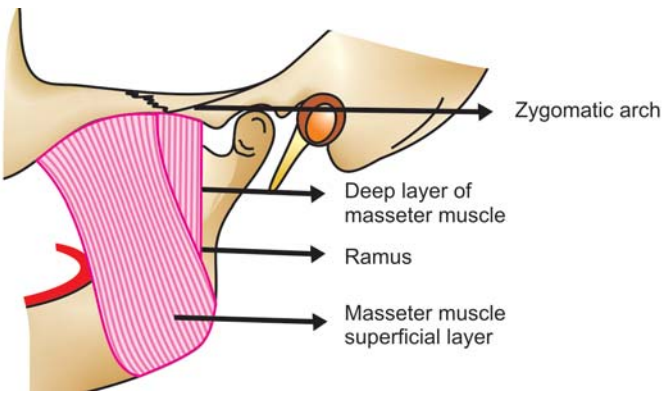


Medial pterygoid: This muscle forms the medial boundary of pterygomandibular space. A small head originates from the tuberosity of maxilla. The deep head originates from the medial surface of lateral pterygoid plate, and the adjoining process of palatine bone. It then runs downwards, backwards and laterally, to get inserted onto the medial surface of the ramus of mandible.

Lateral pterygoid: It is a muscle with two heads. The upper head originates from the infratemporal surface and crest of greater wing of sphenoid bone. The lower head originates from lateral surface of lateral pterygoid plate. The muscle runs laterally to get inserted on the pterygoid fovea on the anterior surface of neck of mandible and the anterior margin of articular disk and capsule of temporomandibular joint.



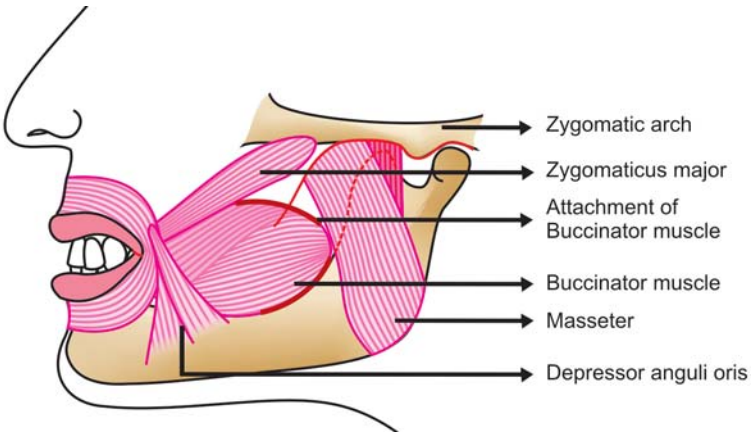
Temporalis muscle: A fan-shaped muscle, related to the infratemporal and temporal space. It originates from temporal fossa and fascia, converges and passes through the gap deep to the zygomatic arch and gets inserted on the margins, deep surface of the coronoid process and also the anterior border of the ramus of mandible.



Masseter muscle: It is a large quadrilateral muscle, formed of three layers. This muscle forms the posterior border of the buccal space and encloses the massetric space. Superficial layer originates from anterior two-third of the lower border of the zygomatic arch and adjoining zygomatic process of maxilla and inserts in the lower part of the lateral surface of ramus of mandible.

The middle layer originates from lower border. The deep layer originates from the deep surface of zygomatic arch and moves downwards to get inserted onto the middle and upper part of ramus of mandible.

Buccinator: This is the muscle that forms the cheek. It originates from the alveolar process of first molar to the tip of pterygoid hamulus. Posteriorly from the pterygo-mandibular raphe, then lateral ridge outlining the retro-molar triangle. On the mandible it originates along the external oblique line up to the lower first molar. The muscle fibers run forward to blend with the orbicularis oris. The upper fibers pass downwards and the lower fibers upwards, crossing at the corner of the mouth.

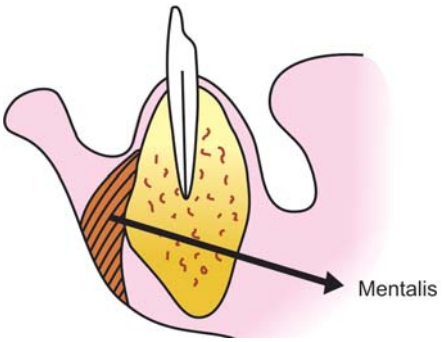


Depressor anguli oris: Forms the anteroinferior border of the buccal space. It originates from the outer surface of the mandible below the mental foramen and gets inserted onto orbicularis oris muscle.

Zygomaticus major: It is the muscle of facial expression, forming the anterosuperior border of the buccal space its fibers originate from base of zygoma and are inserted into the orbicularis oris.

Mentalis: This muscle directs the direction of infection from the lower central incisor either into the oral cavity or submental space.

This muscle originates from the mental portion of mandible and is inserted onto the skin and soft tissue of the chin.



FACIAL SPACES

Mandibular Spaces

1. Submandibular space
2. Sublingual space
3. Submentalspace
4. Submassetric space
5. Buccal space
6. Parotid space
7. Pterygomandibular space
8. Pharyngeal space
9. Peritonsillar space

Maxillary Spaces

1. Within the lips
2. Within canine fossa
3. Palatal subperiosteal
4. Buccal space
5. Maxillary antrum
6. Infratemporal
7. Subtemporalis

Submassetric Space

It lies lateral to the ramus of the mandible, and therefore it is bounded.

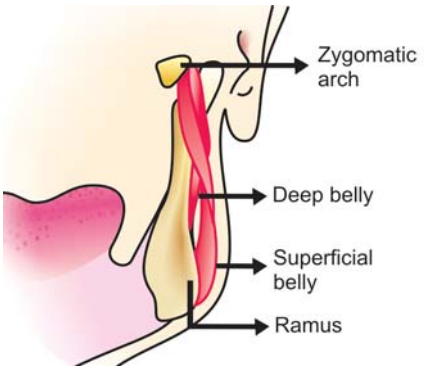
Medially: By the ramus of mandible.

Laterally and inferiorly: By superficial belly of the masseter muscle and superiorly and laterally by the deep belly of the masseter.

Anteriorly: By the oral mucosa of the retromolar triangle.

Posteriorly: The space is bounded by the parotidomassetric fascia.

Superiorly: It extends to the zygomatic arch, communicating with infratemporal space.



Sublingual Space

This space is bounded:

Medially: By the median raphe of the mylohyoid and intrinsic tongue muscles.

Laterally: By the body of mandible.

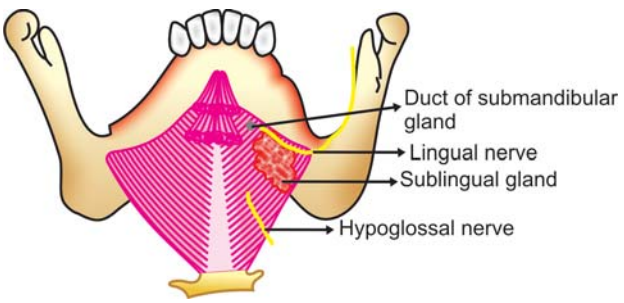
Anteriorly: By the body of the mandible.

Posteriorly: By the hyoid bone.

Inferiorly: By the mylohyoid muscle.

Superiorly: By the lingual mucosa.

It contains: Sublingual salivary gland, submandibular duct, lingual and hypoglossal nerve, lingual vessel and loose connective tisssue between the muscles of the tongue.



Seen from tongue side

Submandibular Space

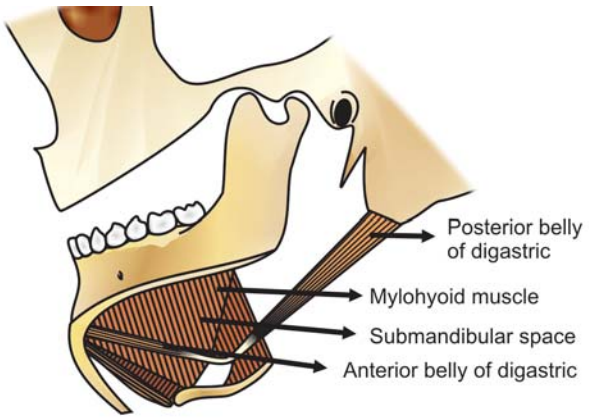
This space is one on each side of the submental space. It is bounded by the anterior and posterior belly of the digastric muscle.

Its boundaries are :

Superiorly: By the medial aspect of the mandible below the attachment of the mylohyoid muscle.

Medially: By the mylohyoid, hyoglossus, styloglossus muscle.

Laterally: By the skin, superficial fascia, platysma muscle.



Seen from neck side at an angle

Inferiorly: By the anterior and posterior belly of the digastric muscles.

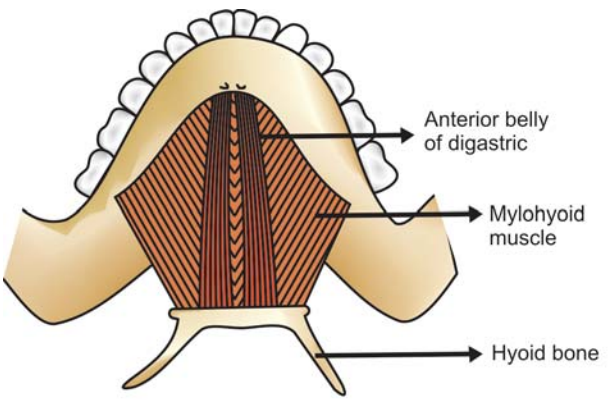
Submental Space

This space is situated in the midline just behind the chin. Its boundaries are:

Laterally: By the anterior belly of digastric muscle.

Superiorly: By the mylohyoid muscle.

Inferiorly: By skin, superficial fascia, platysma and deep cervical fascia.

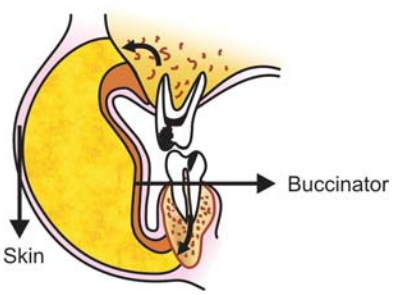


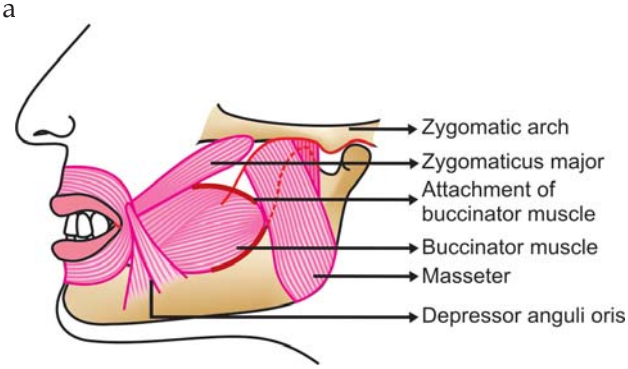
Seen from neck side

Buccal Space

This space contains the buccal pad of fat and is bounded:

Medially: By the buccinator muscle a





Laterally: By the skin and subcutaneous tissue.

Anteriorly: By the posterior border of the zygomaticus major muscle above and the depressor anguli oris below.

Posteriorly: By the anterior edge of the masseter muscle.

Superiorly: By the zygomatic arch.

Inferiorly: By the lower border of the mandible.

Pterygomandibular Space

This space can get infected through the lower third molar. It is the space into which the needle is passed for inferior alveolar nerve block.

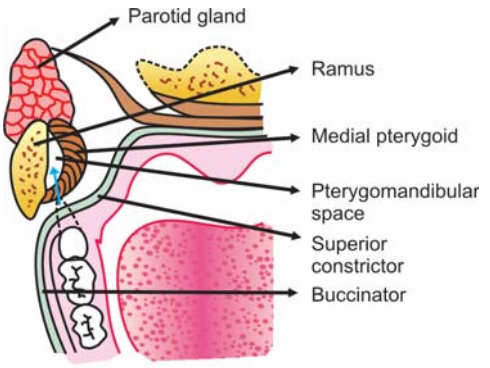
Its boundaries are:

Laterally: By the medial surface of ramus of mandible.

Medially: By the lateral aspect of the medial pterygoid muscle

Posteriorly: This space communicates with lateral pharyngeal space.

An infection from the third molar can also pass into the parapharyngeal space, by extending medial to medial pterygoid muscle.



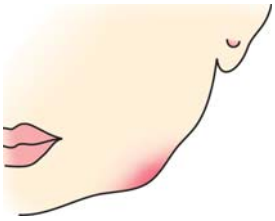
Clinical Features

Locally, the signs of inflammation are:

a. Dolor, i.e. pain.

b. Calor, i.e. warmth.
c. Rubor, i.e. erythema or redness.
d. Functio laesa, i.e. loss of function.

e. Tumor, i.e. swelling.

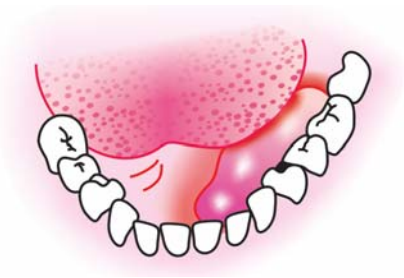


The patients first complaint generally is pain, and it is important to ask the patient where it started and how it spread.

Extraorally the swelling is seen clearly, but if not, most often the patient feels it.

If clinically present, then on palpating, it could feel very soft or firm or hard. Fluctuations can also be felt over the swelling, if pus is already formed.

If the spread of infection is intraoral, a bulge is seen into the oral vestibule or palatally or sublingually.



Extraorally, there will be a rise in temperature of the overlying skin.

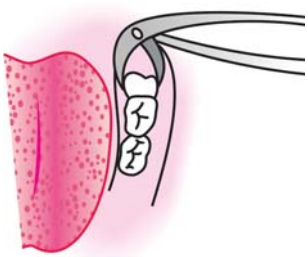
Also that area may show a change in color.

If, the infection is spread into the tissue spaces and the masticatory muscles are involved, then the patient will complain about difficulty in mandibular movements.

Intraoral inspection will reveal either caries exposed tooth or teeth. Periodontaly involved teeth could also be the cause or, pericoronitis involving an impacted III molar may have lead to the development of infection.

On physical examination of the patient it may be seen that he/she is having malaise, rise in body temperature.

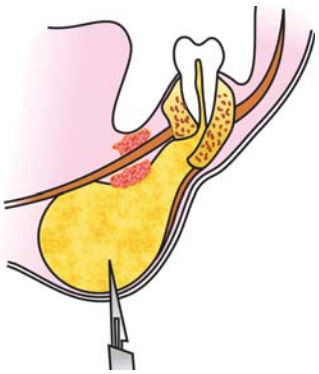
Treatment of Acute Infection

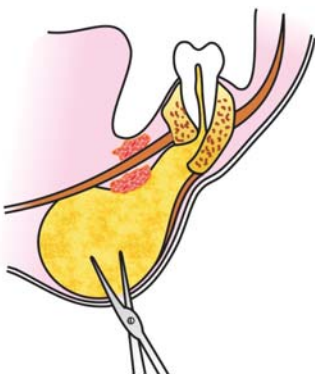


1. *Antibiotics:* Must be given. It is a good practice to take a swab for culture and sensitivity. But in cases of severe infection broad spectrum antibiotics should be started even before the results of culture and sensitivity are out.

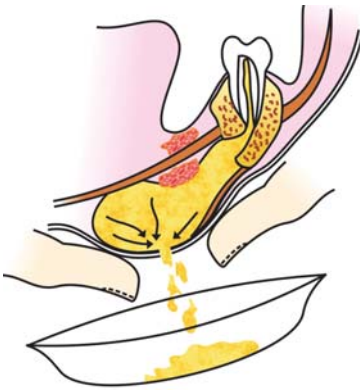
   Benzylpencillin 600 mg, 8-hourly, together with metronidazole 500 mg, 8-hourly is a suitable intravenous regime.
2. *Extraction* of the infected tooth this will remove the source of infection and will also lead to drainage of collected pus.
3. *Use of heat* is not recommended as it probably increase the spread of cellulitis. Hot saline mouthwash may give comfort but have little therapeutic effect.

4. *Incision and drainage (Hilton's method):* An incision is made at the most fluctuant part of the abscess, it should preferably also be the most dependent area.

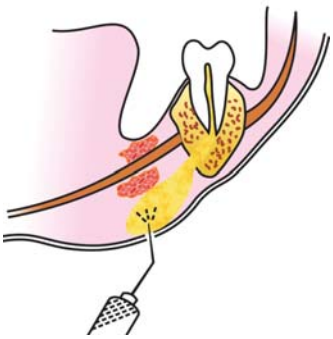




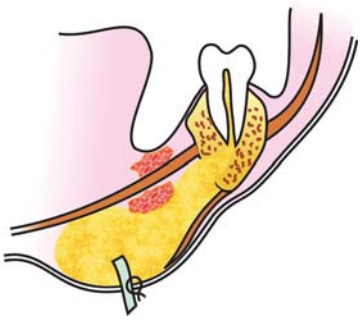
A sinus forcep should be inserted into the abscess space with their beaks closed and once inside the loculii broken, then they are withdrawn open to avoid damaging nerves or vessels by closing on them. Thus, making sure that all the abscess can be drained out.



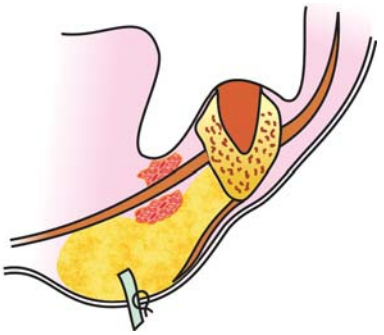
The pus is pressed out from all sides to drain the pus.



The cavity is then irrigated with antibiotic solution.

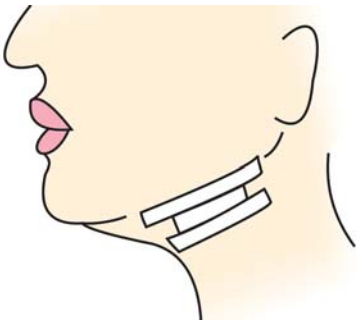


A drain is then passed into the cavity and secured.



The offending tooth is extracted. A gauze dressing is given and changed every day.

Antibiotics are continued till the abscess dries.



LUDWIG'S ANGINA

Definition

Ludwig's angina is a bilateral swelling of the sublingual, submandibular, and submental spaces.

Clinical Features

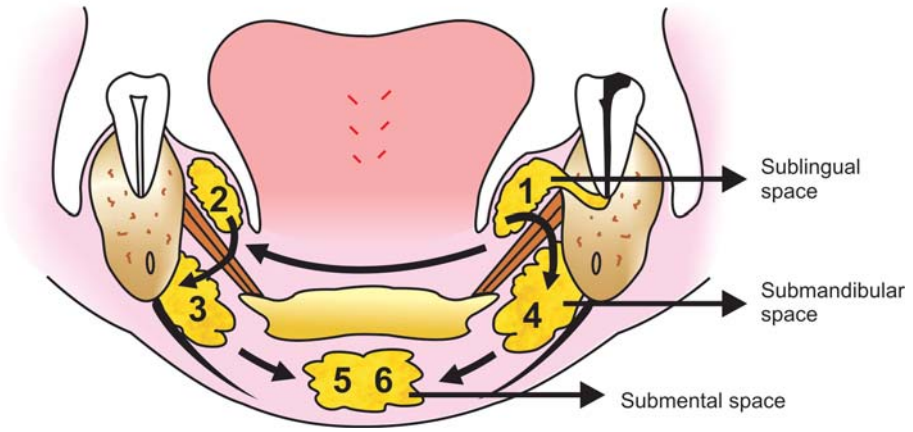
As defined, if the involvement is not of all the three spaces, that too bilaterally, the infection will not be Ludwig's angina.

- It is brawny indurated, nonfluctuant, and painful to touch.
- Because of its position the Ludwig's angina patient has a typical open mouthed appearance.
- The floor of the mouth is elevated, the tongue is protruded, making respiration difficult.
- There is an associated edema of the glottis.
- Deglutition and speech are also difficult.
- Saliva may drool from the mouth.
- Chills, fever, stiffness in the tongue movements and inability to open the mouth.
- Asphyxia is the immediate danger.
- Or death may come through septicemia, mediastinitis, or aspiration pneumonia.

Pathophysiology

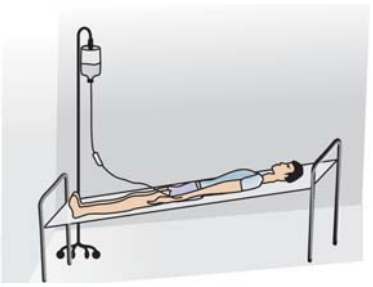
It can start in the submandibular space and then spread upwards to sublingual space and to all the other space. Or the infection starts in the sublingual space, spreads on both the sides, and then moves posteriorly over the edge of the mylohyoid muscle to involve the submandibular space and finally to the submental spaces.

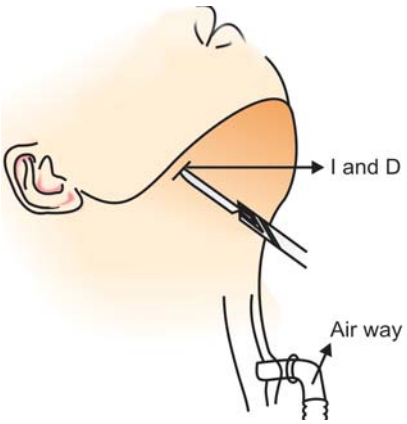
The infection is caused by α-hemolytic streptococcus or by a mixture of aerobic and anaerobic organisms.



Treatment

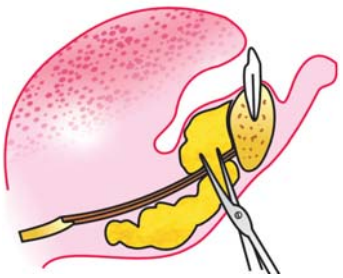
1. Antibiotics should be immediately started.
2. Supportive therapy should be maintained.





3. Tracheostomy should be done to maintain airway.
4. Surgical incision should be given to release the tissue tension and to provide for the pus drainage.

5. The surgical incision is made parallel and medial to the lower border of the mandible. The incision is extended upward to the base of the tongue in the submandibular area. In the submental area the incision extends through the mylohyoid muscle to the mucous membrane.



CHRONIC INFECTION

Osteitis

Osteitis is a localized small scale infection of the bone (Periapical and periodontal abscesses are considered under soft tissue infection).

Dry Socket or Acute Alveolar Osteitis or
Alveolitis Sicca Dolorosa or Fibrinolytic Alveolitis

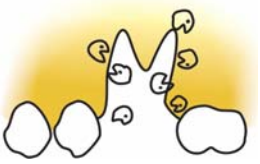
Clinical Features

- This is a condition that is seen to develop 2 to 4 days postextraction, and is characterized by sever pain.
- Fetid odor.
- In this condition the blood clot of the extraction socket disintegrates leaving the infected necrotic bone exposed to the oral cavity.
- The gingival margins of the socket are swollen and dusky red.
- Average age 20-40.
- Females more than male.
- Approximately 3 percent of all extractions.
- Mandibular 3 times more than maxilla.
- Clinically, the blood clot becomes necrotic and remains within the alveolus as a septic foreign body, that can be easily washed away.
- The regional lymph nodes may be tender and enlarged.

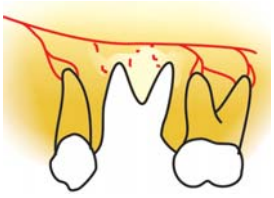
Etiology: Some factors cited are:

- Trauma while extraction

- Infection



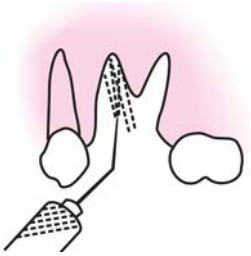
- Decreased vascular supply of surrounding bone



- Dislodgment of clot
- General systemic condition

Treatment

i. The disintegrated clot and other debris should be irrigated out of the socket.

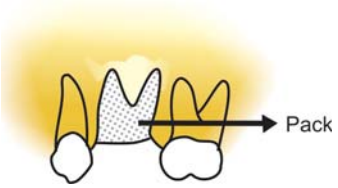


ii. A proper dressing should be given.

iii. Dressings should be changed every alternate day or even earlier.

iv. Pain killers should be started.

v. Metronidazole 400 mg b.i.d. for 5 days.



Osteomyelitis

In this condition there is inflammation of bone, for true osteomyelitis to occur the infected exudates must spread throughout the cancellous spaces of the bone producing thrombosis of the nutrient vessels with ischaemia, infarction and sequestrum formation.

Types of Osteomyelitis

- Suppurative osteomyelitis.
  - Acute
  - Chronic
- Chronic sclerosing nonsuppurative osteomyelitis, Or Garre`'s osteomyelitis.
- Systemic diseases associated osteomyelitis, e.g. T.B., syphilis, actinomycosis.
- It may accompany noma, irradiation, chemicals or electrocoagulation.

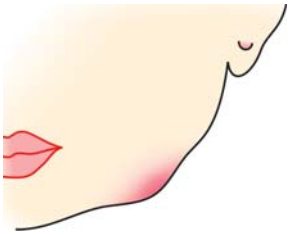
1. Acute Pyogenic Osteomyelitis

Etiology

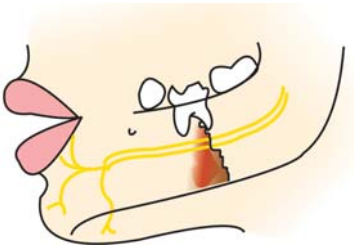
- It is generally caused by odontogenic infection and the *S. aureus*
- From infections other than teeth, e.g. middle ear, boil on chin.
- Delay in surgical intervention or antibiotic therapy on pre-existing infection.

Clinical features

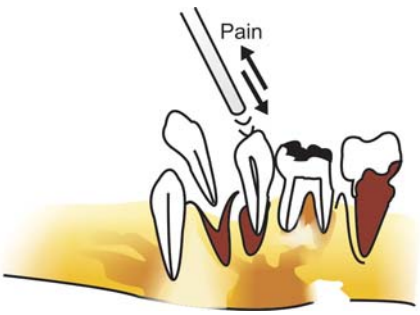
a. Severe deep seated pain.



b. Indurated swelling.



c. Loss of sensation in lower lip.

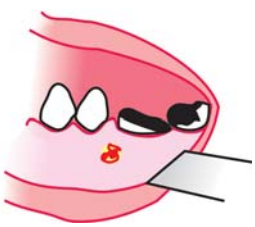


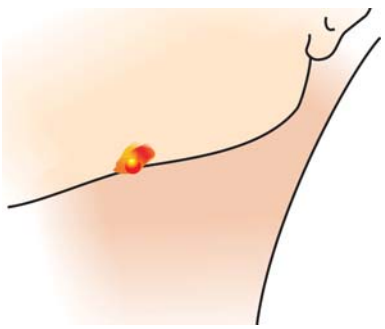
d. Number of teeth become tender to percussion.

e. Teeth also get loose in the affected segment.

Eventually pus discharges through the sinuses in the alveolar process, up the periodontal membrane of adjacent teeth.

Pus eventually discharges onto the face.

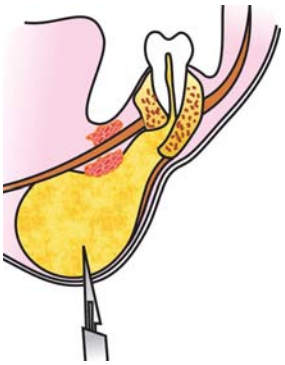




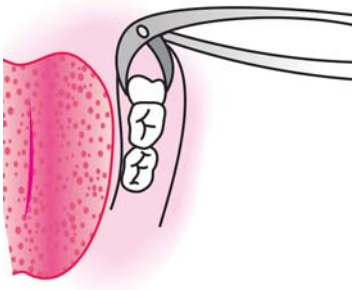
f. The lymph nodes are enlarged and tender.
g. Pyrexia.

X-ray: The bone has a mottled appearance due to widening of the medullary space and enlargement of Volkmann's canal. Later sequestrum formation takes place.

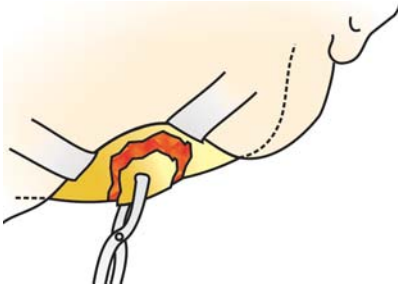
Treatment



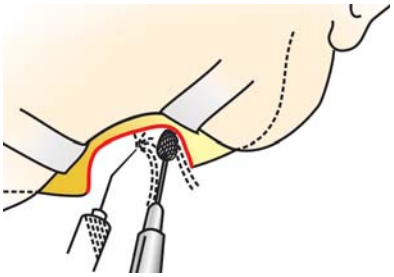
- Extraction of infected tooth.
- Incision and drainage.
- A broad-spectrum bactericidal antibiotic started.



- Sequestrectomy should be done intraorally or through submandibular incision, if sequestrum has been formed.



- The bony cavity is saucerized with an acrylic bur, to eliminate dead space.
- Generous irrigation of bone with normal saline.
- Primary closure of soft tissue done, and suction drain placed.
- Antibiotics administered for minimum 2 weeks.
- If all infected and necrotic bone is removed healing takes place.



2. Chronic Osteomyelitis

Clinical features

- There is minimum pain and discharge.
- Mandible is enlarged by deposition of new bone subperiostially.
- Mental and labial sensation exist.
- History of difficult extraction with retained root.
- There is a combination of resorption and deposition of bone both subperiosteally, thickening of the cortex, and in medulla producing zones of sclerosis.
- Resulting in a low grade infection centered in a multitude of small abscess cavities.

X-ray: There is a moth eaten appearance.

Treatment

- Once diagnosis is established, surgery through intraoral approach should be attempted.
- The bone should be removed with an acrylic bur under copious irrigation, as there is no sequestrum formation.
- This should be done till healthy bleeding bone is reached.
- If primary closure is not possible the wound should be covered with whitehead's varnish gauze.
- Rarely resection of the involved part will be required.
- Antibiotic should be started according to culture's results.
- Metronidazole 400 mg, 12-hourly should be given along with other antibiotics.
- Specific infections like tuberculosis, syphilis, actinomycosis should be treated surgically, but the antibiotic therapy will be given according to the specific condition and required duration.

3. *Garre's Osteomyelitis and Nonsuppurating Sclerosing Osteomyelitis*

- Seen in younger age group.
- A vigorous deposition of subperiosteal new bone is seen, in response to trauma, infection, etc.
- The mass can mimic a tumor in radiographs.
- Chronic nonsuppurating sclerosing osteitis and periostitis ossificans are also synonyms for this condition.
- Infection could be due to obligate anaerobic infections, hence a lack of suppuration, poor response to antibiotics commonly prescribed in the past for osteomyelitis and difficulty in culturing the responsible organism.

4. *Postirradiation Morbidity and Osteoradionecrosis*

5. *Osteomyelitis in Paget's Disease*

6. *Osteomyelitis due to Nonpyogenic Organism*

- Syphilitic osteomyelitis
- Acquired syphilis.
- Tuberculosis.
- Actinomycosis.

Chapter

11 Cyst

DEFINITION

According to Killey and Kay, "A cyst is an abnormal cavity in hard or soft tissue which contains fluids, semi-fluids or gas and is often encapsulated and lined by epithelium".

CLASSIFICATION

1. Odontogenic epithelial origin
   - A. Keratinizing (keratocyst)
     - a. Solitary or primordial cyst
     - b. Extrafollicular dentigerous cyst
   - B. Non-keratinizing
     - a. Periodontal (radicular) cyst
       - i. Periapical
       - ii. Lateral
       - iii. Residual
     - b. Dentigerous cyst
       - i. Pericoronal
       - ii. Lateral
       - iii. Residual
2. Non-odontogenic epithelial origin
   - A. Nasopalatine cyst
   - B. Nasoalveolar cyst
   - C. Median palatal cyst
3. Bone cysts
   - A. Solitary bone cyst
   - B. Aneurismal bone cyst

JAW CYST CLASSIFICATION (WHO)

Developmental

1. Odontogenic
   - i. Odontogenic keratocyst (primordial)
   - ii. Follicular cyst
   - iii. Eruption cyst
   - iv. Alveolar cyst of infants
   - v. Gingival cysts of adults
   - vi. Developmental lateral periodontal cyst
2. Non-odontogenic
   - i. Midpalatal cyst of infants
   - ii. Nasopalatine duct cyst
   - iii. Nasolabial cyst.

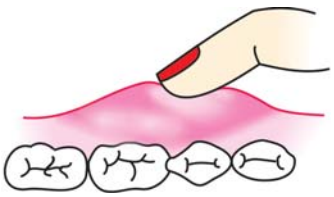
Inflammatory

- i. Inflammatory follicular cyst
- ii. Radicular cyst
- iii. Inflammatory lateral peridontal

Clinical Features

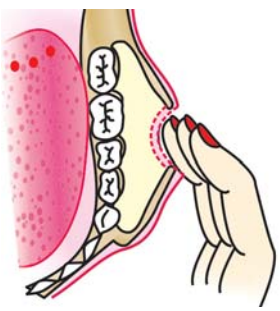
- Small cysts generally remain undiagnosed and are detected during routine radiograph.
- In large cyst there is expansion of the labial and buccal bone.

- At an early stage it is smooth, hard and painless prominence.



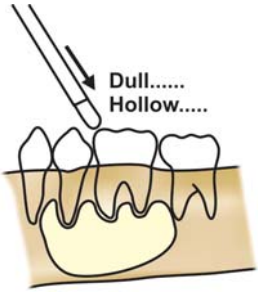
- As it increases in size the thin cortical plate can be indented with pressure.

- With further growth of the cyst the outer cortical plate becomes so thin that it gets fragmented and on pressure produces "egg shell crackling."

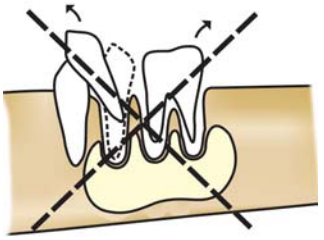


- On further expansion small portions of bone disappear and so the cyst lining lies immediately beneath the mucosa, therefore fluctuations can be felt.

- Later there can be perforation into the oral cavity leading to infection.



- Percussion of the teeth overlying a solitary bone cyst produces dull or hollow sound.



- Cysts rarely cause loosening of teeth.

Radiographic Examination

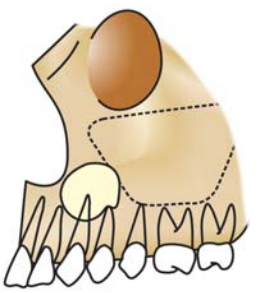
- Should be done with the help of IOPAs occlusal view, OPG, PNS (Waters view) for maxilla.
- Radiographs will show a rounded or oval radiolucency, circumscribed by radiopaque margin.

Surgical Techniqe

- Marsupialization or Partsch's operation or decompression technique.
- Enucleation.
- Combination of the two procedures.
- Enucleation with curettage.

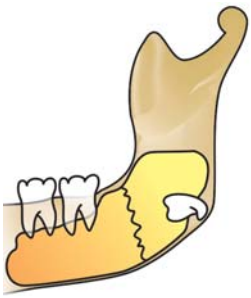
Marsupialization

Indication: Though enucleation is the preferred choice of treatment. But marsupialization should be considered if….

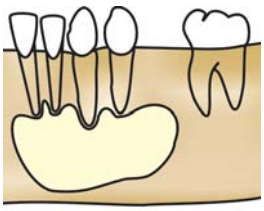


1. The proximity of the cyst to the antrum or nasal cavity is such that it can cause oroantral or oronasal fistula.

2. If the tooth in the dentigerous cyst is so placed, that if given a chance, it can erupt into the oral cavity, especially in a young adult marsupialization can be attempted.



3. If the cyst is so large, as to have hollowed out the bone, then the weakened bone could be at a risk of fracture during enucleation.



4. Enucleation may cause devitalization of many healthy teeth, the blood supply of which passes through the cystic capsule.

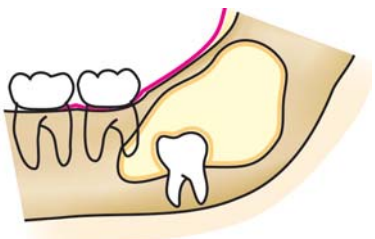
5. When the surgical access to all the portions of the cyst is difficult.

But its greatest disadvantages are:

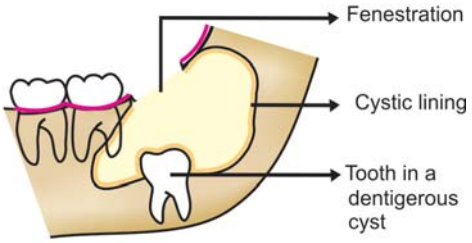
1. If all the cystic lining is not removed and sent for pathological examination it could lead to accidental retention of a tumor. Marsupialization even though accompanied by multiple biopsies is not adequate, as an early small ameloblastoma in the retained cyst wall could be missed.
2. Large spaces take a lot of time to fill, making it very unpleasant for the patient.

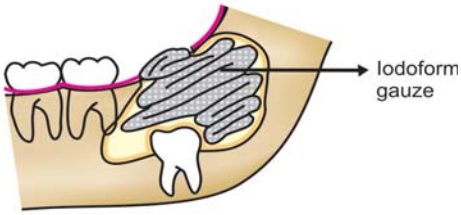
Surgical Technique for Marsupialization

This is the simplest of all techniques.



In it a large window called fenestration is cut in the outer wall of the cyst, allowing the cystic fluid to flow out. The remaining cystic lining is left as such.

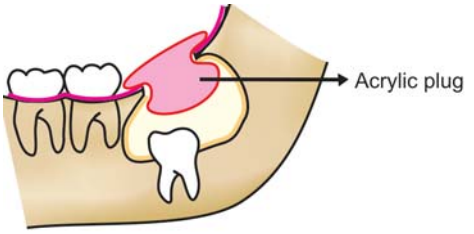


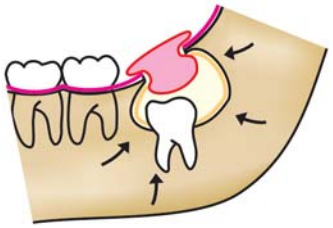


After which an iodoform gauze dressing is layered systematically from side to side into the cavity, thus protecting the surgical site and preventing the food debris from entering the cavity thus created.

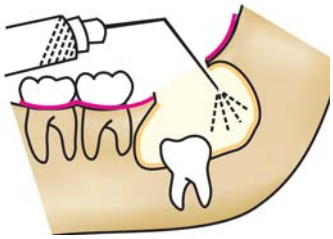
The packing should be kept for 7 to 14 days, allowing for healing between oral mucosa and cystic lining.

After this a plug is constructed and fitted into the window, this will prevent the food from entering the cavity. It will also maintain the patency of the fenestration.

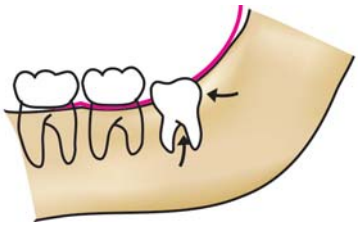




The plug should be such that it is self retentive, also there should be some space between it and the cyst lining to allow for the filling in of the cystic cavity. The early plug should be of resilient material like the gutta-percha, the subsequent one can be of acrylic.



This plug should be removed after meals for irrigation and cleaning of the cavity.



It should be examined at regular intervals and the size adjusted as the filling in process takes place.

Enucleation

In this technique the cystic lining is completely removed and the cavity underlying space fills with blood clot which heals to form normal bone. The patient is totally comfortable once the incision heals.

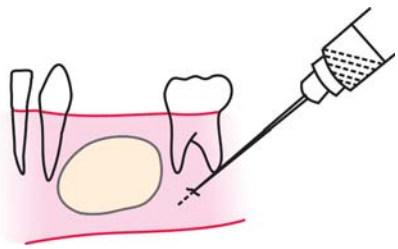
Indications

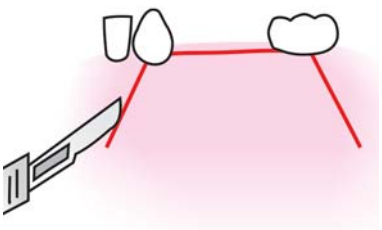
It is the treatment of choice wherever:

- the cystic lining can be removed as a whole,
- and the soft tissue approximated, covering the defect,
- when the vitality of teeth is not affected,
- where chances of fracture do not exist, and
- no vital structure is injured.

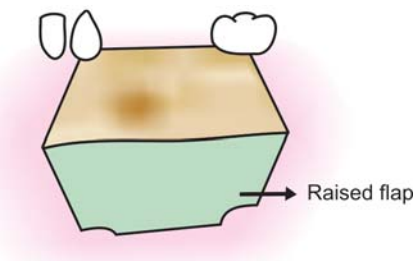
Surgical Technique for Enucleation

Local anesthesia is infiltrated for vasoconstriction and/or anesthetic effect.

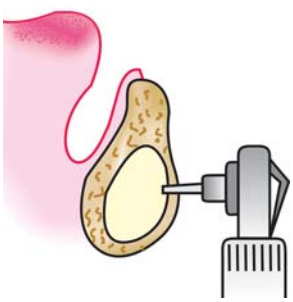




Then the flap is so designed that the sound bone would be present under the suture line once the surgery is completed.



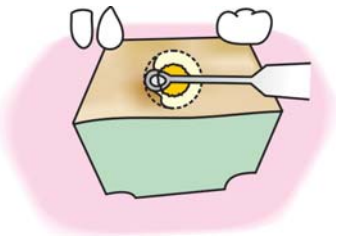
The incision should be mucoperiosteal in depth, so that a clean mucoperiosteal flap can be raised.



The underlying bone is then examined, if it is thin and fragmented, the pieces are carefully peeled off.

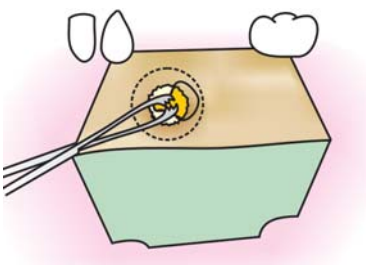
If the bone is present then a window is made in the cortical plate using a bur or chisel.

The cyst lining is seperated from the margins, the fenestration can then be increased in size.

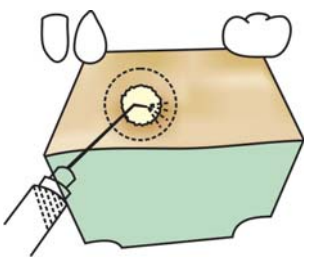


The cystic lining is removed using the broad curved end of the periosteal elevator or a curved curette or a spoon excavator. The largest curette that can be accomodated by the cyst should be used.

The concave surface of the blade should be facing the bony cavity, and care being taken not to break the lining.

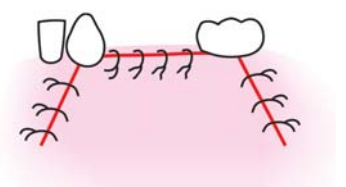


Once free the cystic lining should be carefully removed from the cavity.



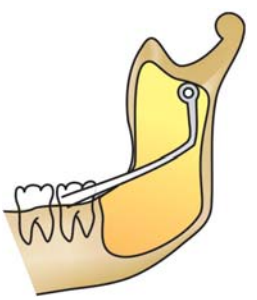
The cavity should then be ceaned and dried before examining it for residual fragments of the lining.

Once satisfied, hemostasis should be achieved before closure of the wound.



Patient should be observed postoperatively at regular intervals to ensure proper healing is taking place.

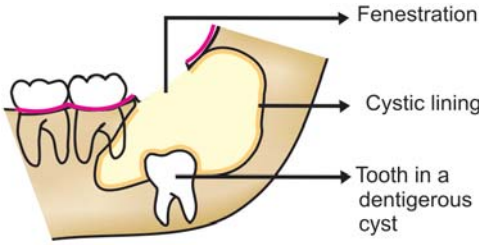
Enucleation after Marsupialization



This is a technique which is used taking advantage of both, marsupialization and enucleation. When complete access to the whole cystic lining is not possible or fracture of jaw could take place, etc. the initial surgery done is marsupialization. Once the cystic size decreases, enucleation can be done, making sure the whole cystic lining is sent for pathological examination.

Procedure

Marsupialization is done by making a fenestration in the cystic wall,



and the healing with osseous filling allowed to take place.

Once the cystic defect becomes small in size it can be enucleated.

Complete enucleation is now much easier as the cyst is smaller also the cystic lining is now thick and more easily cleared off the bone.

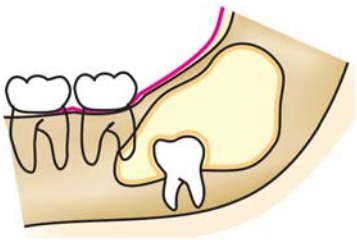
Care being taken to elevate a flap such that it completely closes the defect, at this stage the mucosal healing will take place by primary intension.

Some Differentiating Features of Different Cysts

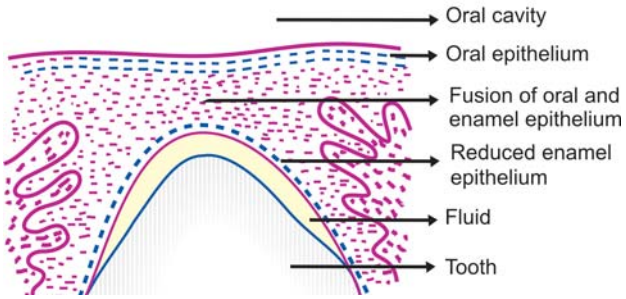
- Odontogenic keratocysts tend to develop in parts of jaws where expansion is less evident and therefore discovered quite late.
- Nonextracted missing teeth can be an indication of underlying dentigerous cyst or odontogenic keratocyst of the primordial type.
- Fissural cysts are in upper jaws, solitary bone cysts in mandible.

Features of Some Lesions

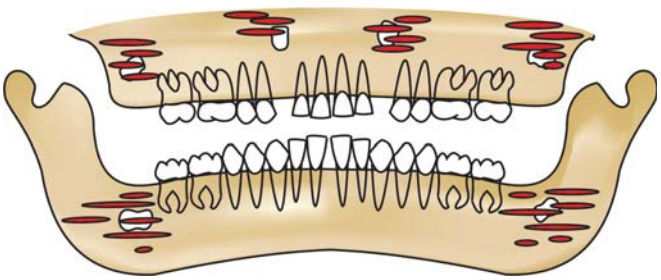
Dentigerous Cyst (Follicular Cyst)



Because it originates after the crown of the tooth has been completely formed by accumulation of fluid between the reduced enamel epithelium and the tooth crown, the dentigerous cyst nearly always involves the crown of a normal permanent tooth.

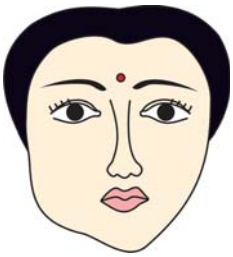


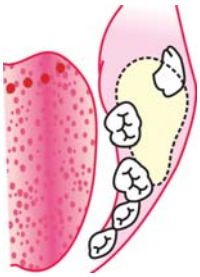
Therefore, the tooth remains impacted, embedded or unerupted. Mostly seen in mandibular and maxillary III molar, and maxillary cuspid.



They may cause:

- Facial asymmetry due to aggressive expansion of bone.





- Extreme displacement of teeth.

- Severe root resorption of adjacent teeth.

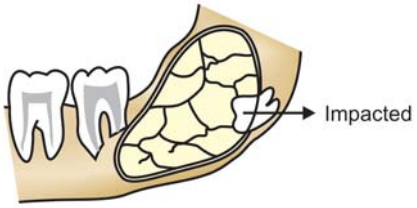
- Pain

- "Hollowing out" of the entire ramus, extending up to the coronoid, condyle, as well as expansion of the cortical plates.

X-ray

Roentgenograph will show a radiolucent area associated with the crown of an unerrupted tooth.

It is usually a smooth, unilocular lesion, but occasionally a multilocular appearance may occur.



In actuality, the various compartments are all united by the continuous cystic membrane.

In cases of apparently multiple dentigerous cysts, care should be taken to rule out the possible occurence of the odontogenic keratocysts- basal cell nevus- bifid rib syndrome.

Complications

- Recurrence following incomplete surgical removal.
- The development of ameloblastoma.
- The development of epidermoid carcinoma.
- The development of mucoepidermoid carcinoma.

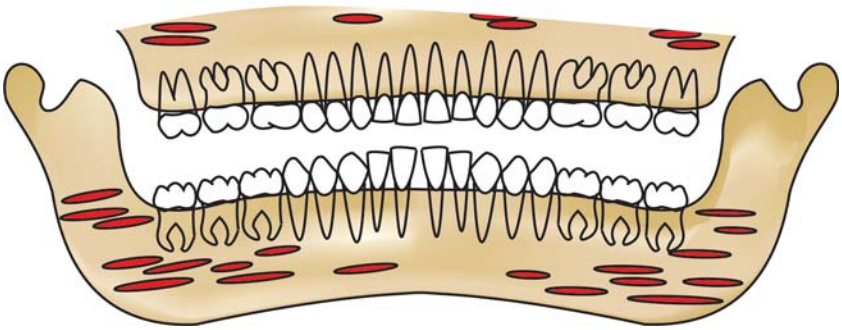
ODONTOGENIC KERATOCYST

Clinical Features

A cyst should be differentiated from other similar appearing, bone destroying lesion, e.g. ameloblastoma, giant cell lesion, central fibroma, etc. This can be done preoperatively by aspiration biopsy.

- It is a highly recurrent lesion.
- It may occur at any age from the very young age to the very elderly, but it rarely occurs below 10 years of age.

- Is found in mandible more than in maxilla. Ramus of the mandible being the most common site.

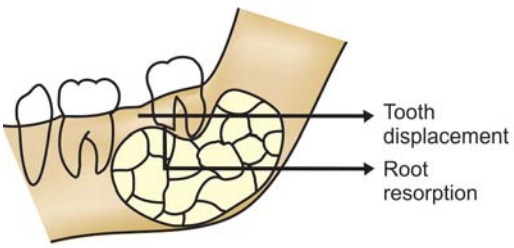


- This lesion has no characteristic clinical features.

X-ray

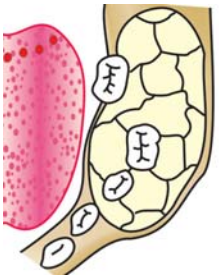
- The cyst may appear unilocular or multilocular radioluscency, with a thin sclerotic border.
- This border may be smooth or scalloped, sharply demarcateds.

- May be associated with an impacted tooth.



- Sometimes causing resorption of roots of adjacent teeth.

- But displacement of teeth is very common.



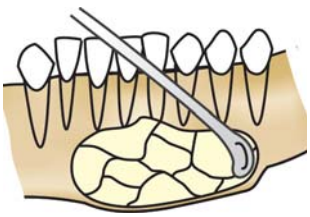
Histopathology

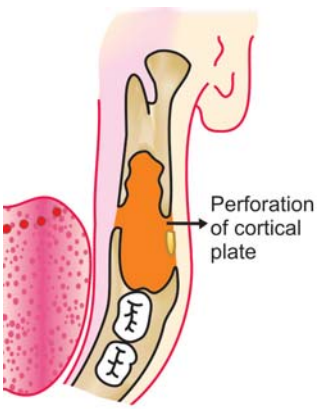
These cysts characteristically have:
1. A parakeratinized surface which is corrugated.
2. Epithelium is uniformly thick of about 6-10 cell thick.
3. A prominent palisaded basal layer of cells is seen.

The connective tissue wall often shows small island of epithelium similar to the lining epithelium; some of these islands may be small cysts "daughter cyst". The lining of these cysts are very commonly folded. The lumen of the keratocyst may be filled with a thin straw colored liquid or a thick creamy material. Sometimes, the lumen contains a great deal of keratin. Cholesterol as well as hyaline bodies at the site of inflammation may be present. Dysplastic and neoplastic transformation of the lining epithelium is uncommon.

Treatment

It should be surgically excised. Complete eradication of the cyst may be difficult because the walls of the cyst are very thin and may easily fragment.





Perforation of cortical bone, particularly in lesion involving the ramus, is common.

Recurrence is very high but does not appear related to the presence of satellite cyst, presence of additional remnants of the dental lamina from which the cyst may develop, and is not related to the method of treatment.

Therefore, follow-up of the patients should be done annually by taking roentgenograms.

This should be continued for atleast a period of 5 years.

Ameloblastoma: Central giant cell granuloma or giant cell tumor of bone (See chapter, Tumor).

CYSTS OF THE ORAL SOFT TISSUE

Mucocele

A mucocele is a mucous containing cyst, formed by minor salivary glands.

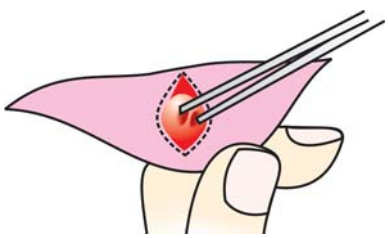
There are two types of distinct entities, (i) The retention cyst which is lined by epithelium, and, (ii) mucous extravasation cyst which does not have a definitive lining. It is therefore, not always possible to enucleate the cyst out.

Clinical Features

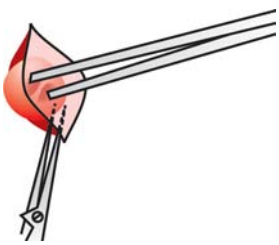
They are painless swellings generally found on the lower lip, they are small in size from 2 mm to 2 cm. Sudden rupture of the mucocele with the mucous flowing out is common.

Treatment

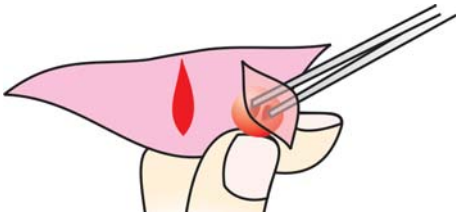
a. If possible enucleation should be attempted. Incision is made along both the sides of the mucocele.



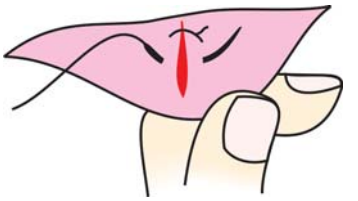
As soon as the tissue surrounding it are released the mucocele pops out. Then very carefully the tissue attached to it are dissected out.



Care being taken not to rupture it.



The wound is closed by interrupted suturing.



b. When enucleation is not possible, an incision should be made through the mucosa into the lesion, the mucous flows out.

Then the incision line is spread and the underlying mucous glands are identified and excised.

The incision is sutured.

c. Liquid nitrogen cryosurgery is another method for treating a mucocele effectively.

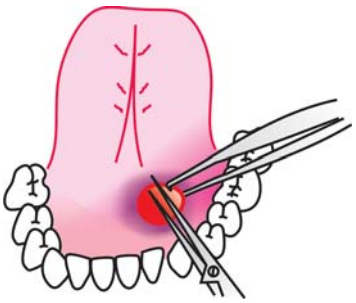
Ranula

It is a large mucocele present in the floor of the mouth. Ranula means frog's belly.

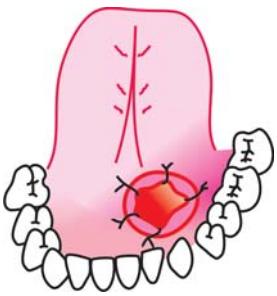
Clinical Features

It is thin walled, bluish, transparent in appearance. It is present under the tongue, therefore sometimes the tongue is raised or displaced. Once punctured the mucous flows out, and the ranula becomes flaccid, but it refills as soon as the puncture point heals.

Treatment



Marsupialization or surgical removal of the cyst along with the gland is the treatment of choice. For marsupialization the mucous membrane overlying the ranula is cut, allowing the mucous to flow out.



Then these cut margins are turned outwards and stitched to the lingual mucosa, thus exposing the epithelium of the ranula to the oral cavity, allowing for the healing to take place.

Chapter

12 Tumor

DEFINITION

A ceaseless, purposeless, uncoordinated and uncontrolled growth of the tissue, resulting from multiplication of its cells and the condition persists even after the stimulus or the initiating factor is removed.

They are of two types:

i. Benign
ii. Malignant.

CLASSIFICATION

Benign Odontogenic Neoplasms

- Neoplasms of epithelial tissue origin
  - — Ameloblastoma
  - — Squamous odontogenic tumor
  - — Calcifying epithelial odontogenic tumor
  - — Clear cell odontogenic tumor
- Neoplasms of mixed tissue origin (made up of both epithelium and mesenchymal tissue)
  - — Adenomatoid odontogenic tumor
  - — Ameloblastic fibroma
  - — Ameloblastic fibro-odontoma/fibrodentinoma
  - — Odonto-ameloblastoma
  - — Complex odontoma
  - — Compound odontoma
  - — Calcifying epithelial odontogenic cyst.
- Neoplasms of mesenchymal tissue origin
  - — Odontogenic fibroma
  - — Odontogenic myxoma
  - — Cementoma

— Familial gigantiform cementoma
— Cementifying fibroma
— Benign cementoblastoma

Malignant Tumors

- Odontogenic Carcinoma:
  — Malignant Ameloblastoma
  — Primary intra-alveolar carcinoma
  — Malignant variants of other epithelial tissue neoplasms
  — Malignant changes in odontogenic cysts.
- Odontogenic sarcomas
  — Ameloblastic fibrosarcoma
  — Ameloblastic carcinosarcoma
  — Ameloblastic fibrodentinosarcoma.

Neoplasms of Debatable Origin

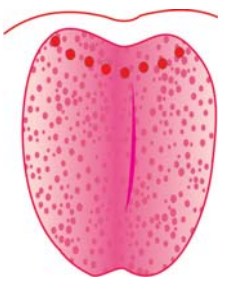
- Melanotic neuro-ectodermal tumor of infancy.
- Congenital gingival granular cell-tumor (congenital epulis).

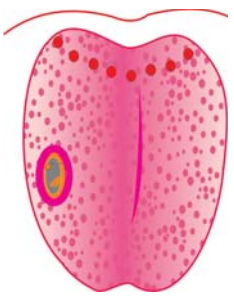
STAGING OF MALIGNANT TUMORS

TNM Classification

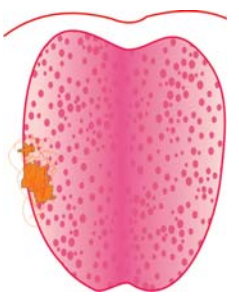
T - refers to tumor.

T0 - No evidence of primary tumor

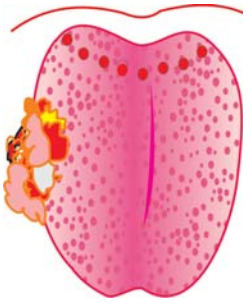




Tis - Carcinoma *in situ*.

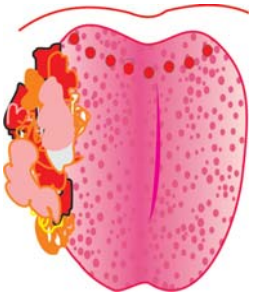


T1 - Tumor size - 2 cm or less at its widest portion.



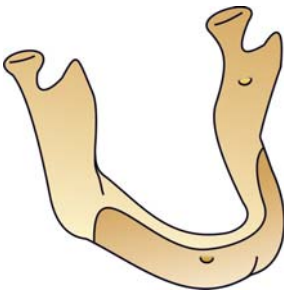
T2 - Tumor size - more than 2cm. but less than 4 cm.

T3 - Tumor size - is more than 4 cm.

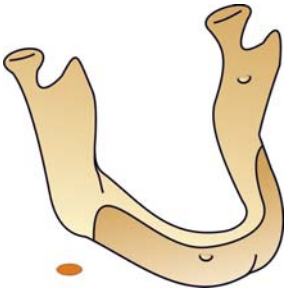


T4 - Tumor size - it is invading adjacent structures

N - refers to regional lymph nodes.

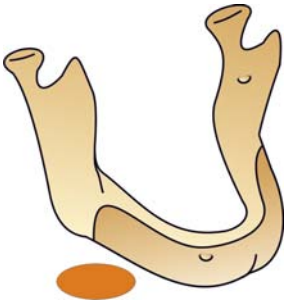


N0 - lymph node not palpable.



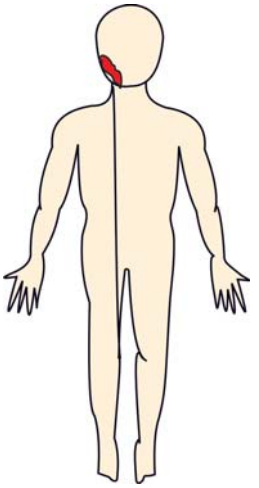
N1 - only a single lymph node is palpable on the ipsilateral side.

N2 - contralateral lymph nodes are also palpable.

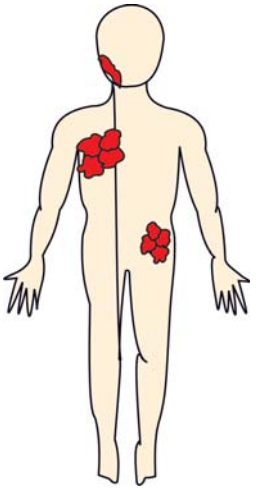


N3 - Palpable, large, fixed nodes.

M - refers to metastasis.



M0 - No metastasis

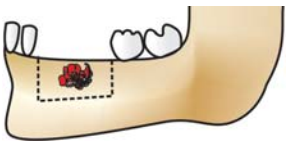


M1 - Metastasis present

BIOPSY

Excision Biopsy

When the lesion is small, it should be totally excised.



The excision should include a border of healthy tissue along the entire cut surface.

This is to be done, so that no further surgery is required if the pathology report is of a benign tumor.

Incision Biopsy

When the size of the lesion is such that complete excision is not possible or feasible, a specimen which is representative of the lesion should be taken. The area which has the maximum pathological changes should be considered for excision.

Thin deep sections should be removed

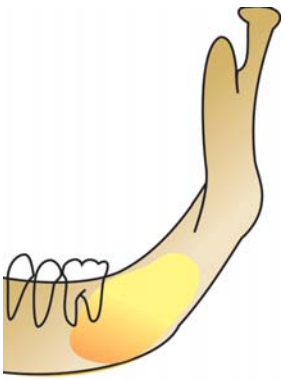
rather than broad, shallow sections.

A small superficial specimen may only show degenerative, or inflammatory or necrotic changes. Never perform biopsy in the centre of a lesion as it may show only degenerative changes, which may cause wrong diagnosis.

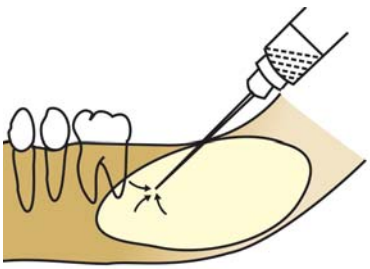
The section should include healthy tissue beyond the margins of the pathology. If one specimen does not give all the pathological changes, then specimen can be taken from several areas.

Aspiration Biopsy

If the lesion is deep seated, cystic or hemorrhagic aspiration biopsy should be done.



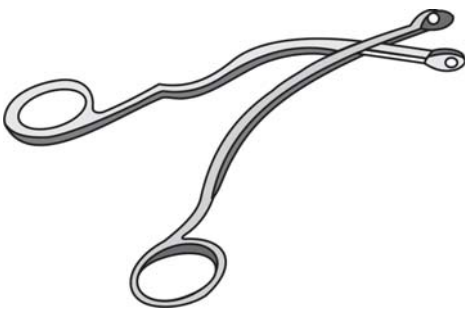
A wide bore needle is inserted into the tissue and then aspirated, the fluid collected in the syringe is then sent for pathological examination.



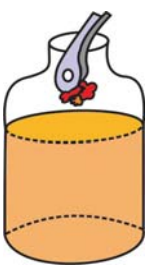
If no fluid comes in the syringe it could have gotten blocked while penetrating, so a fresh needle is taken and inserted through the same point and then aspiration done. If the bone is thick and the needle can not penetrate, fenestration (an opening) can be done.

Punch Biopsy

It is of limited value in the oral cavity. It is useful when small tissue specimen is to be taken from inaccessible areas e.g. the maxillary sinus, the lateral or posterior pharyngeal walls.

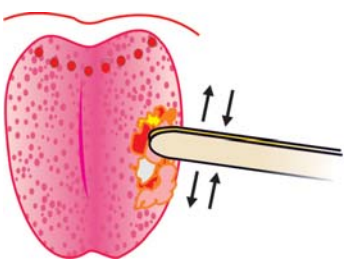


The punch forcep is used to pinch off a small portion of tissue,



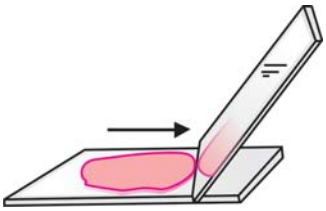
to be sent for pathological examination.

Exfoliative Cytology



This technique will provide only the external cells for pathological examination and therefore this technique may not be of great use to the oral surgeon.

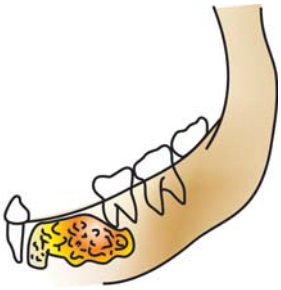
In it, the blade of a spatula is rubbed over the surface of the lesion

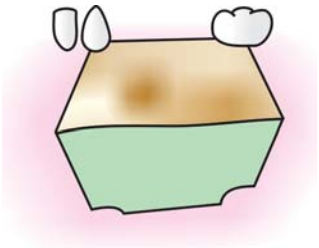


some cells exfoliate which are transferred to a glass slide, fixed and examined under the microscope.

Osseous Tumors

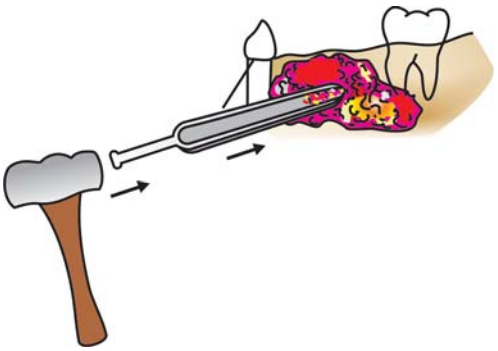
After a thorough history taking, the osseous lesions that are located centrally within the bone, are biopsied.





The biopsy can be done through an extraction socket, but if extraction is not indicated, a flap is reflected.

A window is made in the cortex with a bur, and a sample of the tumor is excised or curetted.

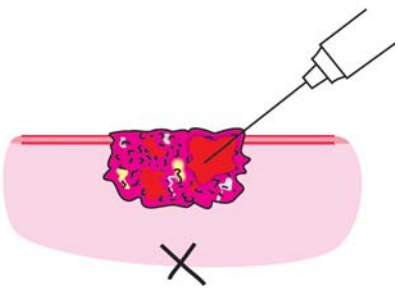


Which is placed in 10% formalin. Hemorrhage is controlled and sutures given.

Technique of Biopsy

Anesthesia

Mostly local anesthesia is used. The anesthesia should not be injected into the tumor,

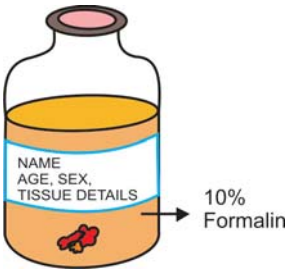


because infiltration with the anesthetic tends to balloon the tissue and distort their structure.

Removal of Specimen

Extreme care should be taken not to crush or mutilate the tissue. Forceps like hemostats, tissue forceps etc. should be avoided to pick the specimen.

Handling of Specimen



The specimen should be placed in the fixing solution as soon as it is obtained. Delay may result in the loss of cellular details.

The specimen bottle should be properly labelled to indicate whether the tissue specimen is soft tissue only or whether it contains bone. A brief history should accompany the specimen. Name, age, sex etc. should be clearly written on the label.

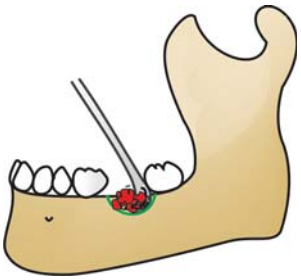
Surgical Techniques

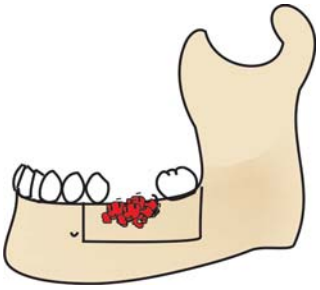
Different types of treatment modalities can be done depending on the behaviour of the lesion.

The techniques available are:

i. ***Enucleation and or curettage,*** e.g. Odontoma, Cementoblastoma, Calcifying odontogenic cyst, Aneurysmal bone cyst. etc.

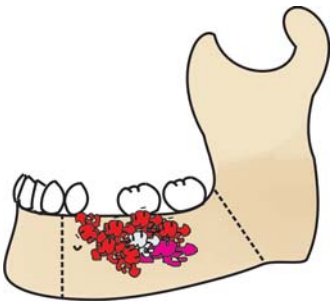
ii. ***Resection***

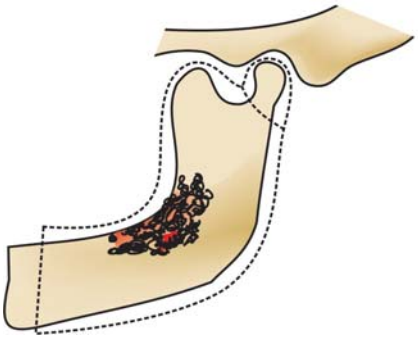




a. *Marginal or segmental resection*, e.g. Ameloblastoma, Ameloblastic odontoma, etc.

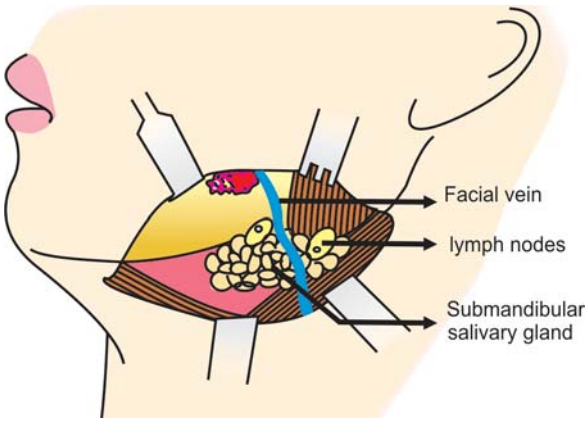
b. *Partial resection*, e.g. Ameloblastoma, Myxoma, Squamous odontgenic tumor etc.



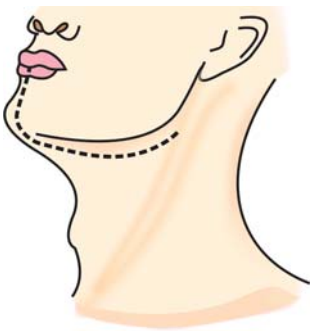


c. *Total resection.*

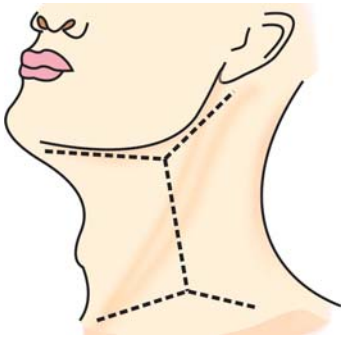
d. *Composite resection*, e.g. Fibrosarcoma, Osteosarcoma, Malignamt Ameloblastoma etc.



The surgical approach for enucleation, and marginal resection is intra-oral. While the approach for partial or total resection is from the skin surface, The incision can be limited for the submandibular region or may extend for the neck dissection depending on the kind of surgery.



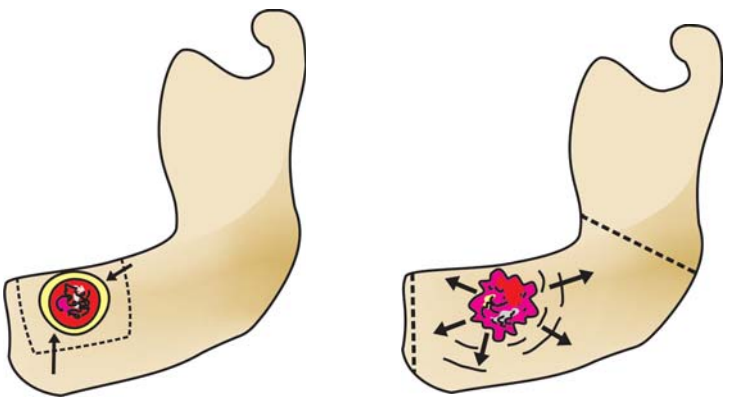
Submandibular incision with a lip split



Incision lines for radical neck dissection

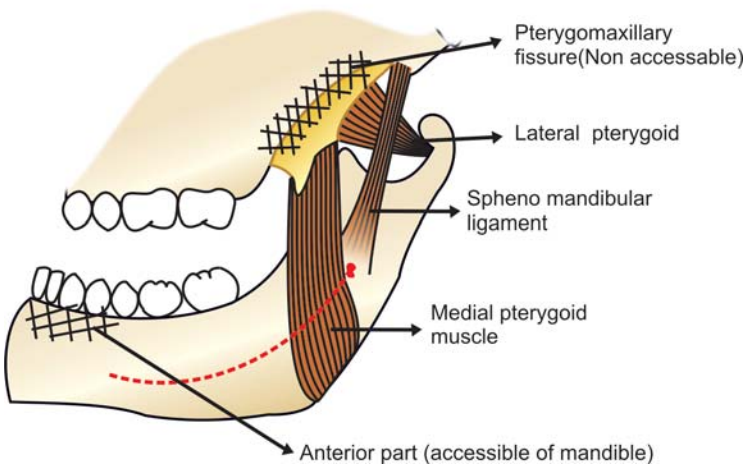
- These surgeries can be done separately or in conjugation with radiotherapy, and/or chemotherapy.
- The factors that help decide on the type of surgery that is best suited for a particular lesion are:

i. *Behaviour* of the lesion i.e. how aggressively it will behave in the future. If the pathology is suggestive of a slow, restricted or encapsulated growth. Then while planning its surgery, the surgeon can consider options like curettage or marginal resection. While if the pathological picture is that of a more aggressive lesion then the surgeon has to consider options like; partial resection, total resection or composite resection.



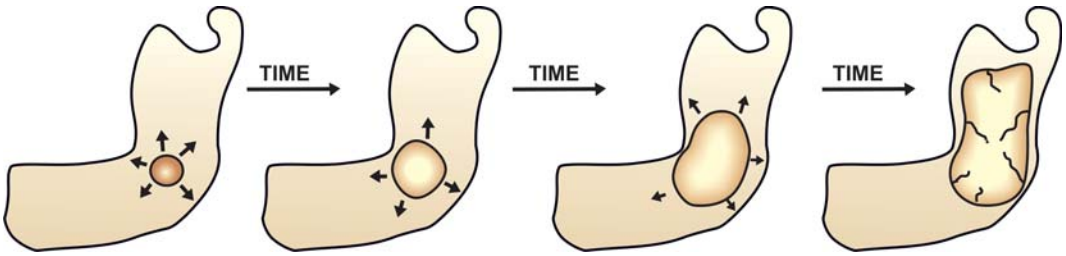
Slow growth Aggressive growth

ii. *Anatomic location:* of the lesion is a very important factor in deciding the prognosis of the lesion, sometimes a non-aggressive lesion which is placed in a non accessible area poses a bigger problem, than an aggressive lesion that is present in an accessible region.



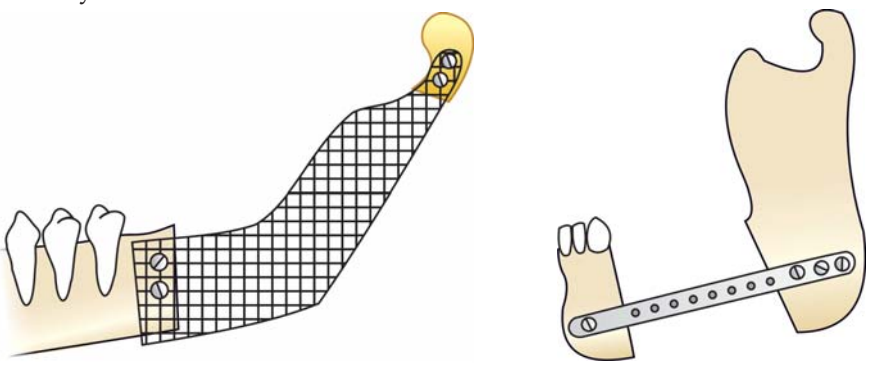
iii. *Confinement:* whether the lesion is confined to the bone or not. Some carcinomas present in the maxilla soon involve the sinuses and remain asymptomatic, but continue to grow and spread before they are discovered, whereas those in the mandible can be sited earlier and are therefore treated when smaller.

iv. *Duration* of the lesion, generally the longer standing it is, the more it has had a chance to spread. E.g. an Ameloblastoma may remain asymptomatic, and is diagnosed early only in routine radiographs, or when it has become so big as to have hollowed out the ramus.



v. *Reconstruction* after surgery also helps the surgeon decide the surgical lines to be followed.

If resection is the only choice then a plan is made on the reconstruction of the excised portion, and the surgeon will leave behind some important osseous structures that can be useful in reconstruction and rehabilitation of the patient. E.g. if a tumor of the mandible is to be excised by radical resection consideration can be made to keep the condyle behind that can be used for reconstruction.



AMELOBLASTOMA

(Adamantinoma, Adamantoblastoma, Multilocular cyst)

Definition

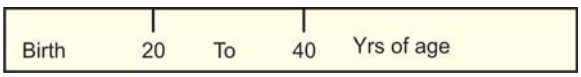
It is usually unicentric, non-functional, intermittent in growth anatomically benign and clinically persistent (by Robinson).

It is a true neoplasm of enamel organ-type tissue, which does not undergo differentiation to the point of enamel formation.

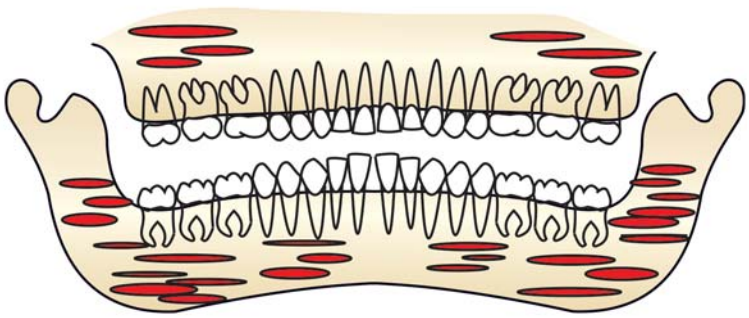
Clinical Features

- Ameloblastoma is evenly distributed between the two sexes.

- Mostly found in 20-40 years age group.

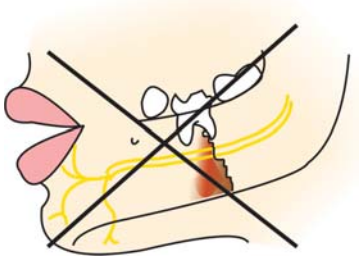


- It has racial discrimation, seen more in black people than white race.
- Mandible more than maxilla, about 80:20%.
- In mandible 3/4 are seen in molar-ramus region.



- It begins as a central lesion of the bone.
- Expands the bone rather than perforate it.
- It is a slow enlarging, painless, ovoid or fusiform, bony hard swelling of the jaw.
- Even when very large and disfiguring, there is seldom a breakdown of the oral mucosa.
- Not painful.

- Does not show nerve involvement.



- Because of thinning of cortical plates, we elicit "fluctuations" or "egg shell crackling" of the affected part.

- Resorption of roots of teeth is common.
- There can be loosening of teeth.
- Malignancy is seen occasionally.

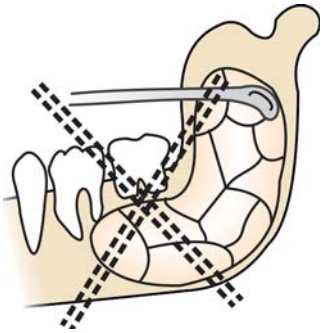
X-ray

- It is multilocular and cystic in appearance.
- There is compartmented appearance with septa of bone extending into the radiolucent tumor mass.
- When the multiple radiolucencies are small, the lesion has a "honeycomb" or "soap-bubble" configuration.
- May appear unilocular with no characteristic features.
- Margins (periphery) appear smooth.
- With advancement, jaw expansion and thinning of the cortical plate may be seen.
- When the tumor develops before tooth eruption is complete, it may mislead and suggest a dentigerous cyst.

Treatment

There is a great difference of opinion about the choice of treatment, but all agree that complete removal by surgery is a must. The choice of surgery varies from radical excision of the ameloblastoma to the conservative surgical excision or curettage.

Surgical excision is the preferred choice of treatment.



Curettage is the least desirable, since it is associated with the highest incidences of recurrence.

Regardless of the form of treatment, long term follow-up of the patient is absolutely necessary.

The prognosis of this neoplasm, after treatment are very good from the patients viewpoint. As it is essentially a local growth, metastasis seldom occurs. It may cause disfigurement, but seldom causes death, unless it grows into some vital structures.

Differential Diagnosis

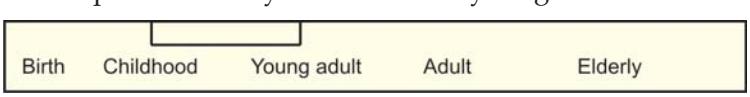
- Odontogenic Keratocyst (Primordial Cyst)
- Dentigerous cyst
- Central giant cell granuloma
- Central hemangioma
- Aneurismal bone cyst
- Pindborg's tumor
- Fibromyxoma.

CENTRAL GIANT CELL GRANULOMA AND GIANT CELL TUMOR OF BONE

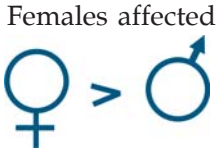
It should be separated from other giant cell-containing lesions such as hyperparathyroidism, fibrous dysplasia, the aneurismal bone cyst, as all these have multinucleated giant cells as a common feature.

Clinical Features

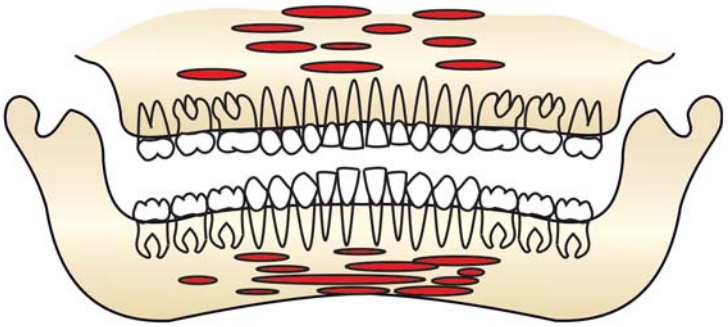
- Found predominantly in children or young adults.



- Females affected more than males.



- Mandible affected more than maxilla.
- Seen more in anterior segment of the jaws, may cross the midline.



- Pain is not a major factor.
- Slight to moderate bulging of the jaws due to expansion of the cortical plates occurs.
- It may be discovered accidentally due to lack of signs and symptoms shown by it.

X-ray

- Radiolucent with a smooth or a ragged border and sometimes showing faint trabeculae.
- Definite loculation are often present, particularly in larger lesions.
- The cortical plates are thin and expanded and may get perforated.
- Displacement of teeth is quite common.

Treatment

Curettage and surgical excision is the treatment of choice. This lesion bleeds profusely, therefore the surgery should be started from one end and the curettage done to remove the complete lesion. Once the whole pathological mass is removed the bleeding gets arrested easily. After the surgery is done, generally the healing takes place routinely. Occasionally if the lesion recurs, it is seldom a cause for more radical treatment.

Radiation is contraindicated.

Chapter

13

Maxillary Antrum

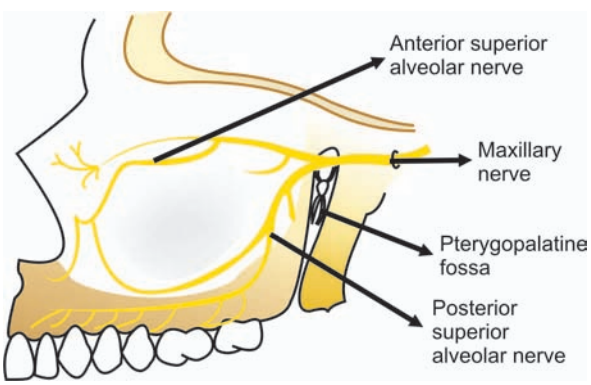
The Maxillary sinus is also referred to as the Antrum of Highmore.

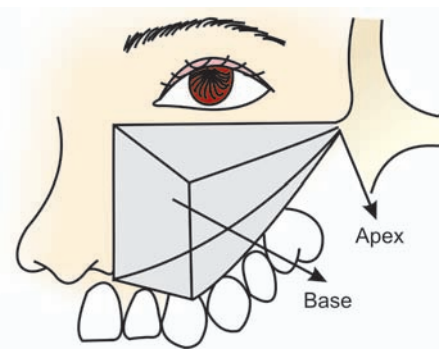
Applied Anatomy

The antrum lies in the body of the maxilla; and therefore one on each side. They are hollow, pyramidal in shape, with the apex at the root of zygomatic bone and the base being formed of the lateral nasal wall. The four walls of the pyramid are represented as:

i. The roof is formed by the orbital plate .
ii. The floor is formed by the alveolar process of the maxilla.
iii. In front the anterolateral or canine fossa is the facial part of the maxilla.
iv. The posterior or sphenomaxillary wall is a thin plate of bone separating the antrum from the infratemporal fossa.

The outlet from the sinus lies just beneath the roof of the antrum, and opens in the nasal cavity through the ostium maxillae.





The sinus is lined by ciliated epithelium, also referred to as Schneiderian membrane, which helps in the removal of secretions from the antrum into the nose.

The nerve supply to the antrum is by the posterosuperior alveolar branch of the maxillary nerve, which is a branch of the 5th cranial nerve. The blood supply is from the infra-orbital artery, a branch of the maxillary artery.

Functions of Paranasal Sinus

1. To reduce the weight of the skull
2. To give resonance to the voice
3. To help warm the inspired air
4. To provide drainage.

Radiographic Evaluation

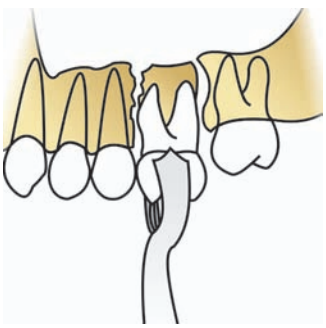
The PNS view i.e. paranasal sinus view is the most often used radiograph. It helps in diagnosing fractures, foreign body e.g. tooth in the antral cavity, antral opacity, fluid level etc.

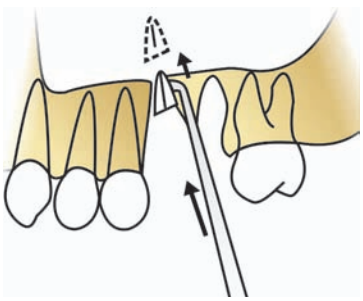
Intraoral radiographs like:

i. Periapical (IOPA),
ii. Occlusal can be used to locate roots, osseous fragments, etc. for treatment planning.

Clinical Importance

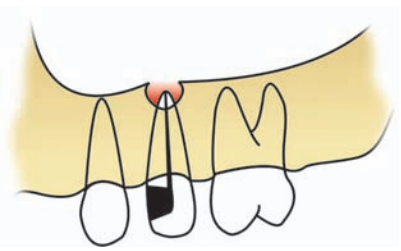
1. Accidental opening in the floor of the antrum during extraction of teeth.

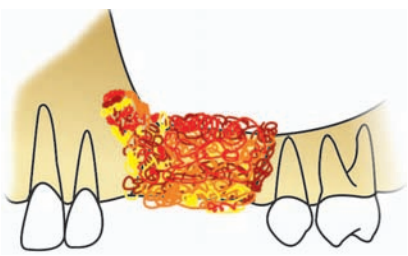




2. Displacement of the root or tooth during extraction.

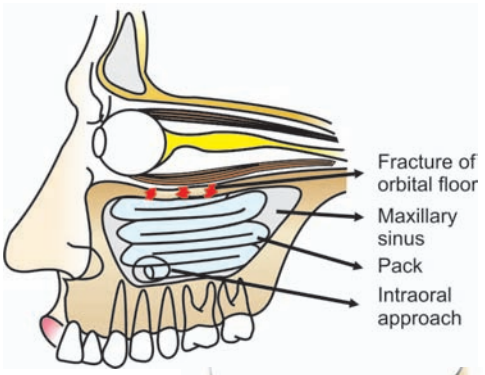
3. Infections introduced into the antrum through periapical infections.
4. Some times patient complains of severe pain in the posterior teeth, which is actually being referred to the teeth from an infected antrum.





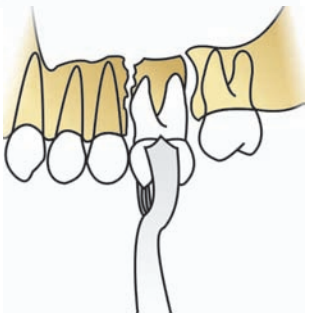
5. Tumors involving or developing in the antrum may penetrate the floor of the maxillary antrum and present as a palatal lump or expansion of the buccal sulcus, causing mobility of teeth.

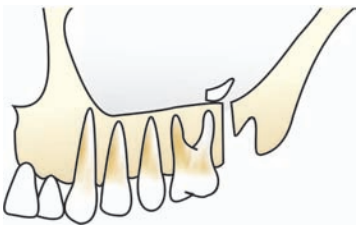
6. Trauma,
   - resulting in fracture may cause infection,
   - pushing of a dental segment into the antrum,
   - fracture of the infraorbital plate causing herniation of fat into the antrum requiring treatment by antral packing.



OROANTRAL COMMUNICATION

Oroantral communication is an accidental opening, caused during extraction of a tooth, which has a thin bone separating the roots from the antrum.

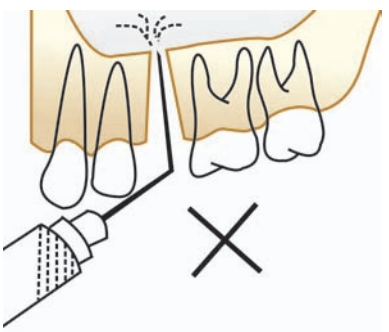




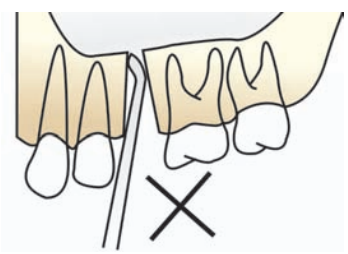
Once it is confirmed that there is an accidental opening into the antrum the patient should be immediately informed. Certain precautions should be taken so that the healing is without incidence.

Precautions

- If while attempting the root/tooth is accidentally pushed into the sinus only a short, precise attempt should be made to remove it, but if unsuccessful the attempt should be abandoned and wound closed. The root/tooth can be removed at a later date through Caldwell-Luc operation.

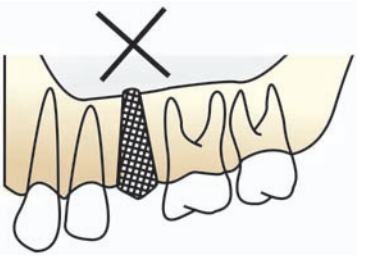


- Irrigation into the socket should be avoided



- Probing the socket with instruments should never be done.

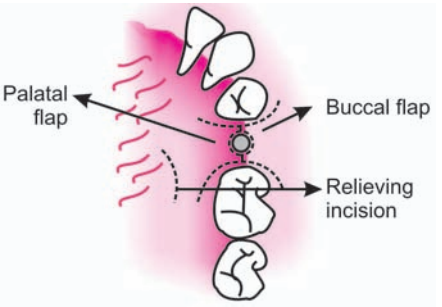
- The socket should not be packed with any material like cotton, gauze etc.



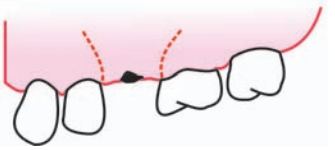
- Patient should be asked not to blow his/her nose frequently.

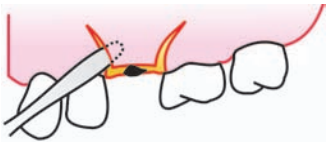
- Nor should the patient do vigorous mouthwash.

Surgical Technique



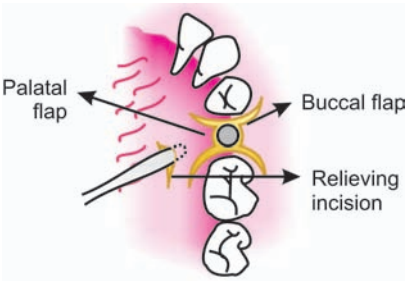
The mucoperiosteum around the extracted site is raised both buccally and palatally,

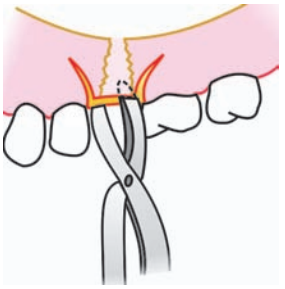




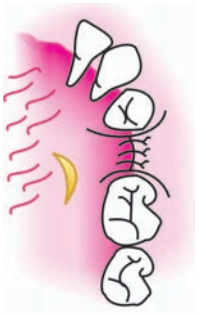
a relieving incision is given palatally

to allow for some movement of the mucoperiosteum





thus aiding in closure of the defect at the extraction site, if required the height of the alveolar ridge is reduced.

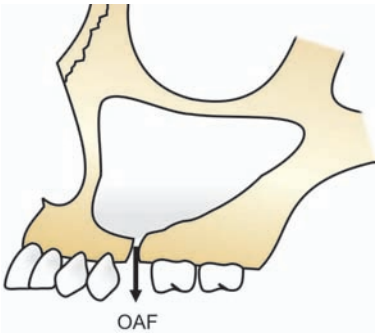


The soft tissue edges are freshened, and the wound closed.

All postsurgical precautions are followed for incident free healing.

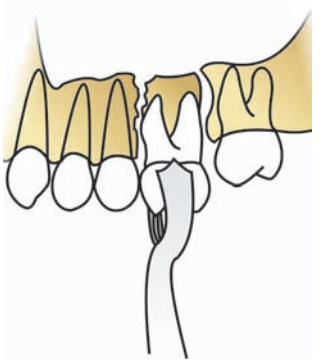
OROANTRAL FISTULA

OAF - unnatural communication between mouth and maxilla.

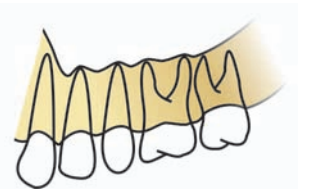


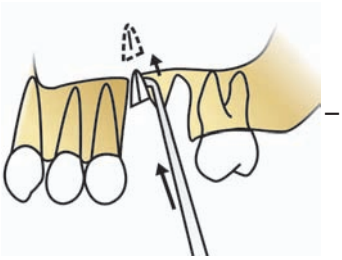
Etiology

1. Extraction of teeth-



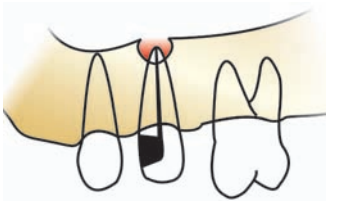
– when antrum is thin walled

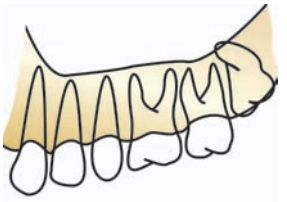




– when roots and tooth is displaced into antrum

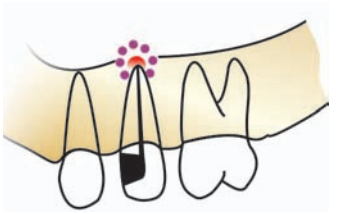
– posterior teeth associated with periapical disease

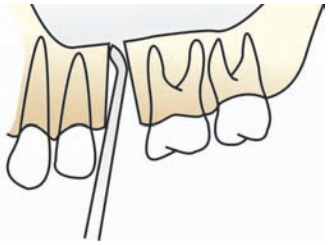




– impacted, submerged tooth

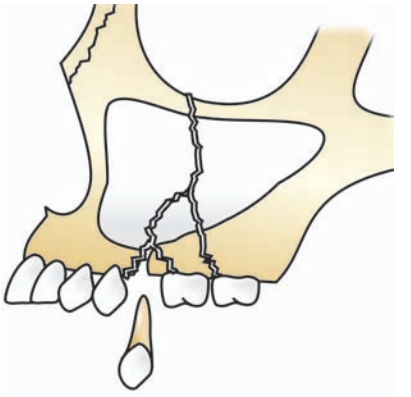
– apicectomy on roots





–blind instrumentation

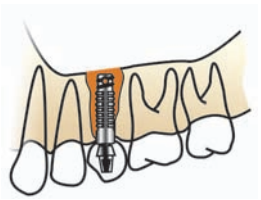
2. Massive trauma to the face



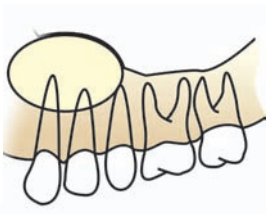
3. Osteomyelitis of the maxilla.

4. Surgery of maxillary sinus.

5. Gumma involving the palate.



6. Infected upper implant.

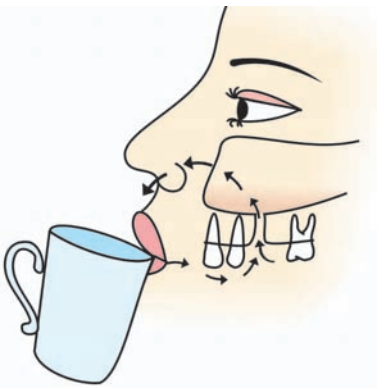


7. Large maxillary cyst.

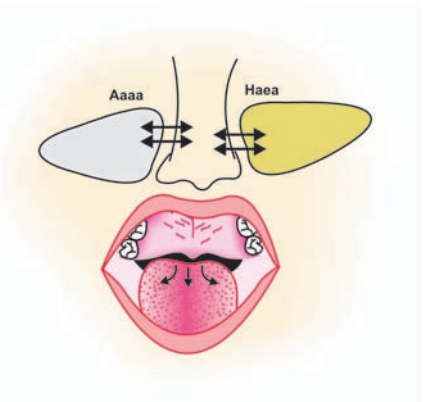
8. Malignant granuloma, etc.

Symptoms

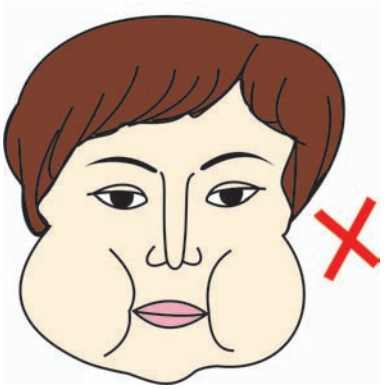
1. Regurgitation of liquids from mouth into nose.



2. Unilateral epistaxis

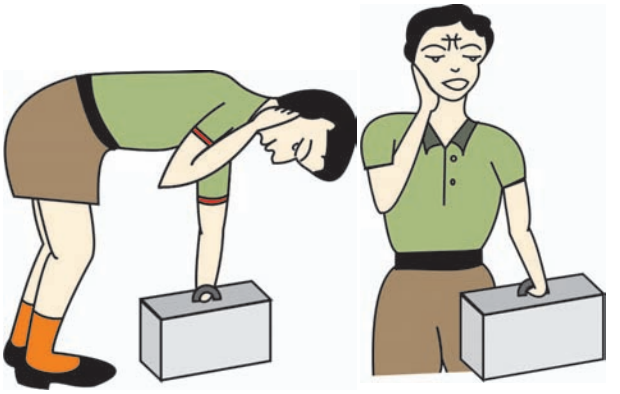


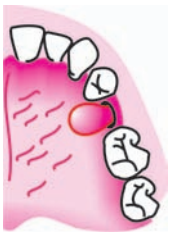
3. Alteration in vocal resonance

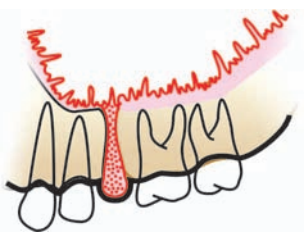


4. Inability to blow out the cheeks

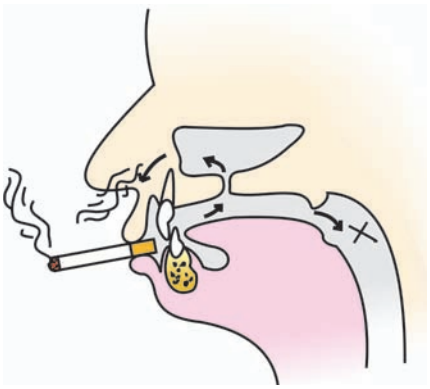
5. Symptoms of acute sinusitis like:
   - pain during bending, lifting, straining.
   - associated frontal headache
   - malaise, etc.



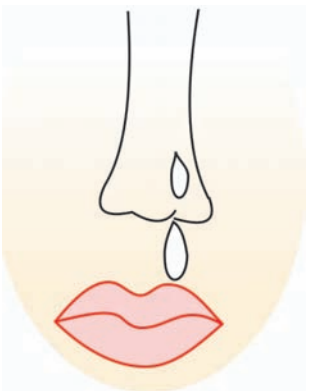




6. Antral polyp may prolapse through the fistulous passage and become covered by oral epithelium.



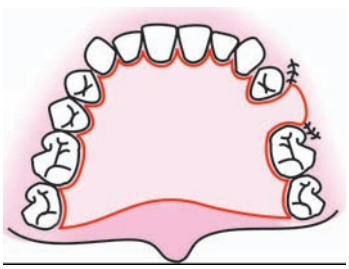
7. Occasionally smokers are unable to draw on a cigarette when infected.



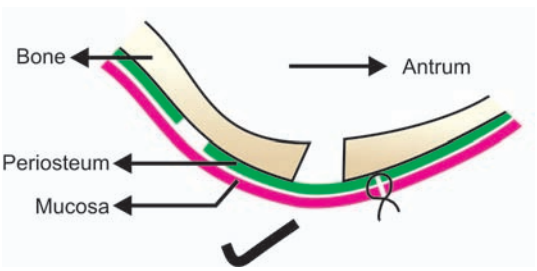
8. Unilateral malodourous nasal discharge specially when they bend down.
9. Foul salty or sweetish fetid taste.

Pre-post Surgical Precautions for Success

1. Surgery should be attempted only when one is sure that the antrum is rid of its infection.
2. A proper antibiotic therapy should be given pre-post operatively.

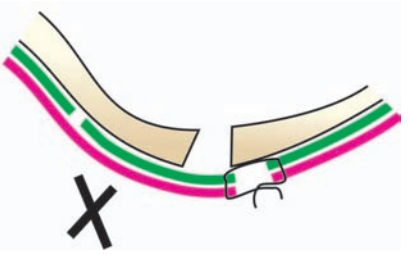


3. Always try to give a palatal plate for the support of the flap.

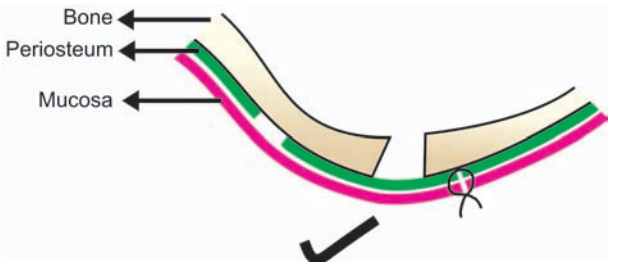


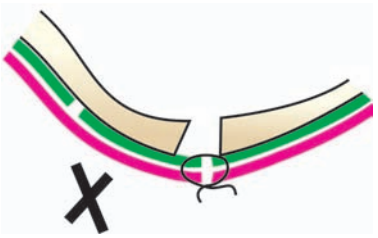
4. The flap should be placed without too much tension.

and the sutures not stretched.



5. The flap ends should rest on firm bone

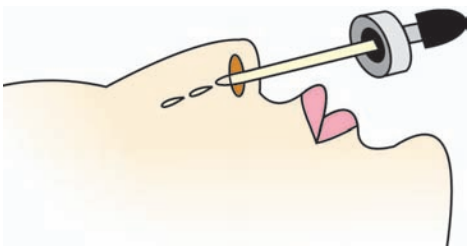


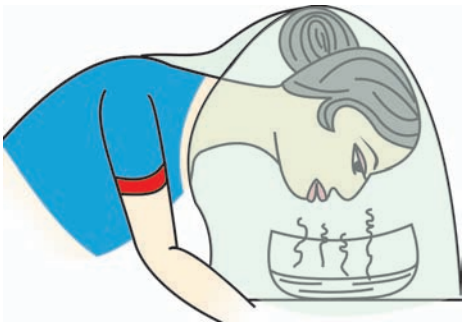


never in the fistulous tract.

6. Sutures should not be removed earlier than 5-7 days postoperatively.

7. Always advise postsurgical nasal drops.





8. Advise steam inhalation.

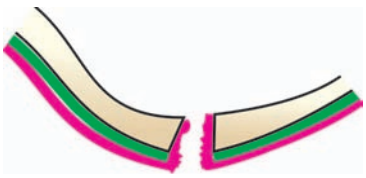
9. Fresh bleeding margins should be available all around.
10. Patient should be medically fit.
11. If necessary the best drainage from the sinus can be got by performing nasal antrostomy.

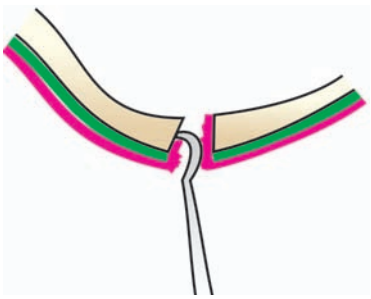
Surgical Techniques

1. Buccal advancement flap or burgers technique.
2. Palatal flap.
3. Advancement of both palatal and facial flaps over a metallic foil plate.
4. Berger's technique combined with Caldwell-Luc surgery.

BUCCAL ADVANCEMENT FLAP/BURGERS TECHNIQUES

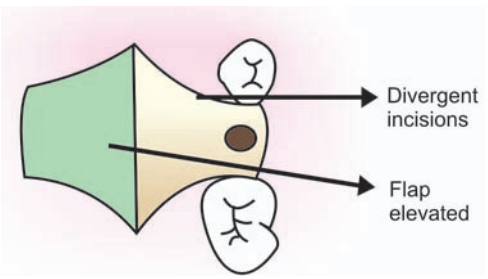
The osseous defect surrounding the fistula is always larger than the clinically apparent soft tissue deformity therefore the flap should be designed to accommodate a large defect.



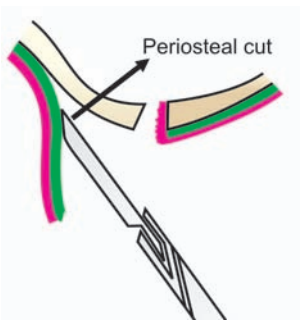


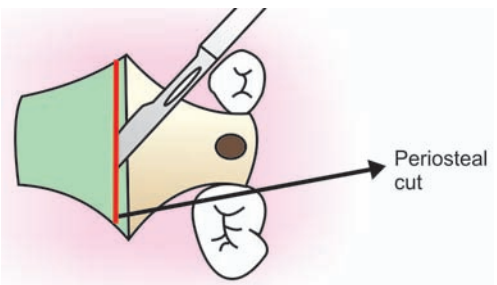
The fistulous tract should be cleared off all its epithelial lining.

Then, two divergent incisions should be made on the buccal side, the mucoperiosteal flap raised and the periosteal side turned outwards.

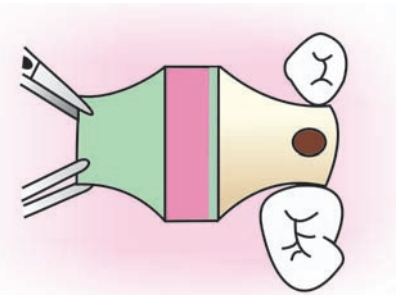


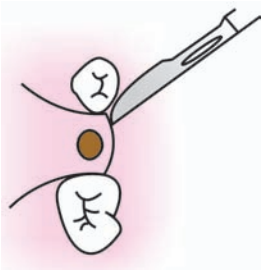
Then with a blade a horizontal incision should be made on the periosteum cutting it from side to side.





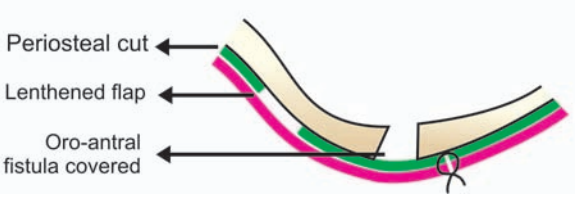
this will allow for the stretching of the buccal flap (as it is the periosteum which cannot be stretched).

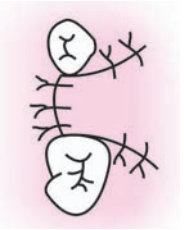




The mucosa on the palatal side of the fistula should also be so removed.

That the buccal flap which is advanced can have the suture resting on the firm palatal bone.

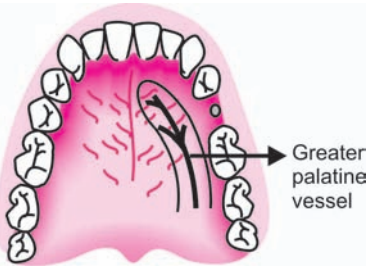


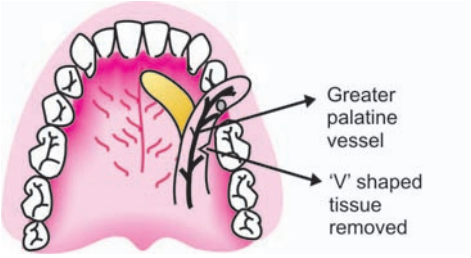


Suturing should be done with care. All the postsurgical precautions should be carefully followed.

Palatal Flap

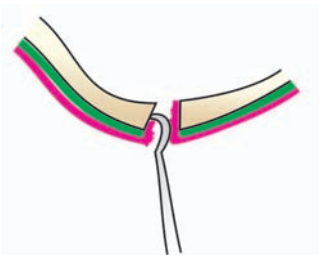
In this technique a pedicle flap is used. The palatal flap is pedicled on the greater palatine vessel.





The flap size is predetermined taking care to estimate the loss in length while turning.

A "V" shaped section of the tissue on the lateral side of the flap is excised, this will prevent folding and wrinkling when the flap is turned. Once the incision is made the mucoperiosteal flap is raised.



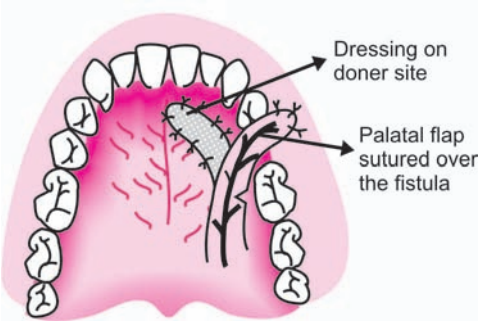
The epithelial lining of the fistulous tract is carefully removed and the edges freshened.

The flap is then turned and tucked under the undermined edge of the buccal flap, thus allowing two fresh bleeding surface to be in contact.

The sutures are placed.

The donor area is packed with gauze or any other surgical dressing.

All the postsurgical precautions should be followed carefully.



DIFFERENCE BETWEEN OAF AND ACCIDENTAL OPENING

Oroantral fistula

1. This tract between the antrum and oral cavity is lined by unhealthy granulation tissue.

Oroantral communication

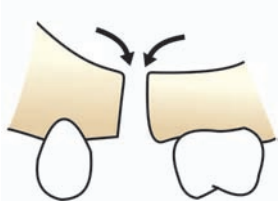
This is a fresh opening not lined by epithelium.

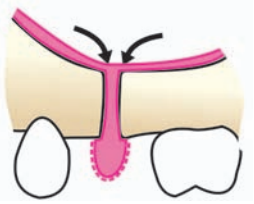
2. There is no fresh bleeding.

There is bleeding.

3. On pinching the nose and blowing. There is no blood bubble formed.

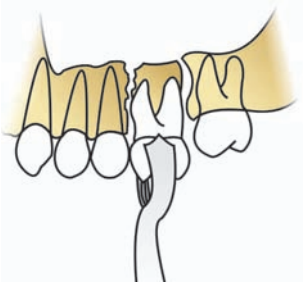
On pinching the nose and blowing gently the blood in the socket bubbles.





4. Untreated oroantral communication leads to oroantral fistula.

During removal of a tooth it is accidentally created.



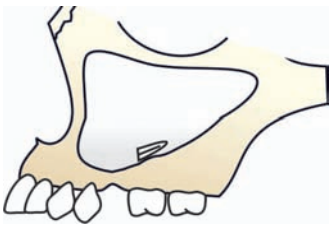
5. More than 72 hours oroantral communication is considered as oroantral fistula.

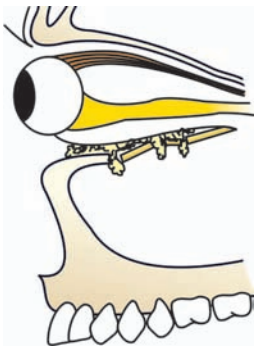
Fracture of the antral floor and tear of the sinus lining leads to oroantral communication.

CALDWELL-LUC OPERATION

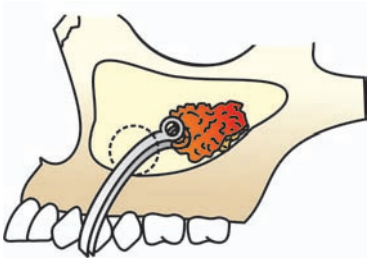
Indications

- Removal of teeth/root fragments from the sinus.

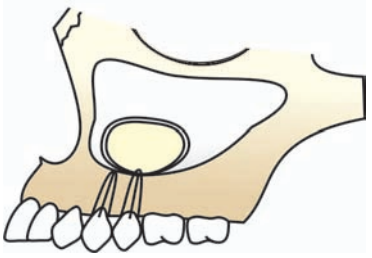




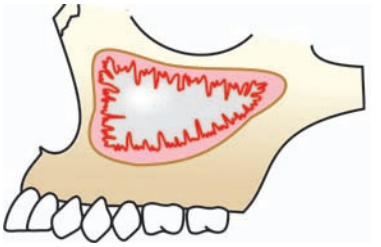
- Truma of the maxilla when the walls are crushed or floor of orbit fractured leading to herniation of fat (antral pack).



- For taking antral biopsies.



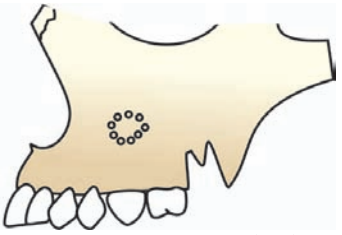
- For removing cysts and other small pathologies of the maxillary sinus.



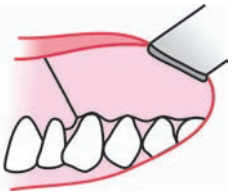
- For treating chronic maxillary sinusitis.
- For management of hematomas of antrum.

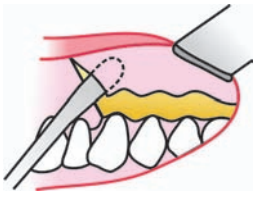
Surgical Technique

In this technique a window is made on the antral wall in the canine fossa region, just above the roots of the premolars.



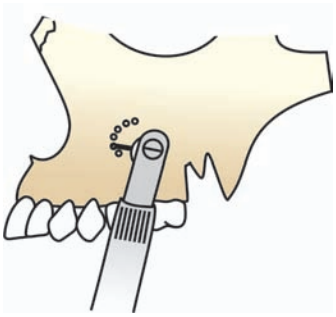
Incisions are made through the mucoperiosteum and the flap elevated.

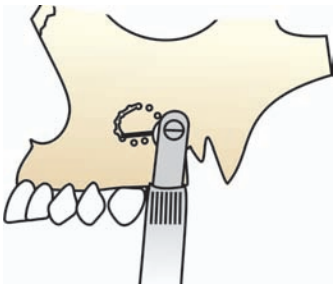




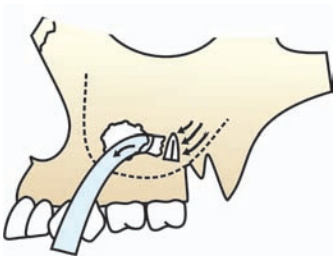
The flap should extend from the canine to the molar region and should be elevated up to the infraorbital foramen.

An opening is made into the facial wall of the antrum above the bicuspids, this can be done making bur holes around the area of bone to be removed, and then joining them together. Thus, creating the required sized fenestration.

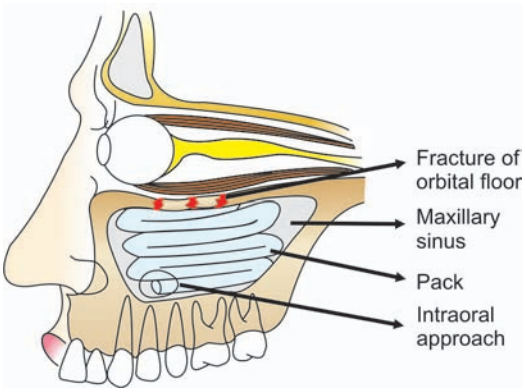




Chisel or gouge can also be used for this purpose. The size of the opening can be enlarged using roungers.



After this is achieved, the root/tooth can be removed with the help of a strong suction or a forcep.



If biopsy specimen is to be taken it is done through this opening. Similarly, antral packing in cases of orbital blow-out fractures, or for the purpose of hemostasis can be done through this approach.

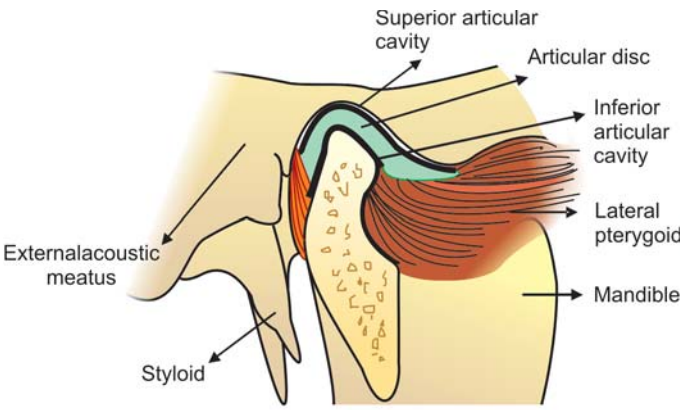
Once the desired purpose is achieved the mucoperiosteal flap is replaced and sutured. The sutures are kept for 5 to 7 days, nasal decongestants are prescribed.

Chapter

14 Temporomandibular Joint

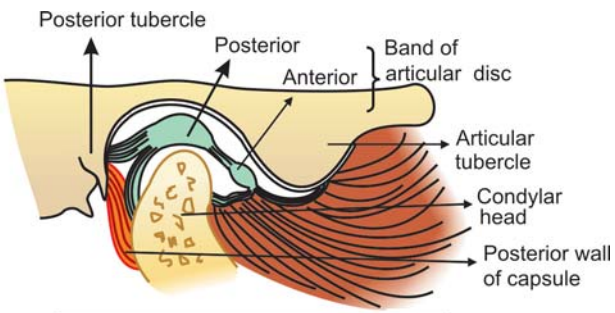
ANATOMY

It is a *synovial joint*. The upper articular surface is formed of the articular eminence and mandibular fossa. The head of the condyle forms the inferior articular surface.

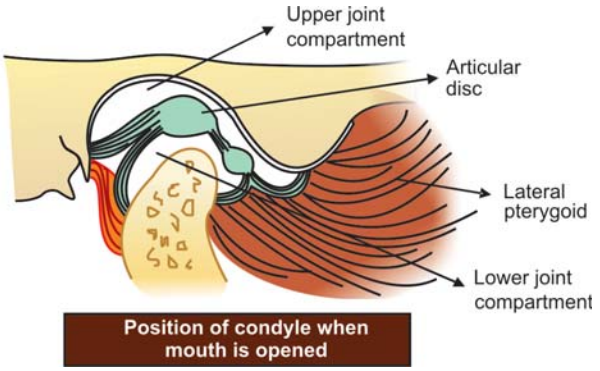


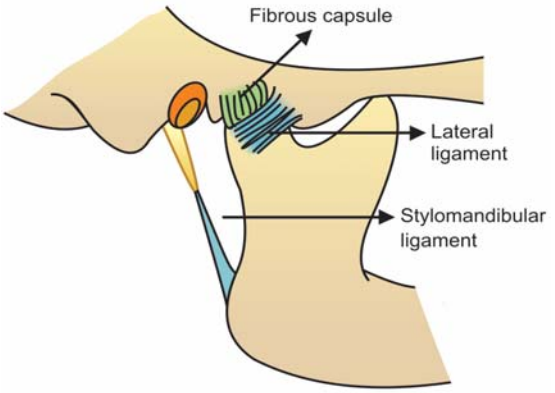
The joint cavity is divided into the upper and lower compartment by an intra-articular disc. The upper compartment allows for gliding movements, the lower has rotatory as well as gliding movements.

The articular disk has a concavo-convex superior surface and a concave inferior surface. It is composed of an anterior extension, anterior thick band, intermediate zone, posterior thick band and bilamellar region. The periphery of the disc is attached to the fibrous capsule.



Condyle in glenoid fossa when mouth is closed





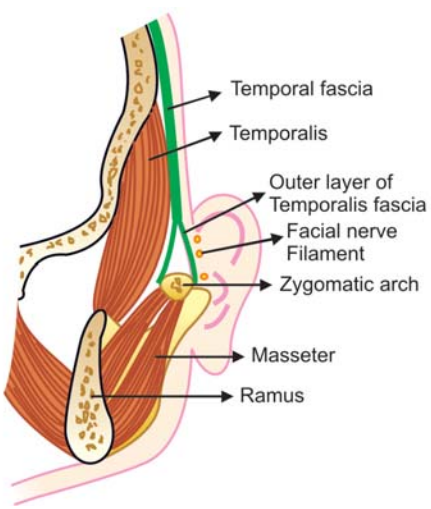
The fibrous capsule is attached above to the articular tubercle, the circumference of the mandibular fossa and the squamotympanic fissure and below to the neck of the condyle.

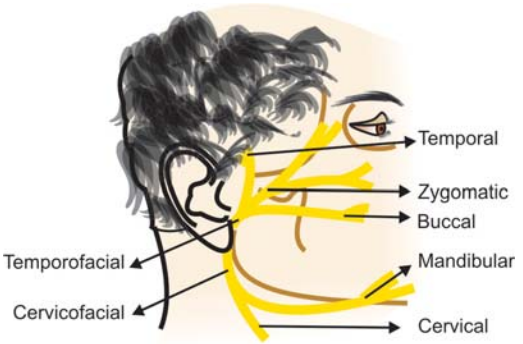
It is reinforced by the lateral ligament. Stylomandibular ligament runs from the styloid process to the medial side of the mandible.

APPLIED ANATOMY

It is the presence of the facial nerve and its branches, that compromise the surgical access to the TMJ.

The temporal fascia divides into two layers, approx. 2 cm above the malar arch, the outer of these layers is attached to the lateral aspect of the malar bone. The inner layer is attached to the medial aspect of the malar arch. Thus forming a pocket which contains the zygomatic branch of the superficial temporal artery and the zygomatico temporal branch of the maxillary nerve. The outer layer of the temporalis fascia blends with the periosteum of the arch as well as the overlying superficial fascia. The temporal and zygomatic branches of the facial nerve, as they cross the malar bone, are embedded in this thick fascia and therefore it is easier to elevate the periosteum of the malar arch.



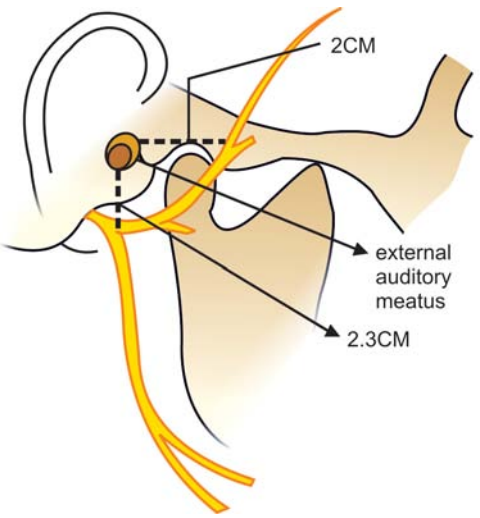


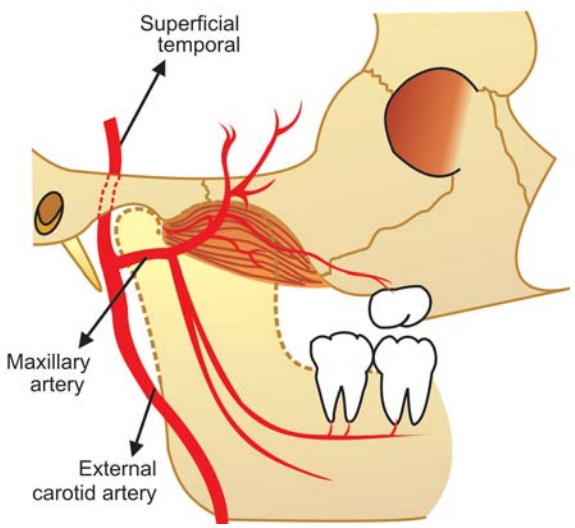
The facial nerve divides into the temporofacial and cervicofacial branches, vertically below the lowest part of the bony external auditory meatus at a distance of approximately 2.3 cm.

The two divisions move in the parotid gland, then divide into five branches—temporal, zygomatic, buccal, mandibular and cervical.

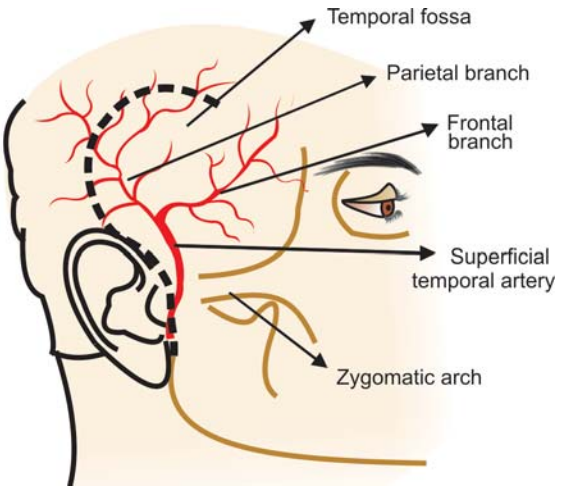
The facial nerve divides into temporofacial and cervicofacial division at a point vertically below the lowest part of the bony external auditory meatus is approximately 2.3 cm.

The temporal branch measures approx. 2 cm from the anterior concavity of the bony external auditory canal to the zygomatic arch.





The maxillary artery lies close to and beneath the condylar neck. Therefore, it should be protected by using sub-periosteal guard before cutting the condylar neck.



The superficial temporal artery is the terminal branch of the external carotid artery which runs with the corresponding vein, posterior to the neck of the condyle and ascends to cross the posterior part of the zygomatic process to the temporal fossa and divides into frontal and parietal branches. Flap should be raised close to the cartilaginous external auditory meatus to avoid damage to these vessels.

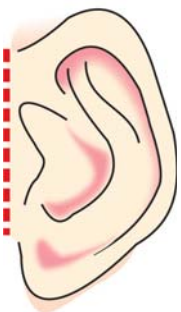
SURGICAL APPROACH

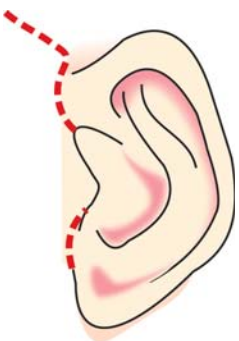
Common methods of approach of TMJ are:

1. Pre-auricular
2. Submandibular
3. Post-auricular
4. Intra-oral

Pre-auricalar Incision

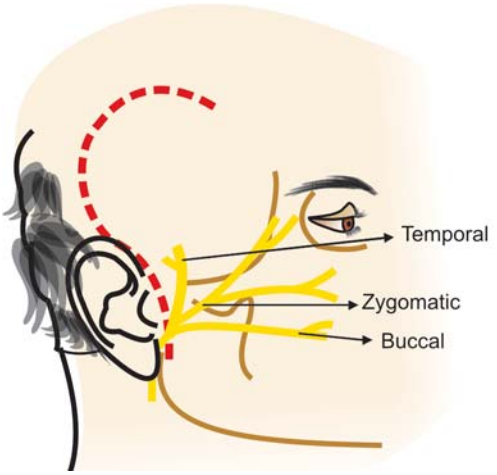
In patients who require limited access, a vertical incision is given.





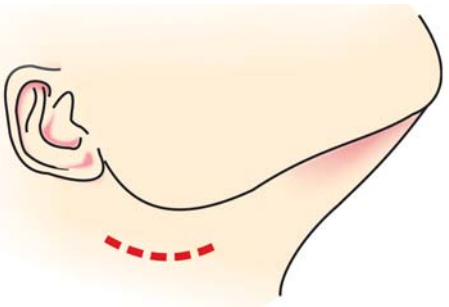
Rowe's temporal extension is an incision line that starts from the superior end of the pre-auricular incision and runs upwards and forwards within the hair line.

Al Kayat and Bramley's modification is an incision line that starts within the hair line, about a pinna's length above the ear, and curves backwards and downwards behind the main branch of the temporal vessels to the uppermost skin attachment of the pinna, then runs anteriorly to the ear lobe attachment.



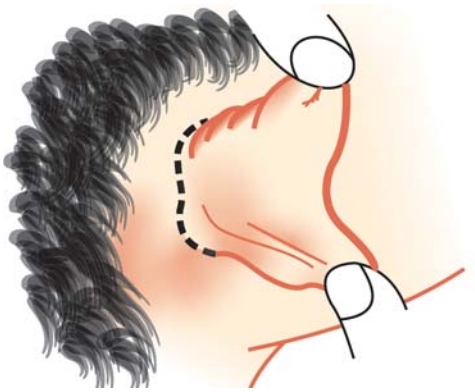
Submandibular Incision

In patients requiring greater exposure to the surgical site, access through the pre-aurical approach alone is not sufficient and an additional or an alternative approach from below is required. The skin incision is placed at least 2cm below the mandibular branch of the facial nerve. A neck skin crease is selected. The incision is made through skin, fat, platysma and the outer layer of deep cervical fascia.



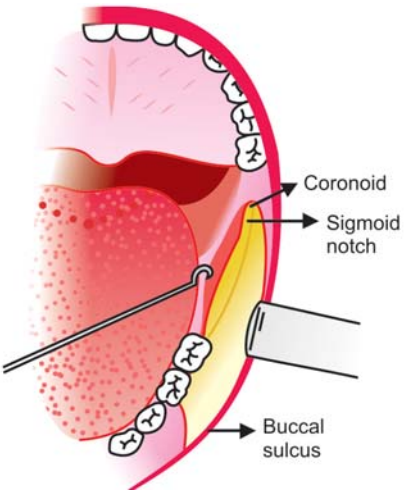
Postauricular Incision

The incision follows the line of the auricular flexure, about 3-4mm posterior to it. The advantages of this incision are—better exposure, better access even anterior to the joint, and better aesthetic results.



Intraoral Incision

This approach is good for oblique sub-condylar osteotomy or in hyperplastic lesions of the condyle. A long, vertical incision from the tip of the coronoid process to the depth of the buccal sulcus is made, stripping muscle and tendon on the buccal surface to expose the sigmoid notch and condylar neck.



TEMPOROMANDIBULAR JOINT DISORDER

Dislocation

Dislocation of the condyle is a condition in which the condyle moves out beyond the articular eminence.

Anterior mandibular dislocation are:

i. Acute dislocation that is usually seen to occur post trauma or it may be spontaneous or may be associated with psychiatric illness and drug therapy.
ii. Chronic recurrent or habitual dislocation is seen to occur in patients whose ligament and capsule become flaccid with an associated flattening of articular eminence or sustained trauma.

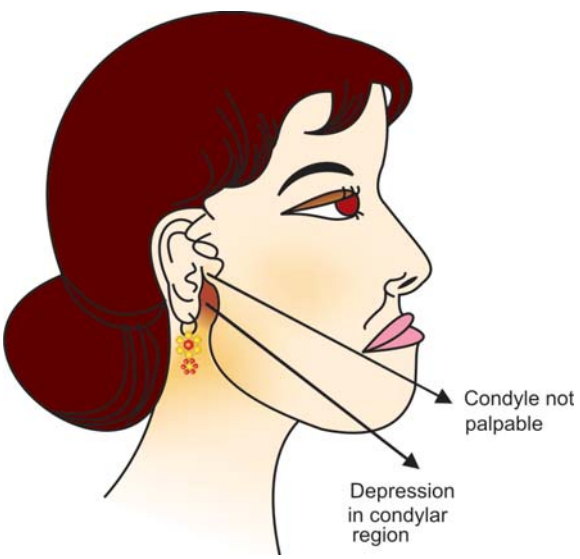
In such patients, regular mandibular movements like yawning, vomiting, laughing may cause dislocation. This chronic or recurrent dislocation occurs when there are repeated dislocations of the condyle.

Clinical Features

Dislocation may be unilateral or bilateral.

In Unilateral Dislocation-

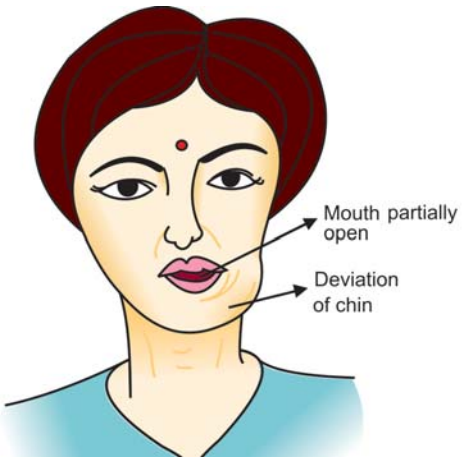
- There is deviation of chin to the contralateral side.
- The mouth is partly open.
- The affected mandibular condyle is impalpable.
- Absence of condyle in the form of a definite depression is seen and felt immediately anterior to the tragus.
- Swallowing and speaking may be difficult.



- Profuse drooling in early stage of dislocation.

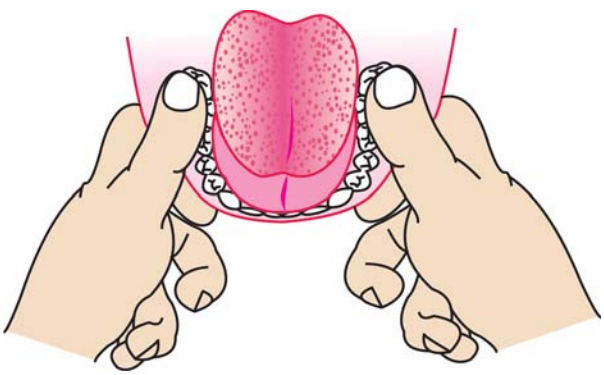
In Bilateral Dislocation:

- The chin is in midline.
- Mouth is wide open.
- Limited mandibular movements.

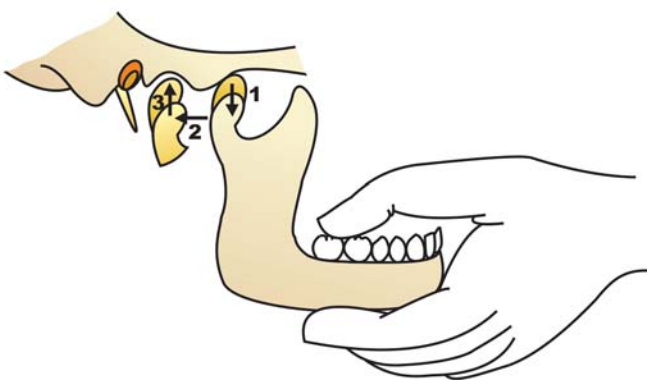


Treatment of Acute Dislocation

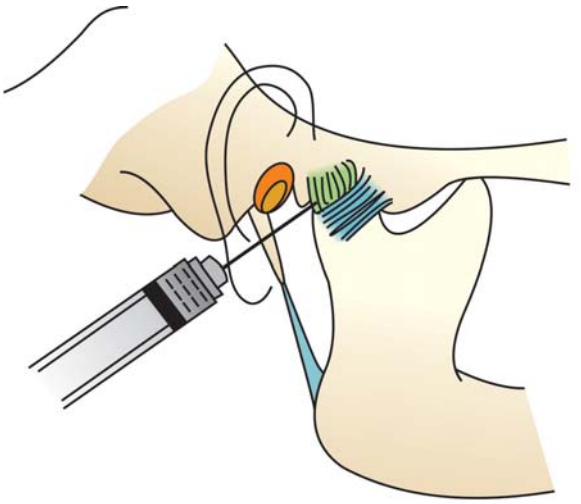
It should be reduced as soon as possible. This can be done by placing the thumbs on the posterior molar teeth and holding the mandible by the index finger of both the hands, then downward pressure is applied on the posterior teeth and upward pressure on the chin, accompanied by posterior displacement of the mandible.



Usually reduction is achieved, unless there is muscular spasm. If this happens then anesthesia and/sedation may be required. After reduction is achieved, the patient is asked to restrict mandibular movements for 2 to 4 weeks. The patient can be advised to do hot moist fomentation of the joint area accompanied with NSAID drugs.



Treatment of Chronic Dislocation



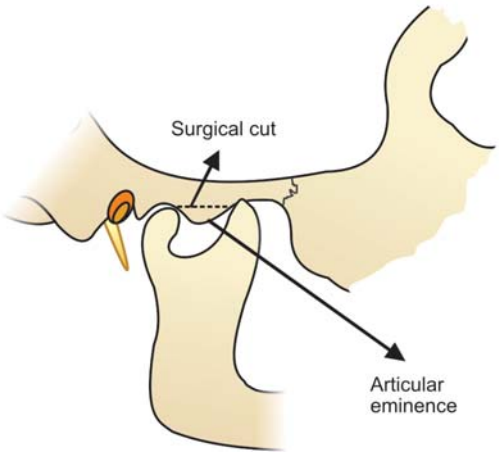
Patients suffering from chronic dislocation can be treated by giving: **Sclerosant solutions** like alcohol, tincture of iodine, etc. These extra-articular sclerosant solutions produce some fibrosis. These are injected into the capsule.

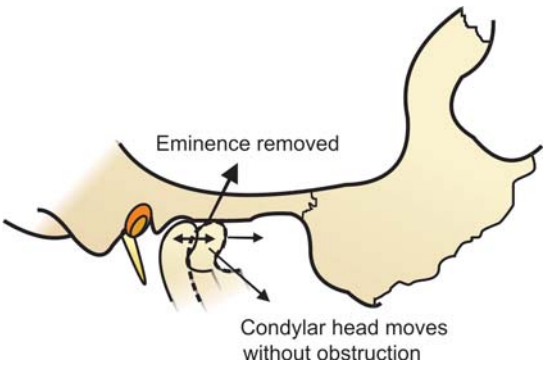
Thus, as there is tightening of the capsule, dislocation is prevented but the effect is short lived.

Some surgical techniques are also used for reducing chronic dislocation.

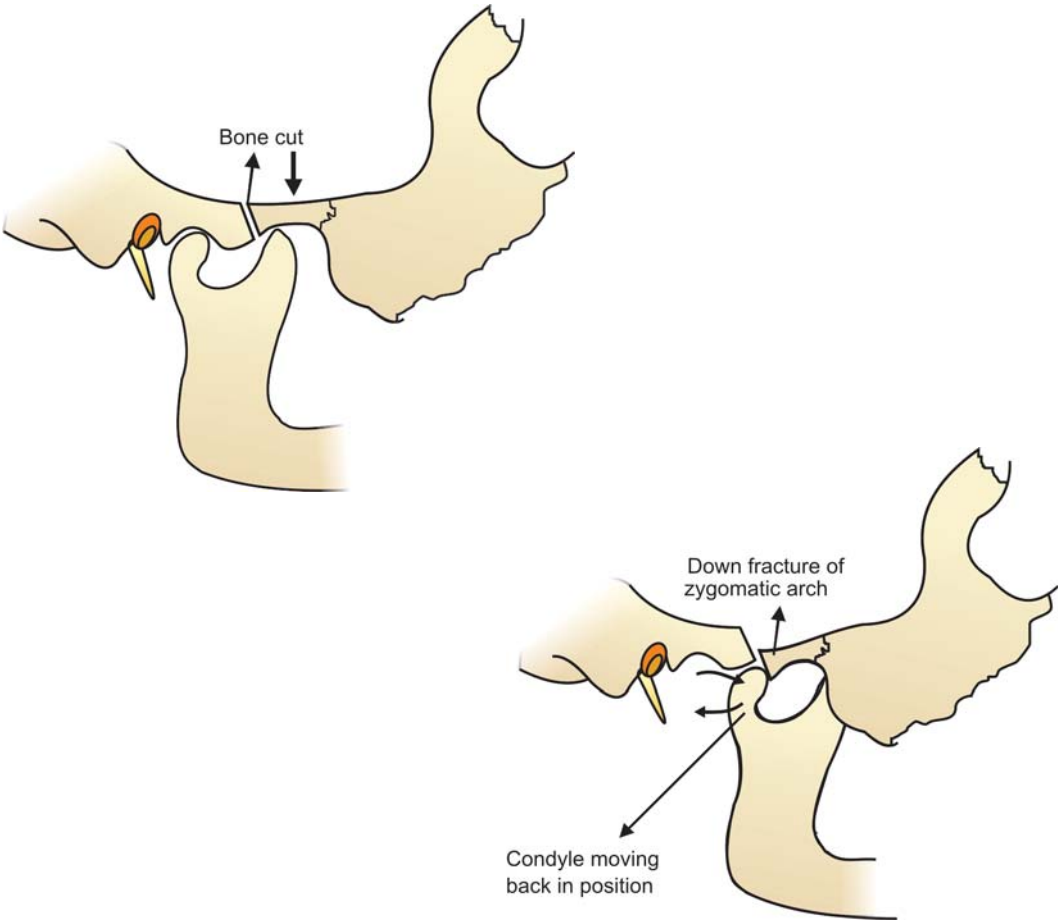
i. *Eminectomy:* In this surgical technique the articular eminence is surgically removed, so that the condyle once moved forward comes back into its fossa without getting obstructed by the eminence.

In this procedure preaurical incision is given to reach the joint space. The articular eminence is then excised using burs and osteotoms.





ii. *Dautrey procedure:* In this surgical technique, the preauricular incision approach is used, the anterior part of the articular eminence is cut in a vertical direction. The anterior part, which is continous with the zygomatic arch, is down fractured, so that the fractured end is wedged against the eminence thus augmenting it. The condyle is unable to dislocate, as now there is an increase in the height of the eminence.



Other methods like bone graft augmentation are also used.

TMJ ANKYLOSIS

Ankylosis means 'stiff joint' in Greek.

Definition

Union of two articulating surfaces of temporomandibular joint with fibrous or bone tissue leading to immobility or decreased mobility.

Classification

1. False or true ankylosis

False ankylosis

True ankylosis

2. Extra- articular or Intra- articular

Extra articular

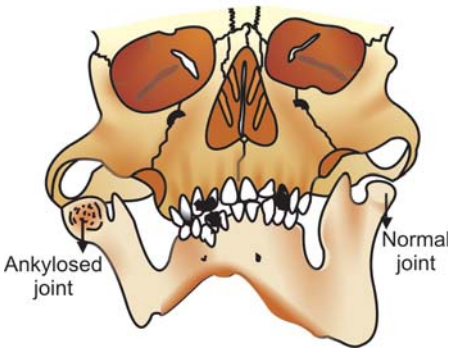
Intra articular

3. Fibrous or bony

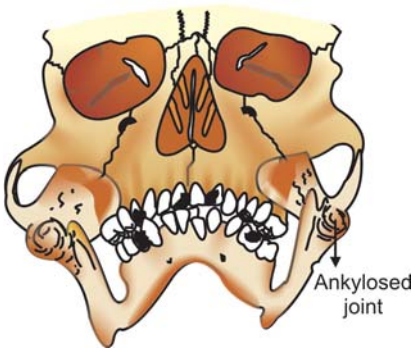
Fibrous ankylosis

Bony ankylosis

4. Unilateral or bilateral

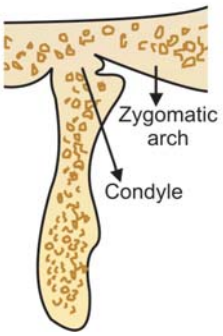


Unilateral ankylosis

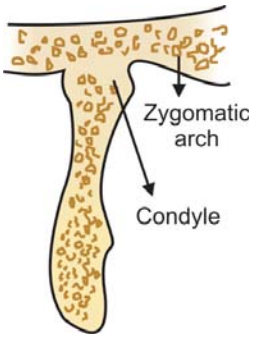


Bilateral ankylosis

5. Partial or complete



Partial ankylosis

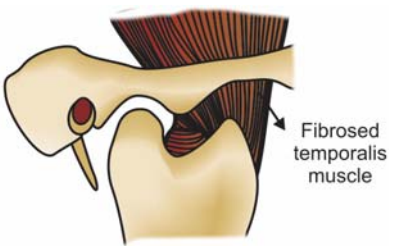


Complete ankylosis

False Ankylosis

It is one in which there is restricted mandibular movements due to extra-articular fibrosis, pathologic conditions or mechanical obstruction.

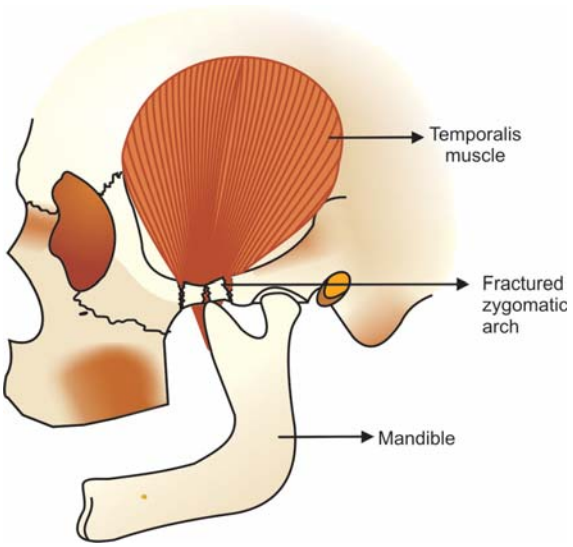
Miller et al classified it into six groups.



1. *Myogenic:* It is the condition when the restriction in the movement of the joint is due to the muscles of mastication that have fibrosed due to the organization of an intramuscular haematoma.

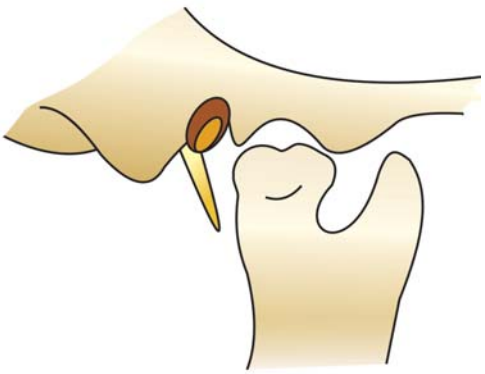
2. *Neurogenic:* This group includes central nervous system lesions or cerebrovascular accidents, because of which the patient is unable to do masticatory activity.

3. *Psychogenic:* It refers to hysterical trismus.



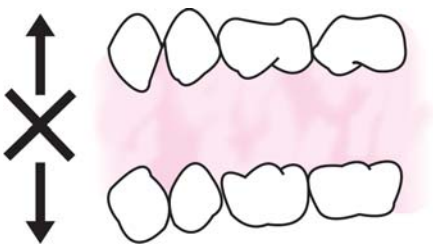
4. *Bone impingement:* This is seen in untreated fracture of zygomatic complex, exostosis of the coronoid process.

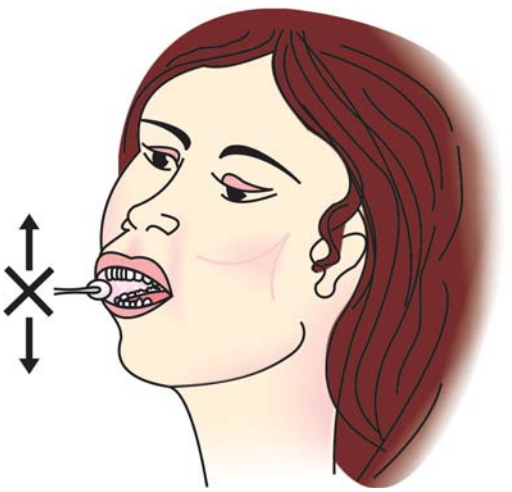
5. *Fibrous scar tissue:* This is formed in any tissue due to trauma, as is seen in burn cases.



6. *Tumors:* This interferes with condylar movements.

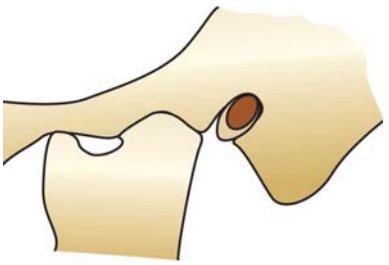
6. *Submucous fibrosis:* Patients, specially in the Indian subcontinent, due to their betel nut chewing habit, develop submucous fibrosis. These are tough fibrous bands in the submucosa of the oral cavity, that restrict the opening of the mouth.



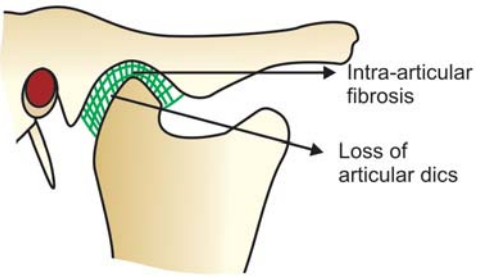


True Ankylosis

It is one in which there is restriction of mandibular movements due to some intra-articular causes. That is there is a union of the articulating surfaces of the joint by fibrosis, fibro-osseous, osseous or osteocartilage.



Bony ankylosis



Etiology

1. Trauma
   i. Hemarthrosis, condylar fractures, glenoid fossa fractures are seen in motor vehicle accidents, falls, fights, gunshot wound etc.
   ii. Caused at birth, i.e. forcep delivery. This situation is decreasing as better facilities and skills are available for difficult child birth.
2. Repeated infections around temporomandibular joint
   i. Parotitis (infection of the parotid gland)
   ii. Otitis media (infection of the middle ear)
   iii. Tonsillitis (infection of the tonsils)
   iv. Osteomyelitis of the jaw
   v. Abscess around the joint as in suppurative arthritis
   vi. Actinomyosis.
3. Systemic arthropathy
   i. Psoriatic arthritis patients given multiple injections of intra-articular hydrocortisone
   ii. Rheumatoid arthritis
   iii. Ankylosing spondylitis.
4. Others
   i. Irradiation therapy
   ii. Scleroderma
   iii. Osteochondroma
   iv. Post surgery
   v. Idiopathic.

Extra-articular Fibrosis

Extra-articular fibrosis is inability to open the mouth caused by chronic cervico-facial sepsis, irradiation therapy, burns or penetrating wounds. A depressed and malunited fracture of the zygomatico-maxillary complex may block normal mouth opening. Elongation of the styloid process has been reported to cause trismus.

Clinical Features

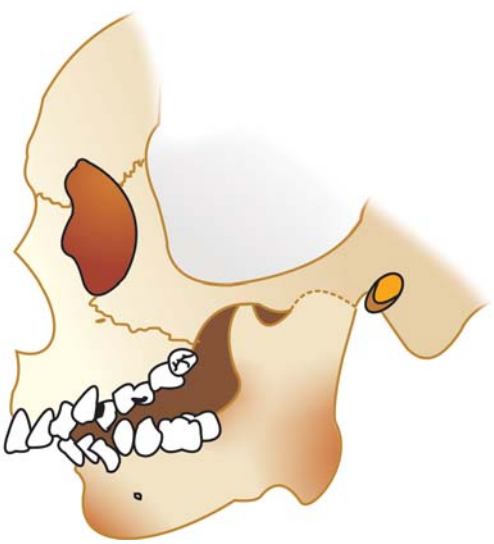
They vary according to the:
- Time of onset of ankylosis
- Unilateral or Bilateral
- Severity of ankylosis
- Duration.

Time of Ankylosis

The time of ankylosis is very important as the clinical features as well as treatment planning is different for the patients in whom ankylosis takes place after the growth of the patient or in those whom growth is not complete.

Before Completion of Growth

Destruction of the condyle and absence of proper function produces
- Typical 'bird facies'
- Micrognathia
- Dental caries
- Restricted somatic growth
- Malocclusion
- Periodontal diseases
- Psychological trauma
- Restricted diet
- Antigonial notching and angular exostoses as a result of bone apposition beneath the pterygo-massetric sling.



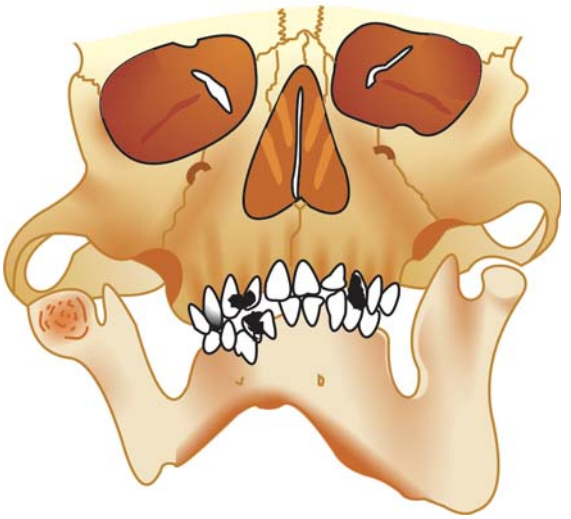
Ankylosis after Growth Completion

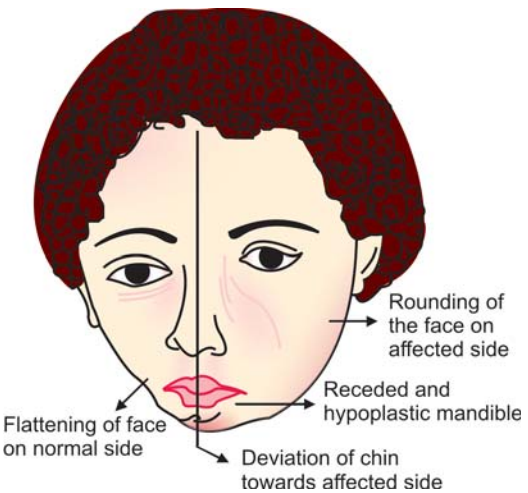
The patient has a restricted mouth opening that may in a long time cause
- Dental caries
- Periodontal problems due to lack of hygiene
- Restricted diet.

There is a lot of variation in the clinical features of a unilateral and a bilateral ankylosis patient.

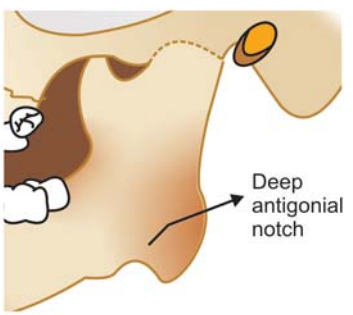
Unilateral Ankylosis

1. The patient has an obvious facial asymmetry.
2. There is a deviation of the mandible and the chin to the affected side.
3. The chin on the affected side is receded with hypoplastic mandible.





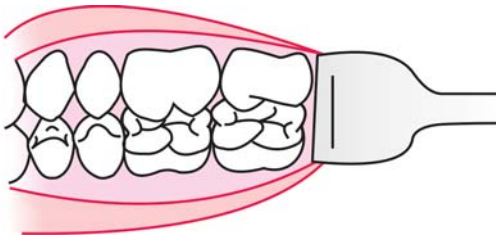
4. The face of the patient on the affected side is rounded.
5. The face appears flattened and elongated on the unaffected side.



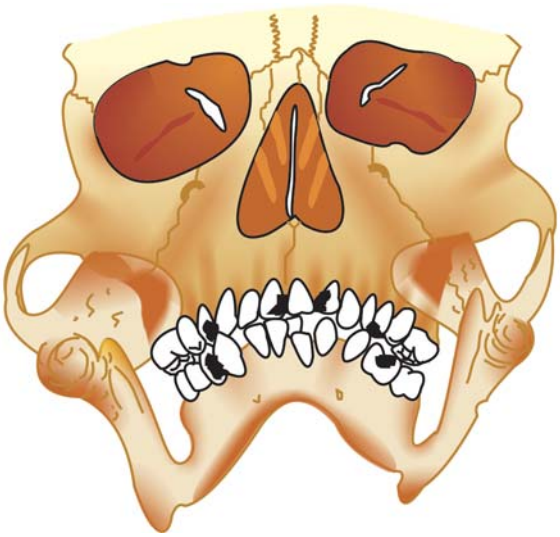
6. The antigonial notch on the affected side of the mandible is well defined and concave.

7. Condylar movements are absent on the affected side.

8. In unilateral ankylosis some amount of oral opening may be possible. Interincisal opening will vary depending on whether it is fibrous or bony ankylosis.

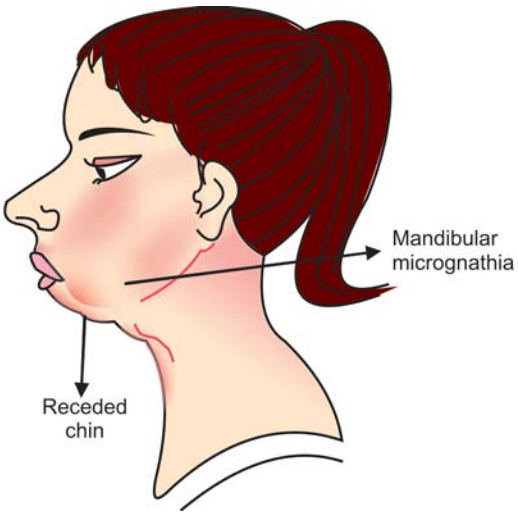


9. Dentition may show cross bite.
10. Class II Angles malocclusion on the affected side with unilateral posterior cross bite on the ipsilateral side is seen.



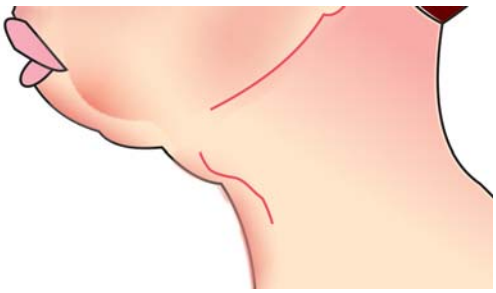
Bilateral Ankylosis

1. The mandible is symmetrical but micrognathic.

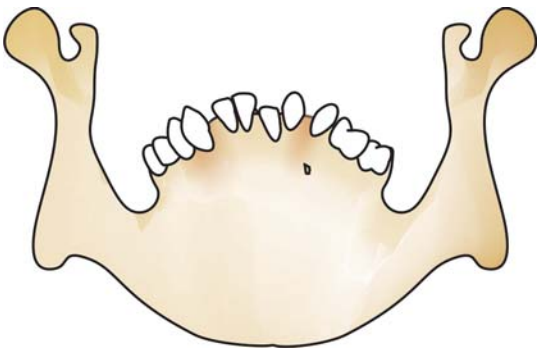


2. The patient develops a typical bird face deformity with receded chin.

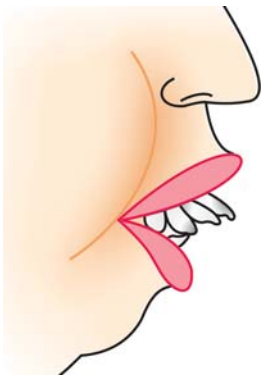
3. Inability to open the mouth.



4. The neck chin angle is greatly reduced. The defect can be so grievous that sometimes the neck chin angle is absent.



5. Antigonial notch is well defined bilaterally.

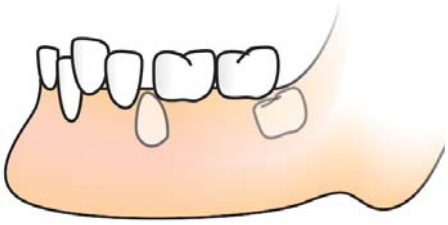


6. Upper incisors are often protrusive with anterior open bite. Maxilla may be narrow.

7. Multiple carious teeth with bad periodontal health can be seen.

8. Severe malocclusion.

9. Crowding with many impacted teeth is seen on a radiograph.



Radiographs

i. OPG.
ii. Submentovertex view
iii. PA view mandible
iv. Transcranial view
v. CT scan.

Treatment of Temporomandibular Joint

Surgery is the only form of treatment for a patient of ankylosis.

- The aims of surgery are to remove the ankylosed mass and create a gap so that mobility of the joint is restored.
- Care has to be taken to prevent re-ankylosis.
- To try to restore the height of the ramus that was lost due to ankylosis.
- If the patient is young, costochondral grafts can be placed to encourage the growth of mandible.
- And most of all to help the patient, to have a chance to live a normal life.

Different Surgical Procedures

i. Condylectomy
ii. Gap Arthroplasty

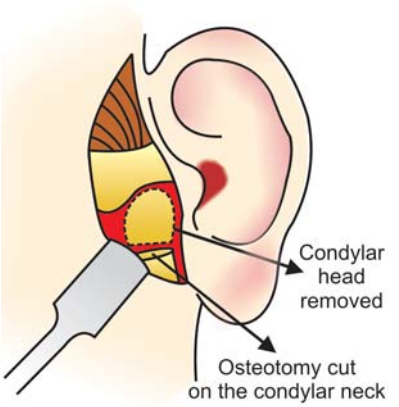
iii. Interpositional Arthroplasty includes:
   a. Autogenous grafts, e.g. Temporalis muscle and fascia, conchal cartilage, full thickness skin graft, etc.
   b. Alloplastic material, e.g. Silicon, tantalum plate, etc.

iv. Interpositional Arthroplasty to allow the growth to continue, e.g. Costochondral graft.

Any suitable incision of the surgeon's choice can be used for these surgeries.

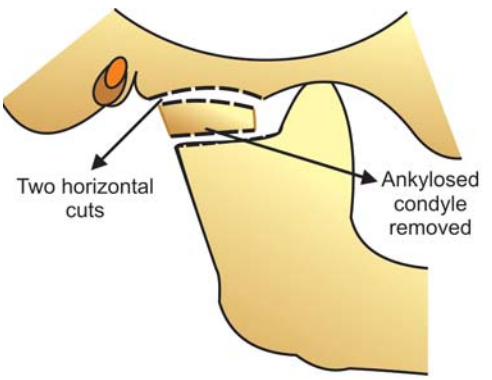
Condylectomy

This is a procedure, in which the condylar head of a fibrosed joint is removed. The condyle can be approached through a preauricular incision. Or as Ward described, a closed procedure can be used, in which the surgery is done through two preauricular stab wounds and the condyle cut by the Gigli's saw as a blind procedure. Once the neck of the condyle is cut, the cut condylar head is removed, pressure pack is given, IMF is done for a few days followed by active mouth opening exercise. Care should be taken to avoid injury to the maxillary artery, as it lies just below the neck of the condyle.



Gap Arthroplasty

Abbe was the first to describe this procedure in preference to a condylectomy. In this surgical technique, a gap of minimum 2 cm is made where the TM Joint should have been present. As these are patients of bony ankylosis, it is very important to make two horizontal osseous cuts in such a way that the gap is equal on the mesial as well as the distal ends of the cut joint. This procedure is very often accompanied with unilateral or bilateral coronoidectomy, i.e. excising the coronoid. Whenever this procedure is carried out, care has to be taken to do vigorous physiotherapy for at least 1 yr. postoperatively. Though this procedure is simple and requires a short operating time, it is not the best option. There is a great chance of re-ankylosis after the surgery. Very often the patient is a young child and is not co-operative for the physiotherapy, which is extremely painful.



Interpositional Arthroplasty

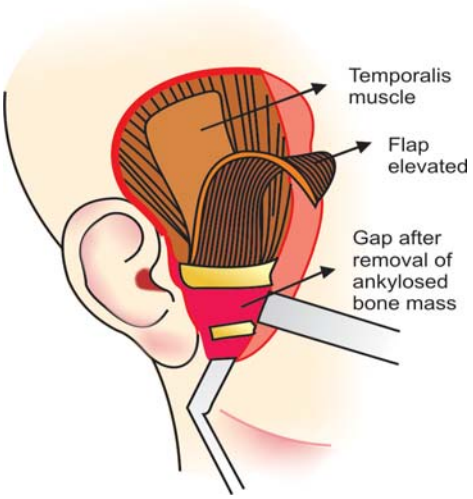
To prevent re-ankylosis, interposition of alloplastic or autogenous graft is placed between the cut ends of the joint.

Temporalis Muscle and Fascia

An Al Kayat and Bramley's pre-auricular incision is given.

The tissue overlying the Temporalis fascia and the TM Joint are retracted.

The joint is identified and two osteotomy cuts are made on the ankylosed joint, then the cut bone is removed, making a gap.



A flap consisting of split thickness of the temporalis muscle along with the overlying fascia is elevated.

It is then turned over the arch and sutured, thus the temporalis muscle and fascia is brought to interpose and prevent the re-ankylosis.

The soft tissue wound is closed in layers.

Full Thickness Skin Graft

Full thickness skin graft is raised from the helix along the retro auricular groove and attached to the lateral aspect of the joint. It is then sutured to the stump of the mandible with the epidermal side facing the skull.

Alloplastic Materials

These materials are generally used in patients whom autogenous grafts are contraindicated, e.g. patients with systemic diseases or those on long term steroid use.

The advantages of using alloplastic material are that there is no donor site morbidity, and there is no risk of foreign body reaction.

Ideally the materials used should be:

- Biologically and chemically inert.
- Noncarcinogenic.
- Adaptable to molding at the site of surgery.
- They should be anchored into position easily.
- They should have sufficient strength and rigidity.
- Sterilizing them should not be difficult.

Some materials that are available are:

- Silicon
- Oxycel
- Teflon sheets, etc.

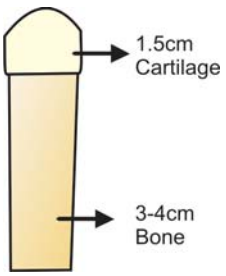
Once the gap arthroplasty has been accomplished, the alloplastic material is moulded to the right size and secured into position before closure of the surgical site.

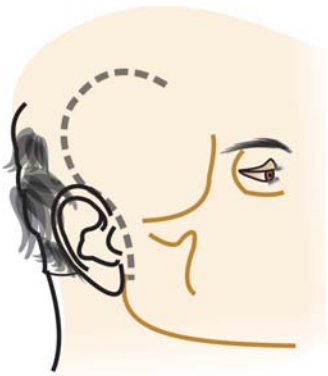
Joint Reconstruction

Young children with TMJ Ankylosis growth develop mandibular micrognathia. This is because, the growth center that is present in the condyle is lost. To overcome this problem, the joint is reconstructed in a way that there is replacement of the growth center with another center. Also there is restoration of balanced mandibular function. For this purpose, a costochondral graft is harvested.

Costochondral Graft

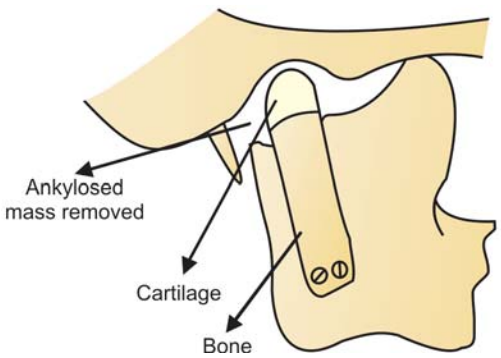
This is harvested from the 5th, 6th or the 7th rib. The harvested portion should at least contain 3-4 cm of bone and 1.5 cm of cartilage. Perichondrium and periosteum at the bone-cartilage junction is carefully preserved.

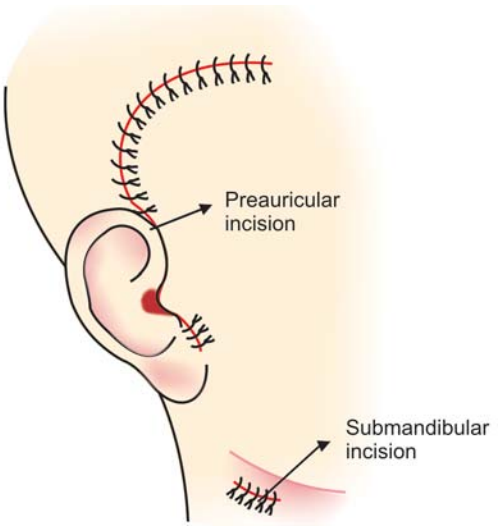




A pre-auricular incision is made. The ankylosed mass is removed and the mandible is checked for mobility. Care has to be taken that there is no obstruction in the mandibular movements. Then in unilateral cases, the mandible is swung anteriorly and laterally until it correlates with the midline. In bilateral cases, the mandible is advanced until a symmetric face and harmonious profile is achieved.

The costochondral graft is then inserted. For doing this, the submandibular incision is made. The graft is fixed using mini-screws or wires. Intermaxillary fixation is maintained for 3-4 weeks. Post-operative exercise is to be done routinely.





MYOFUNCTIONAL PAIN DYSFUNCTION SYNDROME (MPDS)

This condition has been referred to as:

- Temporomandibular joint arthrosis, Facial arthromyalgia, Temporomandibular joint dysarthrosis.
- Some authors have recognized it as a definite condition and others have waved it away as a waste paper basket syndrome stating that it has no definite physical entity but is only psychological.

Etiology

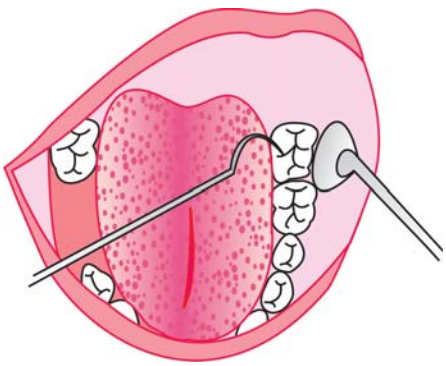
The onus of MPDS could lie either on psychological factors or occlusal derangement or both.

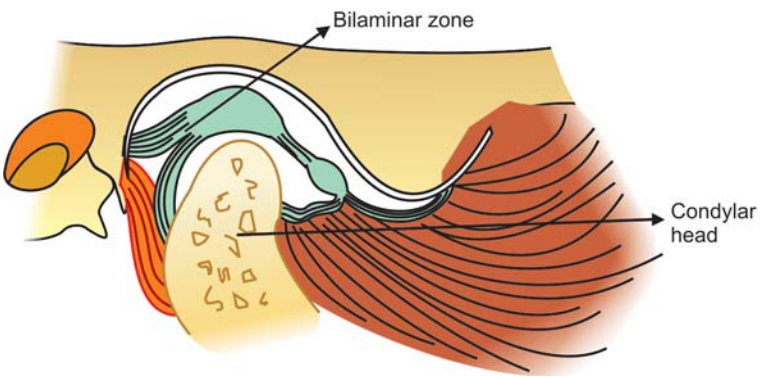
Psychological Factors

Emotional stress can contribute to increased stress on the masticatory muscles that in turn causes muscle fatigue. As the mental tension increases, the patients develop stress relieving habits like teeth clenching, bruxism, jaw thrusting, etc. followed by sleep disturbance—all of which could lead to an aggravation of the problem.

Occlusal Factors

The occlusion of these patients should be observed with great care. Generally, these patients develop TMJ pain after having lost some teeth that can lead to the over-closure of the mandible. Or there could be replacement of missing teeth with a faulty denture or prosthesis, that again would cause stress on to the TMJ.





Loss of vertical dimensions or deep bite causes the shift of the condyles posteriorly, impenging on the sensitive bilaminar zone causing constant pain.

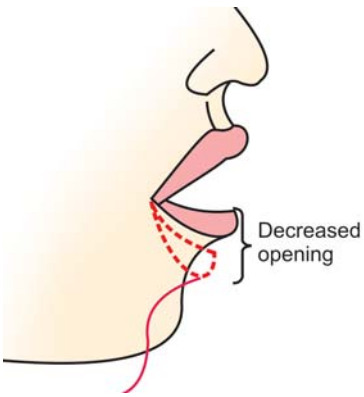
Clinical Features

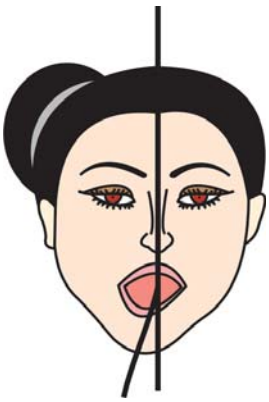
Patients exhibit various symptoms like, a patient may complain of only pain or another may have various symptoms that are:

1. *Pain:* All the patients of MPDS complain of pain, that is of a dull aching type, which may be limited to the joint or may be radiating to head, neck and shoulder.

There is generally a zone of reference, and the trigger point of this pain is in the muscles. The trigger point exists as a localized tender area that is present in the skeletal muscles. On palpation of this point, there is reference of pain in a characteristic pattern to a distant group of muscles that gives rise to a positive 'jump sign'.

2. *Movements of the mandible are limited:* As there is pain in the joint area, the patient is generally careful not to move the mandible.





3. *Abnormal muscle activity:* These patients because of the change in their chewing habits, develop abnormal muscle activity. These changes could have been caused by loss of teeth or a bad fitting prosthesis. Due to pain there is generally a shift of the mandible on the affected side.

4. *Joint noises:* Clicking, grating, snapping sounds are common and usually bilateral, which can occur at any point of the jaw movement and there may be multiple clicks. Recent studies indicate that clicking may be due to intra-articular thickening. These sounds frequently occur without pain.
5. *Locking:* It is an interruption of movements associated with clicking. Locking of jaw may occur at regular times of the day, the most common being on awakening.
6. *Emotional factors:* Emotional problems are concerned with situations of uncertainty, which involve secretion of catecholamines.

Diagnosis

As this condition does not have a definite clinical entity, it is very important to take a detailed history of the patient. The history should assess the mental and physical condition of the patient.

Some of the relevant questions asked should cover the mental state of the patient including a change in job, work satisfaction, family problems etc. It should also cover history of trauma, any prolonged dental treatment, extractions, prosthesis etc.

The history should also cover the onset, direction, frequency and quality of pain, the site and reference area of pain.

Physical Examination

Physical examination should then be carried out. It should cover the articular, muscular, dental as well as cervical state of the patient.

- *Palpation* of the joint should be followed by observing the complete range of motions of the mandible. With great care, the condylar movements can be assessed, while the patient opens and closes his/her mouth. The areas of tenderness should be noted.

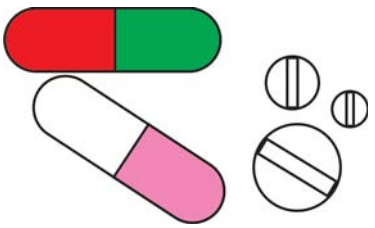
- *TMJ sounds* should be heard carefully, stethoscope can be used, the sound is to be observed whether it is heard early, intermediate or late while TMJ is opened wide.

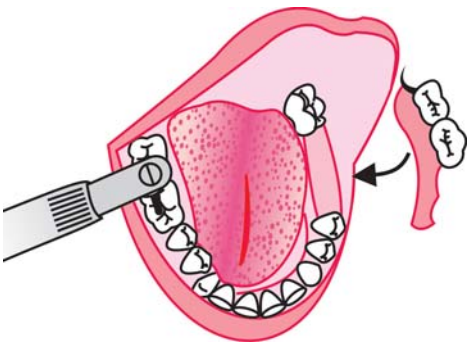
Treatment

The treatment of MPDS varies from giving comfort to the patient to giving intra-articular injection.

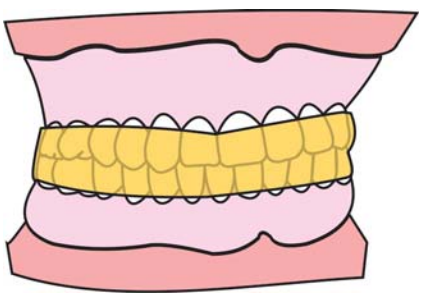
After the patient has been carefully examined, it is the decision of the surgeon whether the patient should be treated for psychological or pathological problem.

- *Reassurance:* The patient should feel comfortable and reassured. They should be able to talk freely regarding any personal/family problem.
- *Placebo:* It can be given in the form of mock adjustment of prosthesis or teeth can be done.
- *Medication:* It can be given in the form of NSAIDs, anxiolytics, muscle relaxants, and antidepressants.



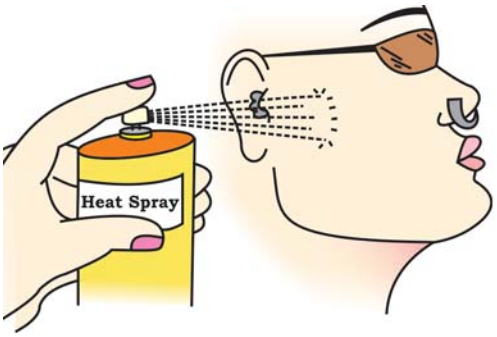


- *Occlusion:* Any missing teeth should be replaced. Any ill-fitting dentures should be readjusted and the occlusion corrected.



- *Acrylic splints:* These splints can be used in the form of night-guard. As a splint inactivates, facial muscles establish a balanced occlusal plane.

- *Hot moist/dry fomentation:* Fomentation of the TMJ area as well as the muscles of mastication should be done. It relieves pain by decreasing muscle tension and increasing the blood flow.

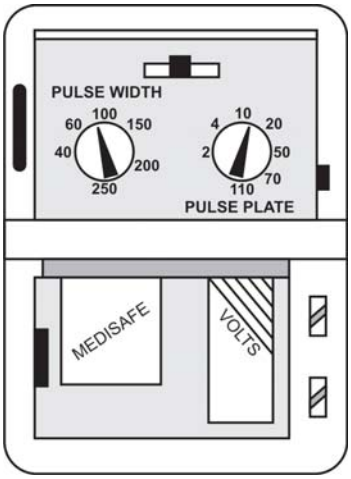


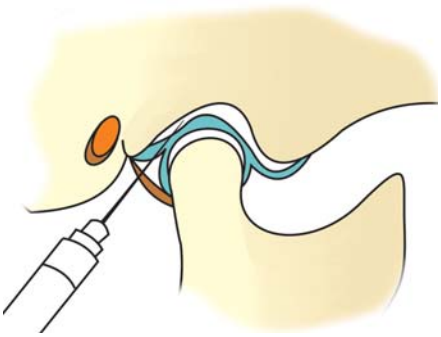
- *Pain relieving sprays:* Sprays with pain relieving medications can be used. While spraying, care should be taken to cover the eyes, nose and ears.

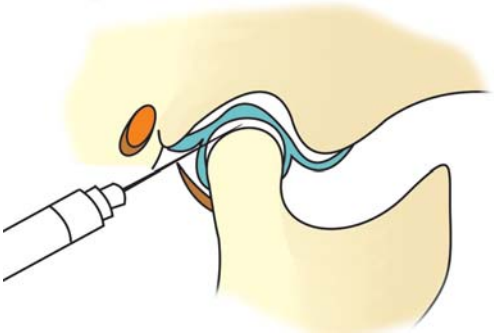
- *Cold fomentation:* It can be applied in the form of ice packs or towels soaked in cold water. The application should be done over the TMJ and related area. This will relieve the patient of pain, as cold decreases nerve conductivity.

- *Ultrasound:* It is an effective way to produce tissue heating with the help of ultrasonic waves. This alters blood flow and metabolic activity at a deeper level than that provided by simple surface moist-heat application.

- *Transcutaneous electric nerve stimulation (TENS):* It also provides symptomatic relief. In this pulse, width and amplitude of an alternating current can be adjusted. It is administered by electrode.
- *Exercise:* The patient can be advised to do home exercise. The mouth should be opened and closed with the tongue thrust against the palate. This can be done many times a day.
- *Intra-articular injections:* Injection of steroid can be given in acute pain and inflammation but it should not be done as a regular practice. These injection should be given to those patients whom all other measures fail.







TEMPOROMANDIBULAR TRAUMA

Trauma and fracture of TMJ is with fracture mandible.

Chapter

15

Preprosthetic Surgery

With an increase in life expectancy, the dentists are treating more patients who have lost their teeth in the course of their lives. This makes an increasing demand on the dentist to provide a well-fitting denture. That in turn, requires a good ridge and supporting tissue. If that is lacking, the job of preprosthetic surgery starts.

Some surgeries deal with improving the alveolar ridge while others deal with the supporting tissue.

HARD TISSUE SURGERIES

Alveoloplasty

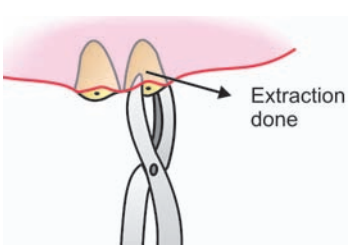
It is the recontouring of the alveolar process to facilitate and prepare the residual ridge for the reception of an artificial denture.

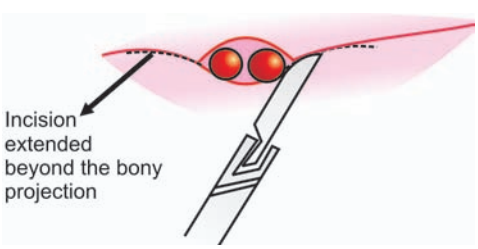
It should be performed to create an optimal ridge contour, so that a well-fitting denture can be worn immediately and for many consecutive years.

The easiest is to compress the outer and inner cortical plates between the fingers just after extraction.

1. Simple Alveoloplasty

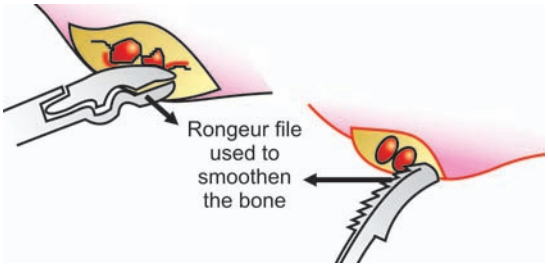
This type of alveoloplasty is performed most often, especially when cortical margins are to be reduced. Overerupted teeth usually have elongated alveolar process and these need to be trimmed at the time of extraction. As any pressure of denture on the teeth will cause pain to the patient, even ulcerations, for their removal, an incision is made over the bony projection after extraction of an isolated tooth.





An envelop type of flap is reflected. It should be extended just beyond the bony projection to be removed.

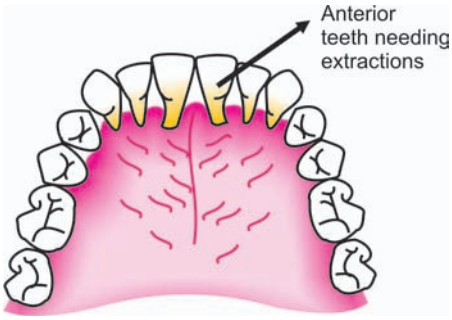
The excess bone is removed, using rongeur and bone file. Care being taken not to over-contour the osseous tissue.

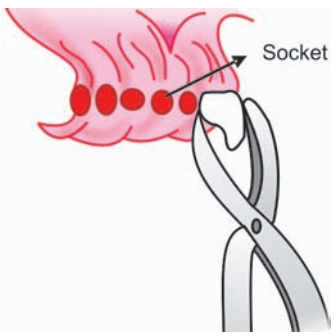


The soft tissue margins are approximated and sutured.

2. Dean's Alveoloplasty or Interseptal Alveoloplasty

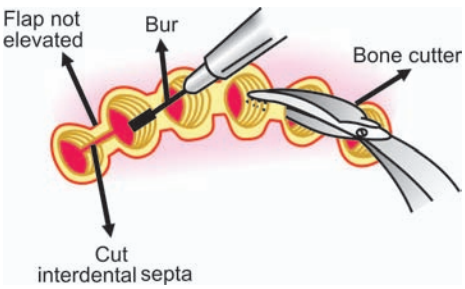
It is done in patients with gross maxillary overjet. In this technique the stress bearing cortical plate is not disturbed, but only the excess cancellous bone is removed.

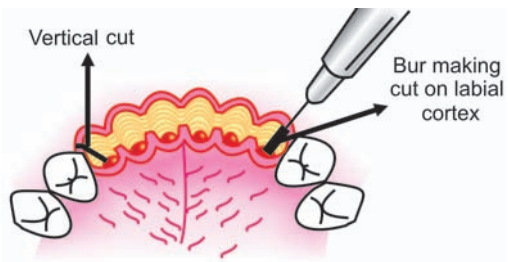




The teeth should be extracted as atraumatically as is possible.

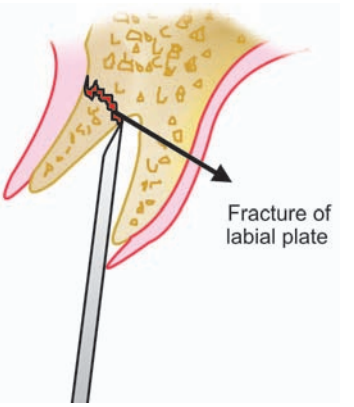
Then the interdental septal bone is cut from canine to canine. This can be done either using a bur or a rongeur.

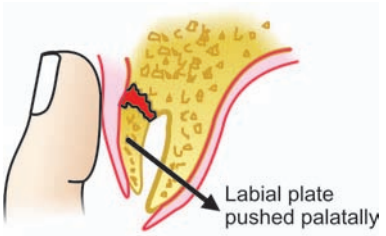




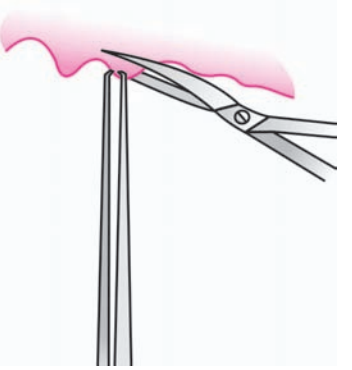
A bur is then used to make two vertical cuts on the buccal plate. These cuts should be placed on the distal end of each canine socket. Care being taken to cut only the bone and not injure the overlying mucosa.

An osteotome is then placed at the base of the canine sockets and the labial plate is fractured horizontally.

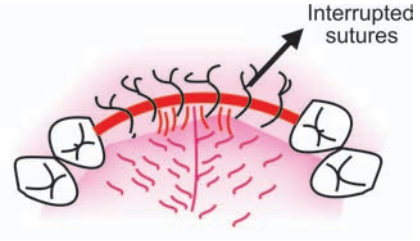




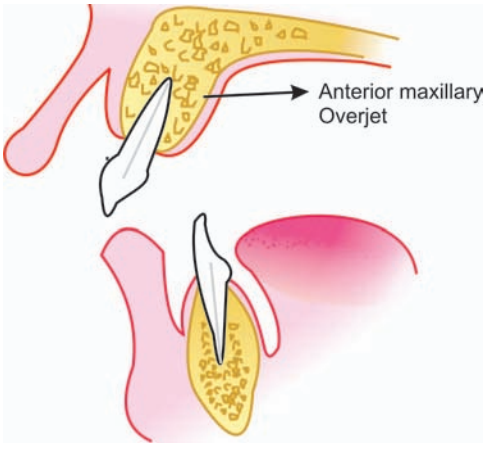
Using the digital pressure, the labial plate is compressed palatally.



Trimming of the uneven tissue is done. This will help in better approximation of the sutures.



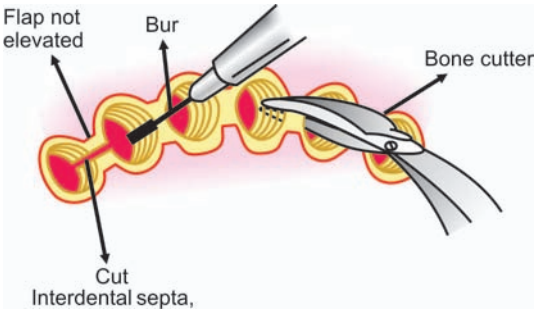
Surgical site is closed using interrupted or continuous sutures.

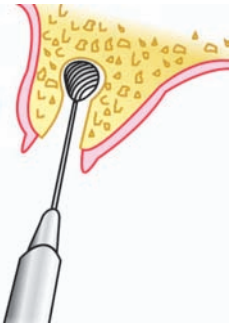


3. Obwegeser's Technique

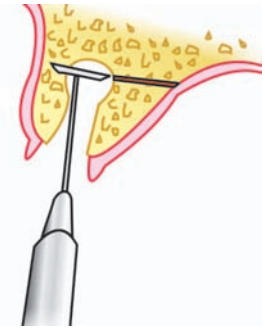
This technique is specially used in patients with gross overjet, in whom only the labial reduction will not be sufficient.

All the sockets are connected with each other using a bur or rongeur.

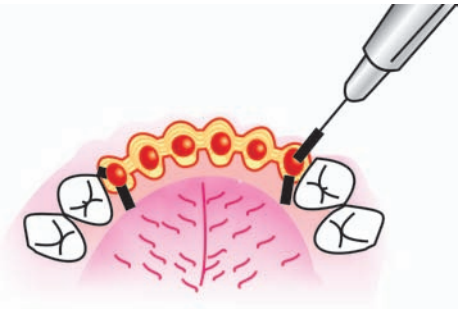




The sockets are widened using an inverted cone vulcanite bur.

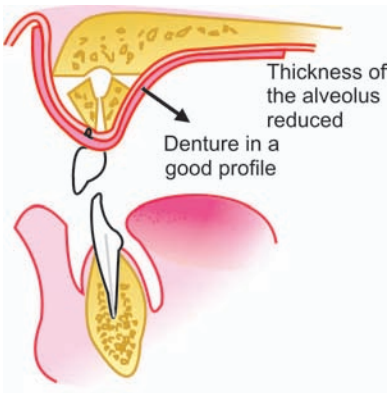


A small cutting disc is used to cut through palatal and labial cortices.



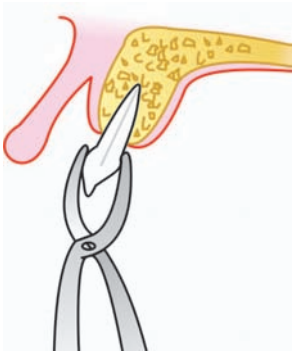
Vertical cuts are made bilaterally in both the labial and palatal cortices distal to each canine sockets.

The two cortices are compressed together using digital pressure. Sutures can then be given.



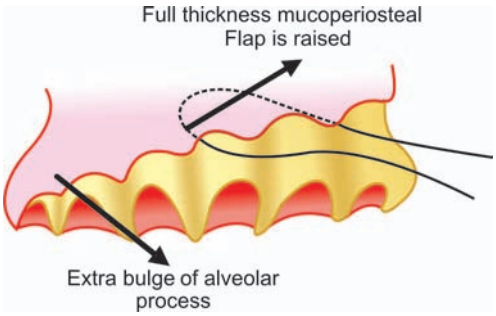
An immediate partial denture is placed to stabilize the fractured alveolar process.

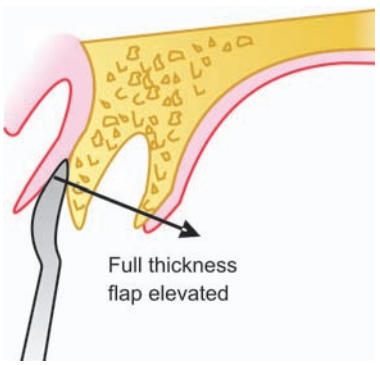
4. Labial and Buccal Cortical Alveoloplasty



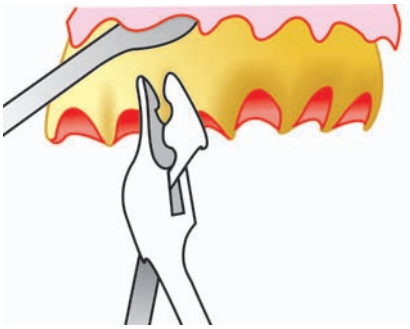
In this technique, the reduction of the outer cortical plate is done. The alveolar ridge is narrowed, allowed to become smaller and more accommodating for a denture. It is the most commonly used preprosthetic procedure although its long-term results are not good.

If indicated, extractions of the teeth is done. An incision is made and a full-thickness mucoperiosteal flap is raised. The flap should extend at least one tooth distance beyond the area to be reduced on both the sides.

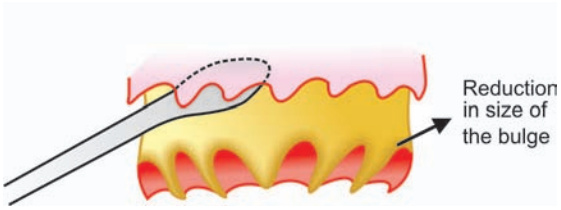


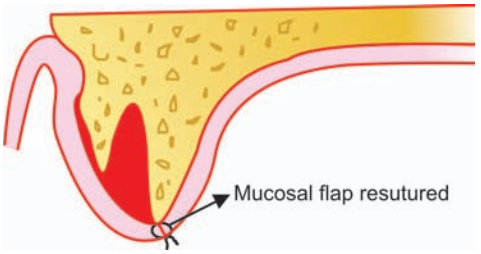


A sharp rongeur is used to remove small pieces of bone. The bone removed should give the desired contour to the ridge.



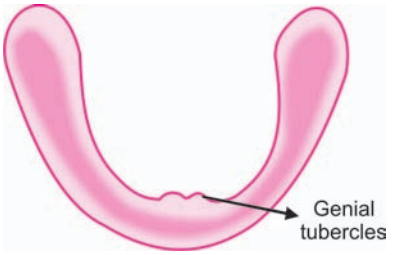
The sharp contours should then be filed off. The mucoperiosteal flap is sutured in place.

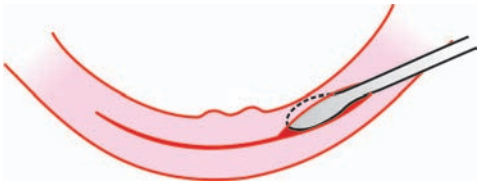




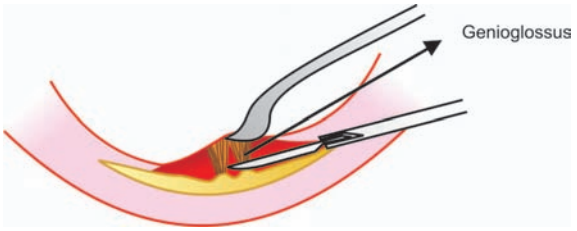
5. Reduction of Genial Tubercles

Genioglossus muscle is attached to the genial tubercles. Sometimes this forms a shelf like projection that dislodges the lower denture.

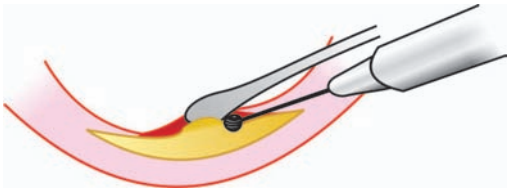




A crestal incision is made between the canines. A full thickness mucoperiosteal flap is raised lingually to expose the genial tubercle.

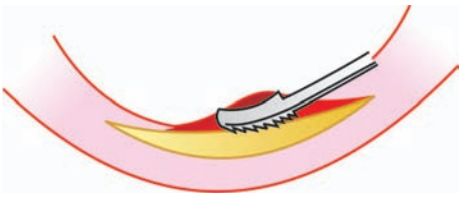


Sharp dissection is used to remove the muscle attachment.



The excess bone (genial tubercle) is removed using a bur or rongeur.

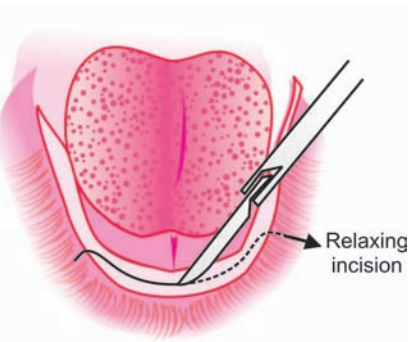
Filing of bone is followed by irrigation and suturing.

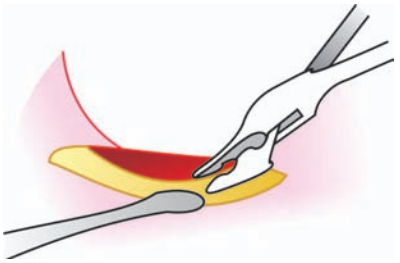


6. Reduction of Knife-edge Ridge

Denture wearing becomes extremely difficult in patients with sharp knife-edge ridges. These patients often get cuts into the mucoperiosteum whenever pressure is brought to bear on the area.

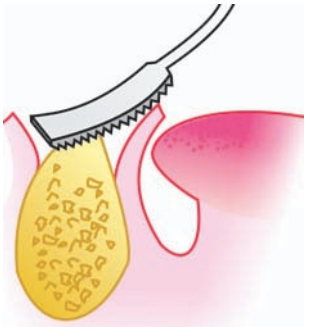
An incision is made along the alveolar crest. Small relaxing incisions are made on each side.

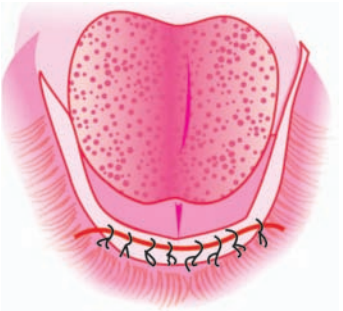




The flap is reflected on the buccal and lingual side, just enough to expose the ridge. All sharp bony edges and prominences are removed using a side-cutting rongeur.

The bone is smooth-ened using the bone file.

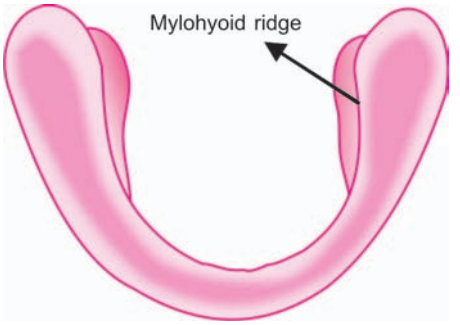




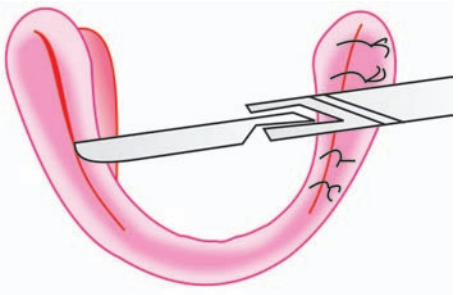
Sutures are given. In this surgery care should be taken not to over cut the bone, as there is already a deficiency.

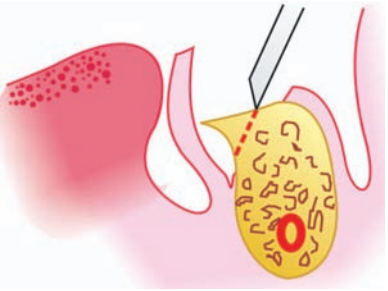
7. Reducation of Mylohyoid Ridge

Occasionally, the mylohyoid ridges are the highest points of the atrophic mandible, as the alveolar process in these persons has been reduced to a groove or a 'negative ridge'. If these ridges are the cause of ulcerations that fail to heal, they are to be removed.

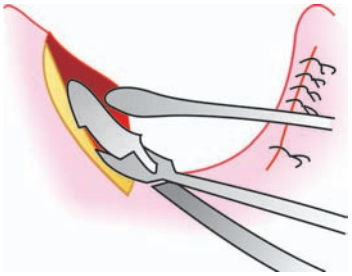


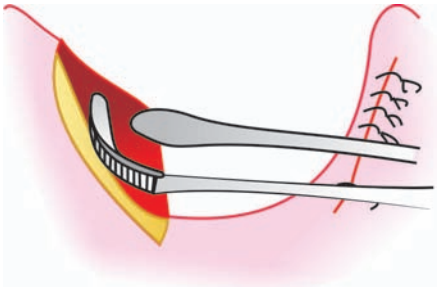
The incision is made in the molar region on the crest of the residual ridge.





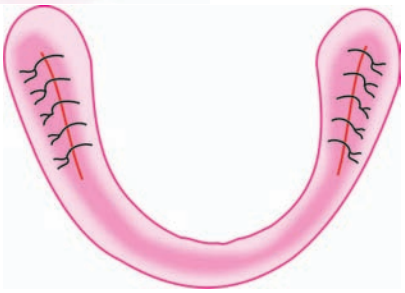
The lingual mucoperiosteum is reflected exposing the mylohyoid ridge and muscle. The muscle is incised and reflected. The mylohyoid prominence is then reduced using a chisel or rongeur.

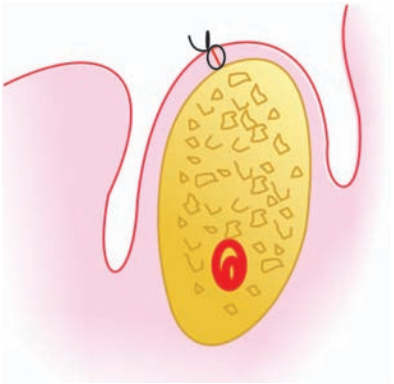




Smoothening of bone is done with a bone file.

Sutures are given.





REDUCTION OF TORI AND EXOSTOSES

1. Palatal Torus or Torus Palatinus

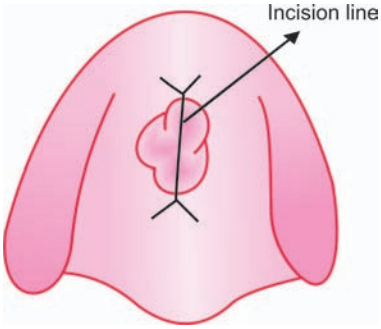
Palatal torus or torus palatinus is a benign, slowly growing, bony projection that occurs bilaterally along the median suture of the hard palate in the oral cavity. It has dense cortical bone and varying amount of cancellous bone.

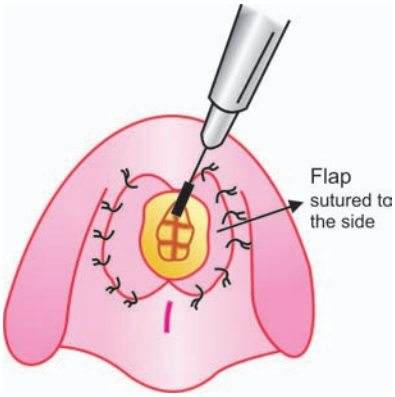
A palatine tori can be left as such, but should be surgically removed if,

i. It interferes with speech.
ii. It interferes with designing and fitting of a removable denture.
iii. Ulcers and cuts on its surface occur frequently.

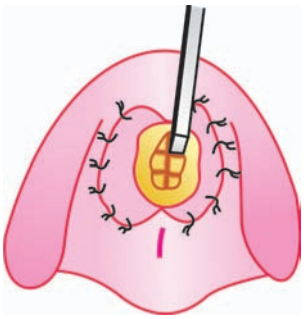
Surgical Removal

A median palatal incision is made extending to the full length of the torus. For better reflection, two divergent incisions are made at both ends of the midline incision.

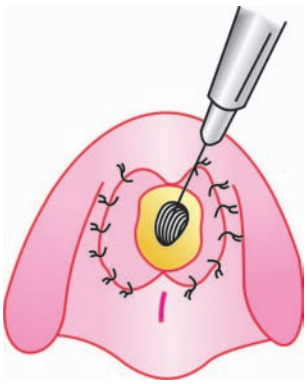




The mucoperiosteal flap is reflected and sutured on the sides. If the torus is large, vertical and horizontal grooves are made in it with the help of a bur.

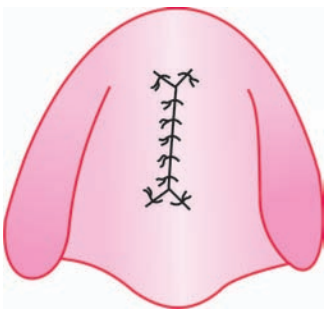


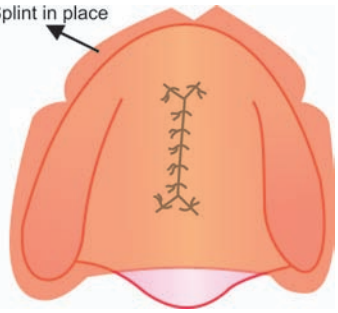
These smaller portions are then removed using a chisel.



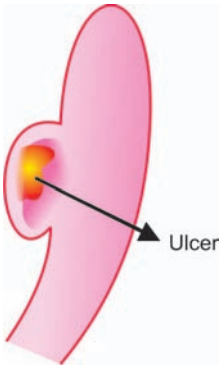
A bone file or a trimming bur is then used to smoothen the surface.

Sutures given earlier are then released, mucosal flaps are repositioned and surgical site is closed using interrupted sutures. It is important to prevent the formation of a hematoma postoperatively, otherwise the palatal flap can necrose. To prevent this, a good fitting stent or splint is fabricated and used postoperatively. This will ensure that the palatal mucosa remains in contact with the palatine bone, and heal without complications.



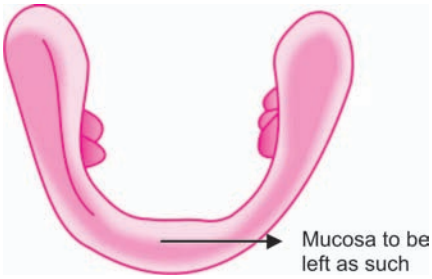


2. Torus Mandibularis or Mandibular Torus



These are exostosis found bilaterally on the lingual surface of the body and alveolar process of the mandible. These are composed of dense cortical bones with minimal medullary core. These should be removed for the same reasons as the palatal torus, i.e,

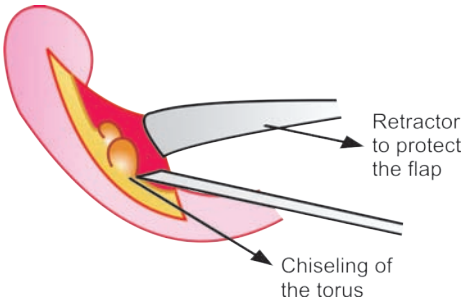
i. When they cause difficulty with speech and eating.
ii. When traumatic ulcers are formed on the overlying mucosa.
iii. Interfere with construction and wearing of a removable partial denture.

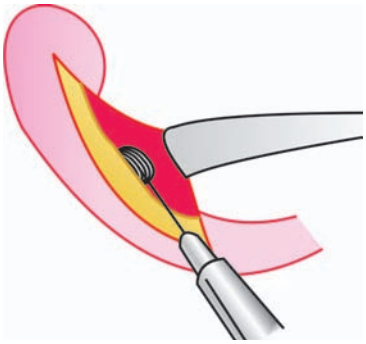


Surgical Removal

After anaesthetizing the area, an incision is made on the crest of the alveolar process from the molar to the incisor region. If the surgery is being done bilaterally, the mucosa lying in the anterior region should be left untouched.

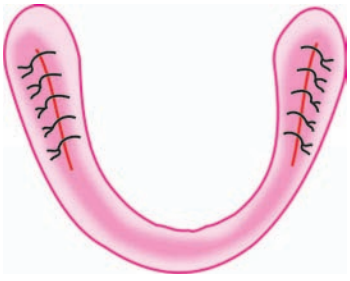
The mucoperiosteal flap is carefully elevated. The flap is protected while the torus is removed using a sharp chisel. If required, a bur can be used first to establish a plane of cleavage before the use of chisel and mallet.





A large bur or file can be used to remove any irregularities.

Proper cleaning of the surgical site is to be done before closure. If required, a stent is used to prevent hematoma formation.



SOFT TISSUE SURGERIES

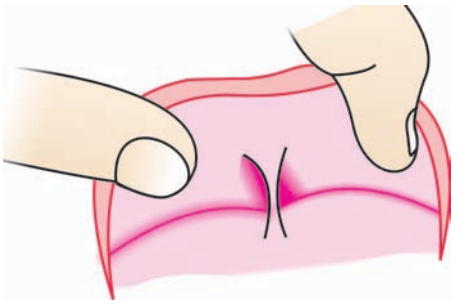
These surgeries improve the soft tissue defects for a better denture fit.

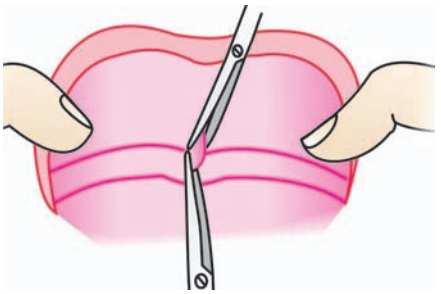
Frenectomy

Frenum is a thin band of fibrous tissue and a few muscle fibres covered by mucous membrane, connecting the lips, cheek or tongue to the jaw bones. In some patients, the frenal attachment is high on the alveolus. This can cause dislodgement of dentures or ulcerations on the frenum. To get over this problem, frenectomy can be performed.

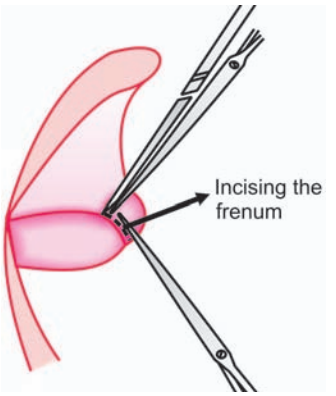
1. Labial Frenectomy

Once the area is anaesthetized, the lip is everted.

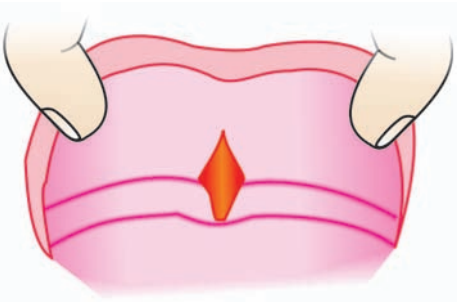




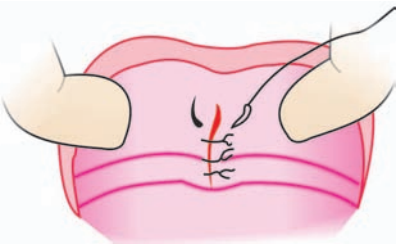
The frenum is held using two hemostats. One hemostat locks the frenum close to the alveolus on the labial surface. Another hemostat holds the frenum parallel to the lip and perpendicular to the first hemostat.



These hemostats are placed such that all the tissues that are to be removed, lies within their grip. Also the tips of the two hemostats should touch each other.



Using a blade, the frenum is cut along the outer surface of both the hemostats. This will remove a diamond shaped tissue attached to them.

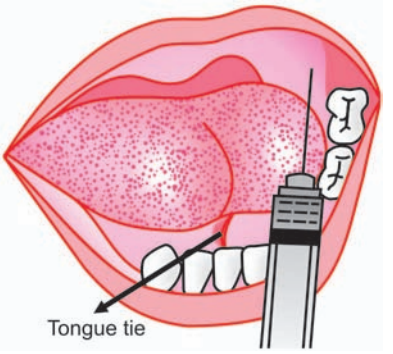


The wound is closed using interrupted sutures.

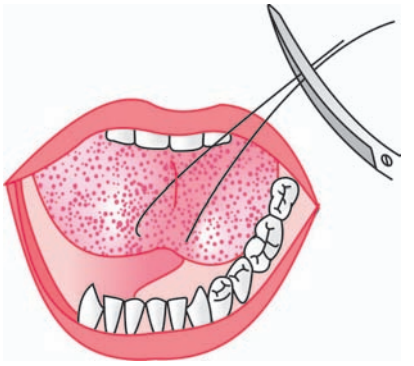
2. Lingual Frenectomy

This is the procedure to release tongue-tie (ankyloglossia). The tongue-tie should be released even when the patient is young as it interferes with speech.

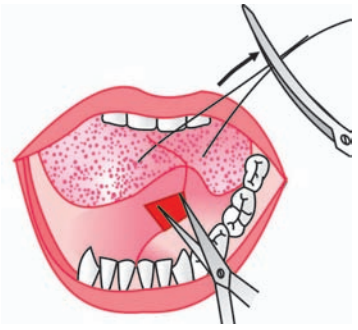
The patient should either be taken under general anaesthesia or lingual block for local anaesthesia. Local infiltration should not be done as it can disturb the normal tissue anatomy.



Then a 3-0 silk suture is passed through the midline of the tongue about 2 cm from the tip.

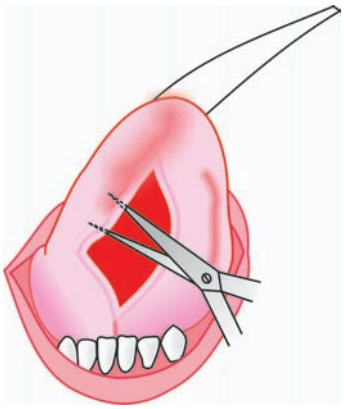


This will help hold the tongue in a retracted position while surgery is performed.



An incision is made midway between the tip of the tongue and lingual surface of the mandible in the mucous membrane. While making the cut, the scissors should be parallel to the floor of the mouth.

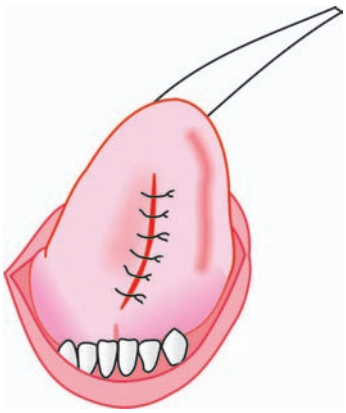
Deeper dissection is performed in the midline. Care being taken to avoid the ducts of submandibular salivary glands, and the sublingual veins.



The dissection should be continued until the tip of the tongue can be stretched to touch the maxillary incisor teeth while the mouth is open. At this stage, the wound appears diamond shaped.

Then the undermining of the edges are to be done so that the closure is done without any tension.

The surgical site is closed in a linear line with interrupted sutures.



VESTIBULOPLASTY

In these techniques, the depth of the vestibule is increased. This can be achieved by either of the following:

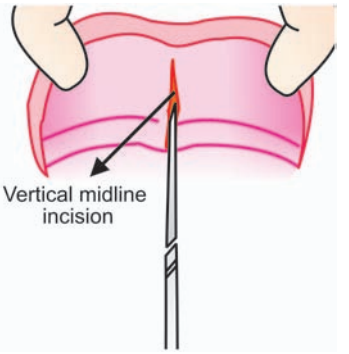
i. Mucosal advancement vestibuloplasty
ii. Secondary epithelization vestibuloplasty
iii. Grafting vestibuloplasty.

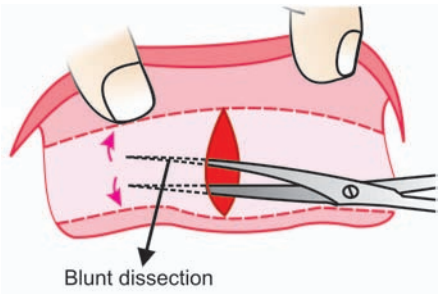
Mucosal Advancement Vestibuloplasty

In this technique, the vestibule is deepened using the mucosa of the surrounding area. It can be performed by closed or open submucous vestibuloplasty.

1. Closed Submucous Vestibuloplasty

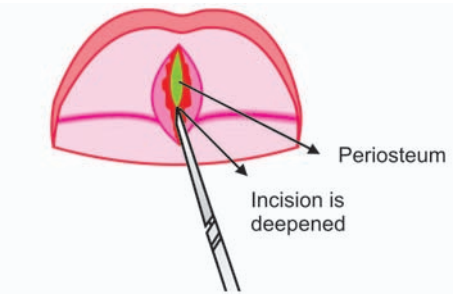
In Obwegeser's technique, a large amount of saline or diluted local anaesthesia is injected into the tissues. Then a vertical incision is made extending from the mucogingival junction to the lip.

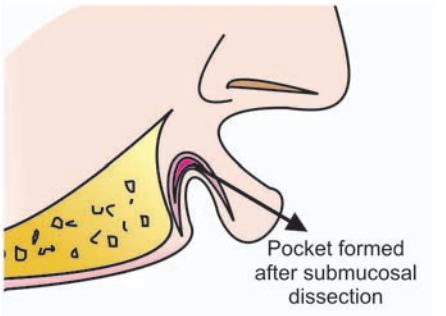


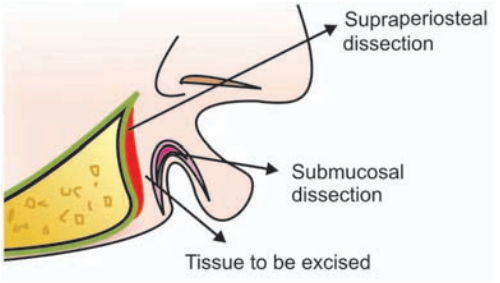


Blunt dissection is done submucosally in both the right and left direction. It should extend upto the molar region. If required, vertical incisions can be made in the molar region to aid in the process.

The submucosal dissection should be such that there is free mobility of the mucosa. Then the vertical incision should be deepened upto the bone.





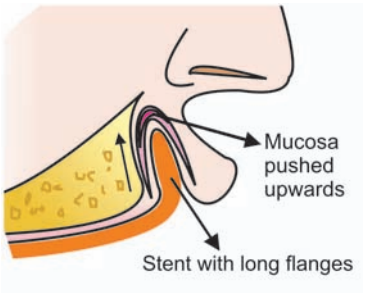


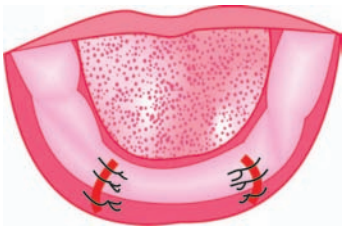
Again blunt dissection should be done in both direction but this time it should be supraperiosteal. In doing so, the muscle attachments on the maxilla will be pushed upwards.

There will be some tissue that lies between the two dissected tunnels, this tissue is then excised. Thus now loose mucosa lies over the periosteum.

The incision line is sutured.

A stent is made that has its flanges upto the height of sulcus that is required. The loose mucosa will be pushed upwards and held in its position with the stent for 10 to 14 days.

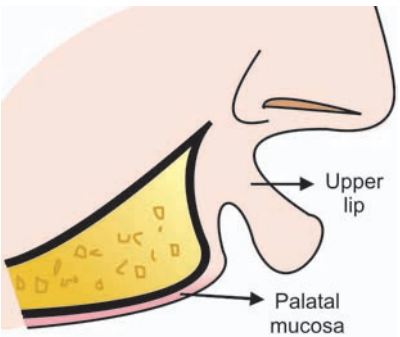


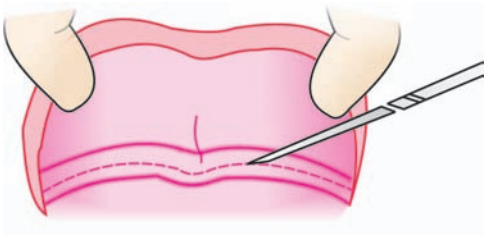


"Boering" suggested that instead of one vertical incision in the anterior region, two incisions, one on each side at the premolar region should be made. This will help in making the submucosal dissection both in anterior and posterior direction. Also the inferior alveolar nerve can be protected from damage.

2. Open-view Submucous Vestibuloplasty

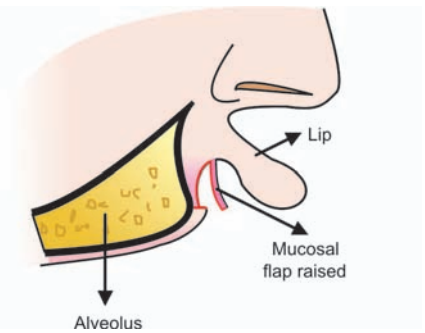
It is done to overcome the relapse of the closed technique.

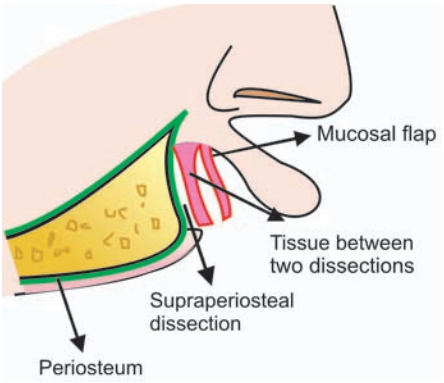




A horizontal incision is made at the mucogingival junction through the mucosa only.

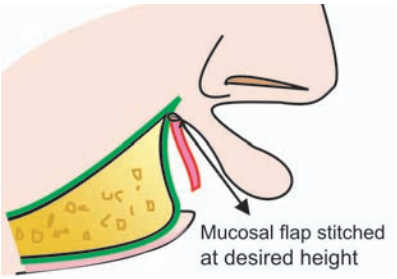
A thin flap of the mucosa is raised upto the desired height of the vestibule.

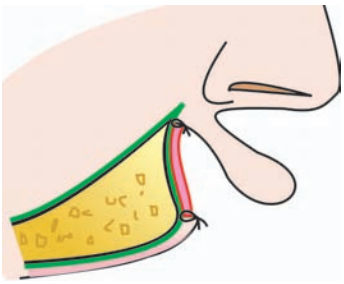




Then dissection of the same region is carried out at supraperiosteal level.

The tissue between the two dissections is removed. The mucosal flap is then stitched with stay suture at the desired height of the vestibule.





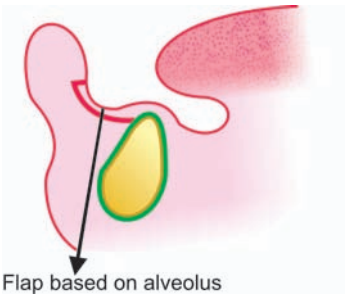
The mucosal flap is then replaced.

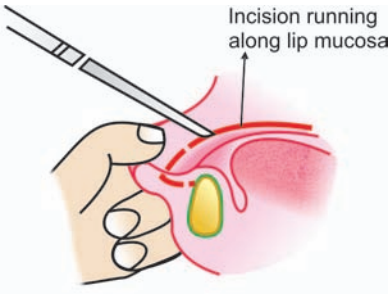
Secondary Epithelization Vestibuloplasty

It is indicated in patients who have sufficient amount of bones but the mucosa surrounding it, is insufficient which results in decreased sulcular depth. This in turn prevents a good fit of a denture. The sulcular depth can be increased by:

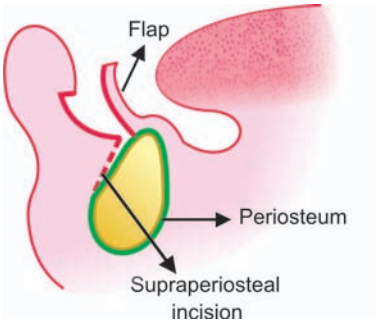
1. Kazanjian's Technique

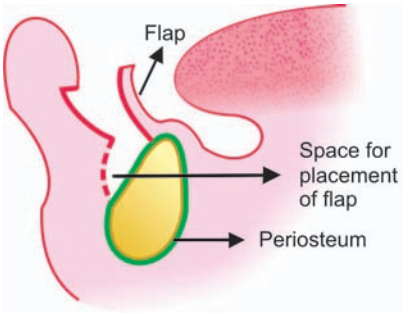
In this technique, an incision is made in the mucosa of the lip, that runs along the lip mucosa. Carefully the flap is raised upto the alveolar process.



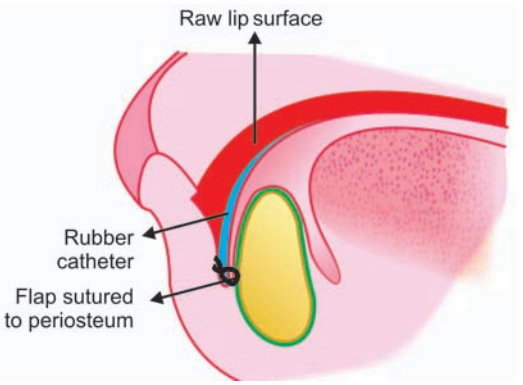


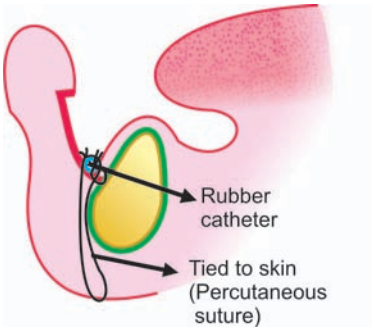
Raising it, another incision is made supraperiosteally along the labial surface of the alveolar ridge. It should be deep enough to accommodate the buccal flap in its depth.





The flap of mucosa is turned downwards and brought to lie over the freshly stripped periosteum. This is then sutured with the periosteum.

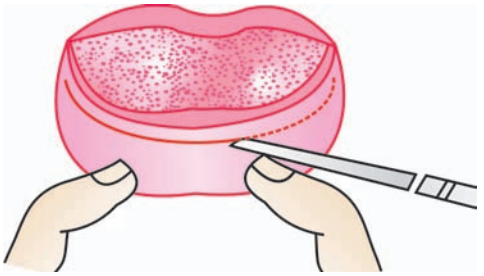




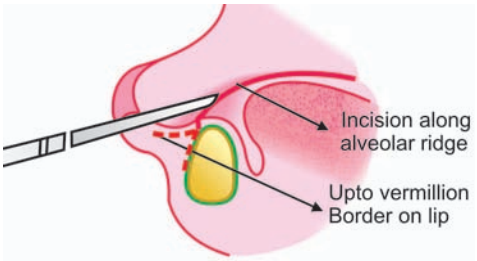
A rubber catheter is placed into the deepened sulcus and fixed to the outer surface with percutaneous sutures. The labial donor site is coated with tincture of benzoin compound and left to heal by granulation and secondary epithelization.

2. Clark's Technique

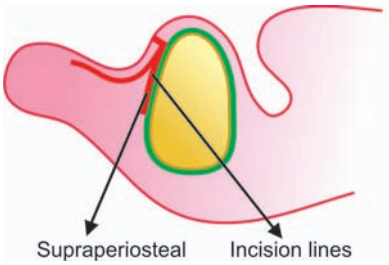
In this technique, an incision is made at the mucogingival junction on the alveolar ridge that extends from the molar teeth from one side to the molar teeth on the other side.

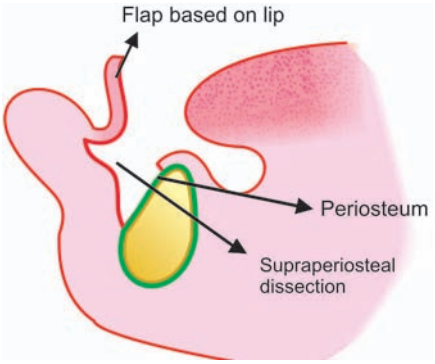


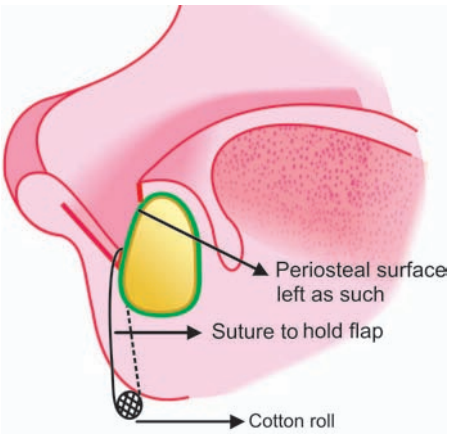
A flap is raised till the vermillion border of the lip this flap has its base on the inner side of the lip.



Then the supraperiosteal dissection is made on the buccal side of the alveolar ridge upto the depth of the vestibule that is desired.





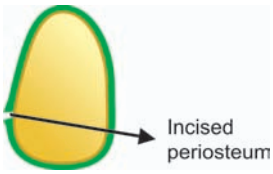


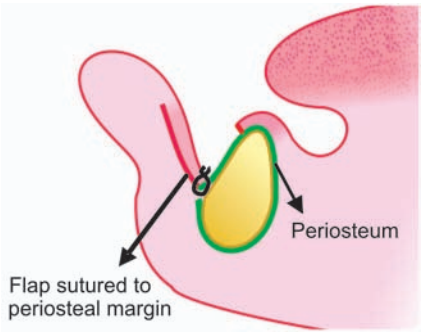
The edges of the flap are then pushed into the depth of the vestibule and sutured. The sutures are passed to the skin of the chin and they should be tied over a cotton roll.

In this way, the raw surface of the lip is covered by the mucosa, while the periosteal over the alveolus is left as such and allowed to heal by granulation tissue.

Tortorelli's Modification or Periosteal Fenestration

In this technique, the periosteum at the base of the newly created vestibular depth is incised horizontally, parallel to the mucogingival junction. The free margin of the mucosal flap is sutured to the inferior periosteal margin to fix the mucosa deep in the vestibule.

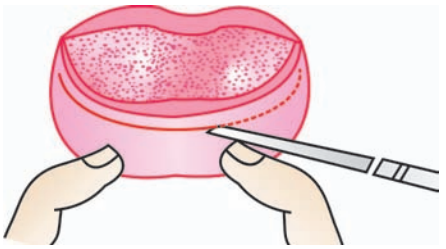


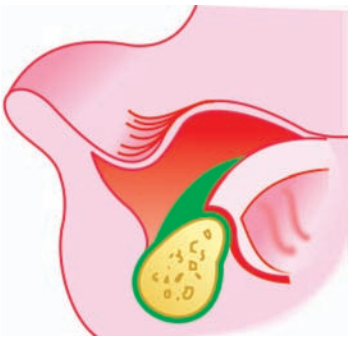


In this technique, the relapse of the mandibular vestibule is limited by the periosteal fenestration. This could be due to the time difference in healing of the fenestrated periosteum and that lying attached to the alveolus.

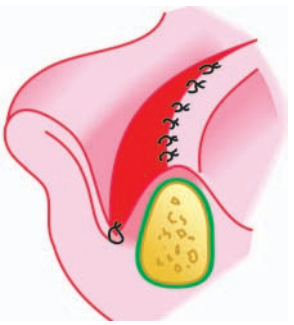
Grafting Vestibuloplasty

In the grafting vestibuloplasty, an incision is made along the mucogingival junction.

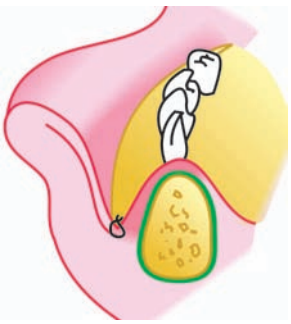




The vestibule is deepened by supraperiosteal dissection. The flap raised is sutured to the periosteum at the base of the vestibule.



Then a mucosal graft or a skin graft (that is taken from that part of the body which has relatively less hair, like the inner skin of the arm) is used to cover the raw periosteal surface.



A stent can be used to place the graft in it, which is in turn secured to the mandible with circumferential wiring for about 10 days.

Advantages

- The relapse due to contraction of wound margins is reduced.
- Healing is quicker.
- Patient discomfort is reduced as there is no raw area in the mouth.

Disadvantage

- A second surgery is done at the donor site.

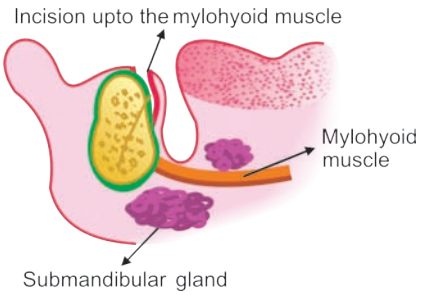
Lingual Sulculoplasty

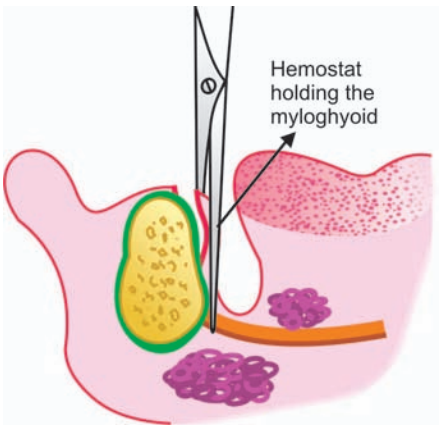
It is lowering of the floor of the mouth. This type of surgeries are to be performed in patients who have the mylohyoid and the genioglossus muscle attached high up such that they interfere with the stability of the denture. The methods used for this correction are:-

- Trauner's technique
- Caldwell's technique
- Obwegeser's technique.

1. *Trauner's Technique*

In this surgery, an incision is made on the lingual mucosa from the 3rd molar of one side to the other. Supraperiosteal dissection is carried out till the mylohyoid muscle.

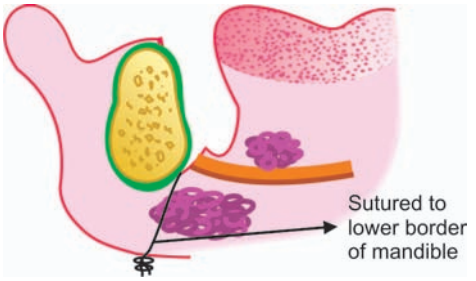




Then with a hemostat, the muscle in the canine region is held and incised. This is done to avoid injury to the periosteum and the lingual nerve.

This is then secured with percutaneous sutures to the lower border of the mandible.

A split thickness graft can be used on a stent to cover the raw periosteal surface.



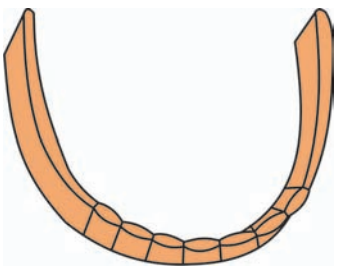
AUGMENTATION

Patients with atrophic mandible are unable to wear a denture, also sometimes the bone becomes so weak that it is liable to fracture with little trauma. In such patients, augmentation of the mandibular bone should be considered.

This augmentation can be done:

i. At the superior border of the mandible using autogeneous grafts like rib grafts, bone grafts or alloplastic material like hydroxyapatite.
ii. At the inferior border using a rib graft, bone grafts.
iii. Interpositional or sandwich grafting using autogenous graft i.e. bone or rib and alloplastic material like hydroxyapatite.
iv. Visor technique.
v. Onlay grafting.

Rib Graft Augmentation to Superior Border of Mandible

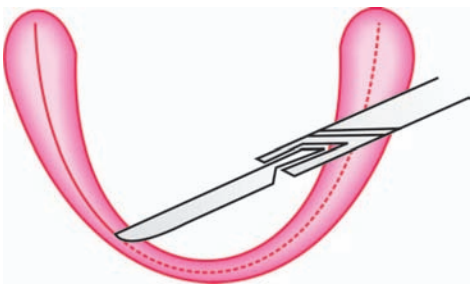


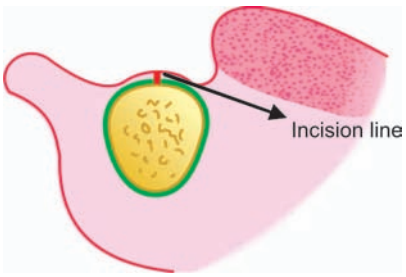
Technique

In this procedure, the two rib segments about 16 cm long are taken from any rib between 5th to 9th.

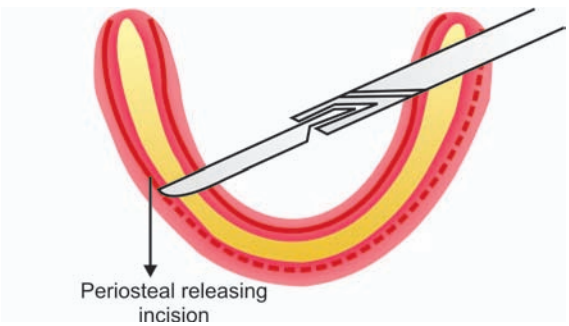
Then on the internal surface of one of the ribs, vertical cuts are made from superior to inferior surface. This will allow bending of the rib. The 2nd rib is cut into small pieces.

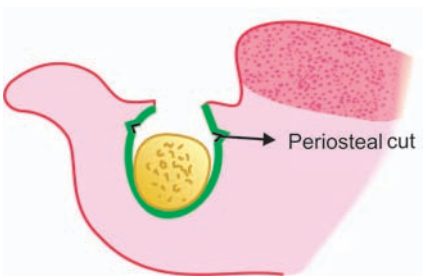
An incision is carried from the retromolar region of one side to that of the other side. Care being taken that the incision runs on the fixed gingiva.



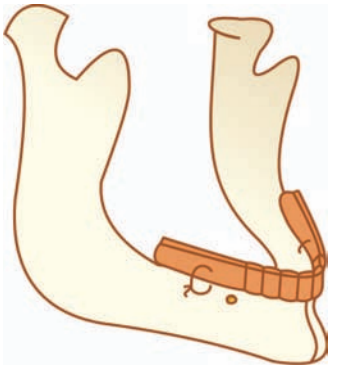


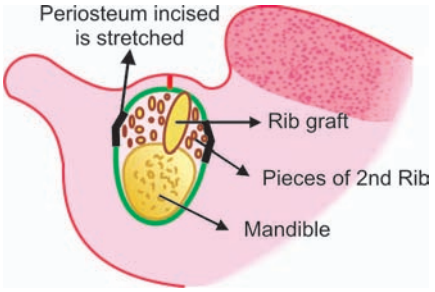
The buccal and lingual mucoperiosteum is raised. Periosteal releasing incisions are made to help stretch the flap so that the graft can be accommodated.



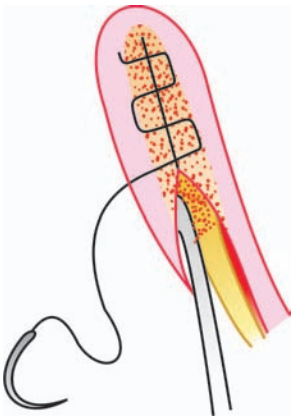


The size of the rib graft is adjusted and then it is ligated to the mandibular bone.





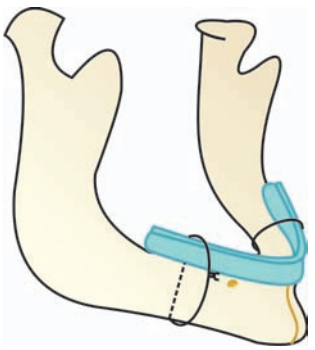
The soft tissue closure is started from one retromolar region and continued to the other end.



While suturing is being done, the area should be packed with pieces of the other rib into the pocket created.

Disadvantage

i. There is a continuous resorption of the grafted site.
ii. Donor site morbidity.
iii. Trauma of two surgeries.
iv. The patient cannot wear a denture for a long time postoperatively.
v. Obliterates the vestibule for which a second surgery needs to be done.
vi. Oral mucosa may have dehiscence.



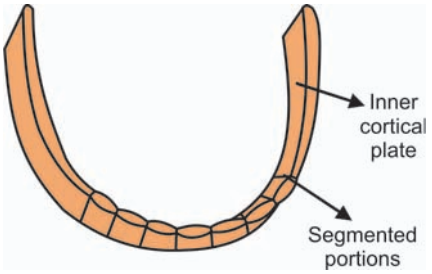
Hydroxyapatite blocks can be used in a similar manner. These grafts can be fixed onto the mandible using circum-mandibular wiring.

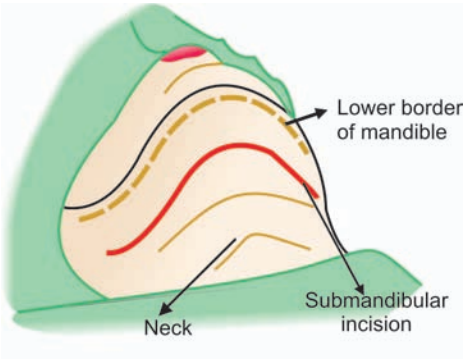
Rib Graft Augmentation to Inferior Border of Mandible

This is done in extremely atrophic mandible or those who have suffered pathological fracture or who have gone into nonunion.

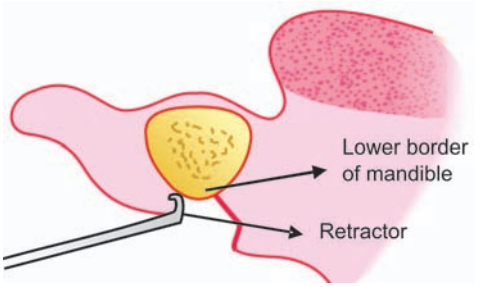
Technique

In this technique, two ribs are removed. Their inner cortical plate is segmented to facilitate their bending. The cortical pieces removed are used for packing between the grafts.

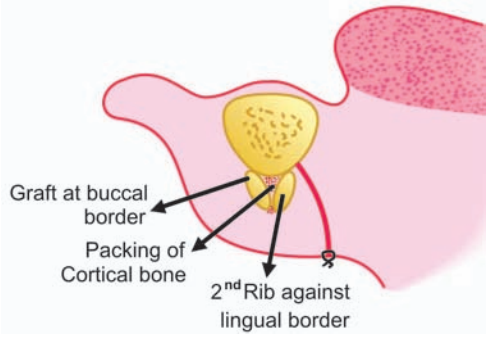


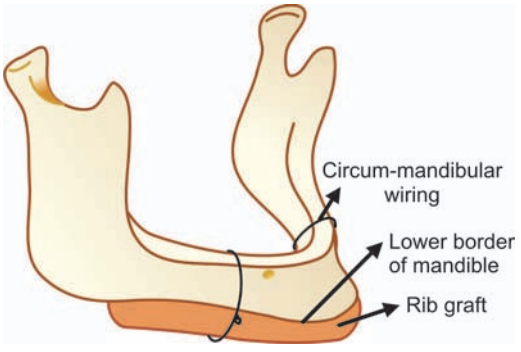


Through the submandibular incision, the grafts are placed and fixed, one against the lingual aspect of the inferior border and the other rib against the buccal border.



The space between them is packed with the cortical bone removed earlier.





Closure of the wound is done by multilayer suturing.

Advantages

i. Denture can be worn relatively soon.
ii. Second surgery for deepening of the vestibule is not required.
iii. Mucosal dehiscence does not take place.
iv. In this technique, the vertical height of the occlusion does not change.
v. The resorption of the graft is much slower.
vi. As the lower facial height is increased, patients facial profile improves.
vii. Compared to intraoral technique, it is a simpler procedure.

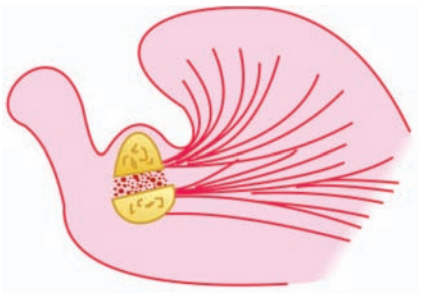
Disadvantages

i. A large extraoral scar may form.
ii. Surgery should be done in those patients who have loose tissue available at the submandibular region to accommodate the graft.

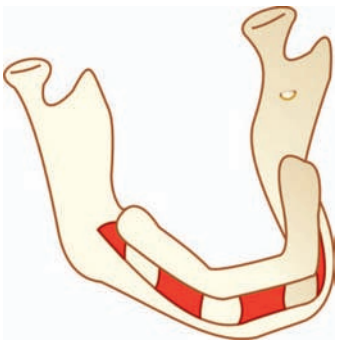
INTERPOSITIONAL BONE GRAFTING

Horizontal Osteotomy or Sandwich Augmentation

It is called sandwich augmentation as in this technique, the mandibular bone is cut horizontally and bone from the iliac crest is placed and fixed between the two cut ends.



In these surgeries, advantage is taken of the fact that the lingual aspect of the mandible has multiple muscles attached to it that give it a good blood supply.



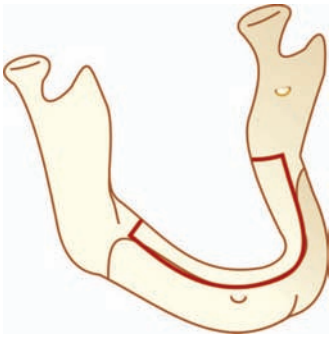
Bone is cut using reciprocating saw, care is to be taken not to injure the neurovascular bundle. The cut parts of the mandible are separated and the grafting material is packed between them. They are secured in place with long lasting resorbable sutures.

Advantages

- It has a slower resorption rate than onlay grafting.
- As the bone segments remain attached to the muscles, the blood supply is good and so the long term results are good.

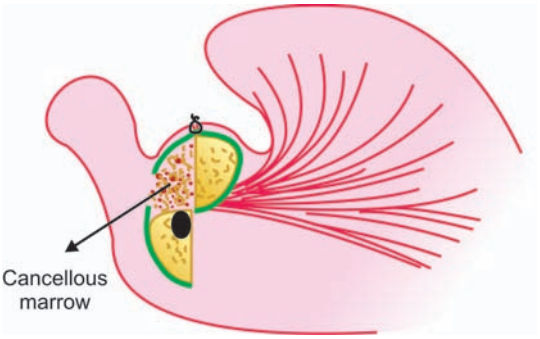
Visor Osteotomy or Vertical Osteotomy

In this technique, a sagittal cut is made in the mandible such that there is a buccal and a lingual segment. The lingual segment is then elevated above the buccal segment, it looks like a 'visor' and hence the name.



An osteotomy cut is made, starting from one end of the mandible cutting through the lingual plate upto the depression between the lingual and buccal plate. This is done on the other side also. The bone cuts are such that the two segments formed are separated.

The mobilized pedicled lingual segment is then elevated to its new position and secured with resorbable sutures. While suturing is being done, the cancellous marrow taken from the ilium is packed on the lateral aspect of the superior segment.

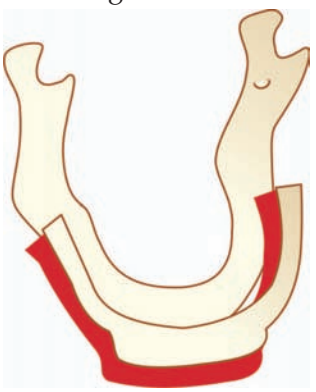


Advantage

In this the superior-inferior dimensions are doubled, while the bucco-lingual dimension is maintained.

Modified Visor Osteotomy

In this technique, the vertical osteotomy cut is made only in the posterior region to divide the segments buccolingually. A horizontal osteotomy is performed in the anterior region of the mandible. This will divide the anterior part of the mandible into superior and inferior segments. The two segments are separated and the gap is filled with the cancellous bone harvested from the iliac crest.



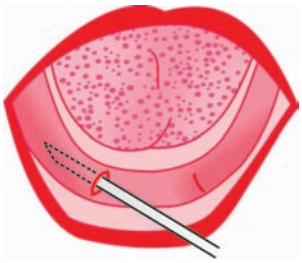
Advantage

Long term results are good. About 80 percent of the height is maintained at the end of 3-5 years.

Onlay Grafting

Hydroxyapatite crystals are used to augment the mandibular and the maxillary ridges.

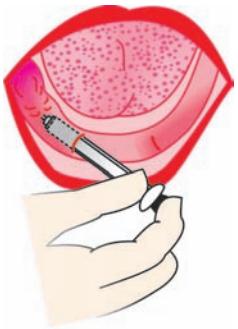
For maxillary ridge augmentation, an incision is made in the mid- line. While for the mandibular augmentation, two incisions are made one on each premolar region.

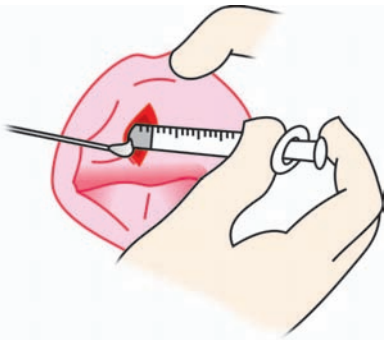


Subperiosteal tunneling is done. It is important to restrict the tunneling to the area where the augmentation is required.

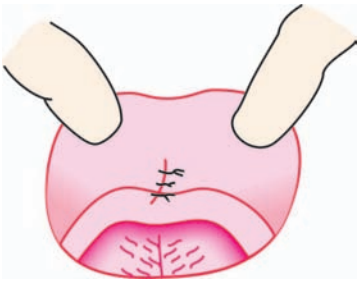
Then the hydroxyapatite crystals filled syringe is pushed into the tunnel. HA is injected posteriorly and while injecting, the syringe is slowly pulled out.

In this way there is an even spread of the crystals. Once the HA is filled, it can be moulded well.





Suturing of the incision line is done prior to filling HA in the anterior region, in case of mandible to prevent outflow.



Chapter

16

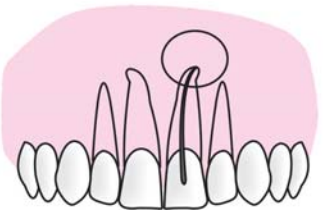
Surgical Endodontics

This chapter includes those surgeries that are performed along with endodontic treatment in order to help maintain the tooth in the oral cavity. Thus the tooth will be able to perform its function of mastication and aesthetics in the arch. Surgeries like periapical curretage to hemisectioning of a tooth are included.

APICECTOMY

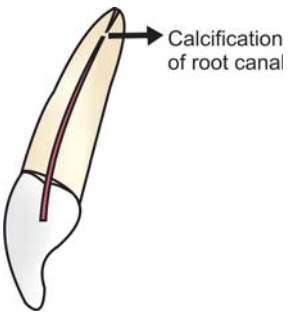
This surgery includes resection of a portion of the root that contains unobturated canal space that could be responsible for the periapical lesion.

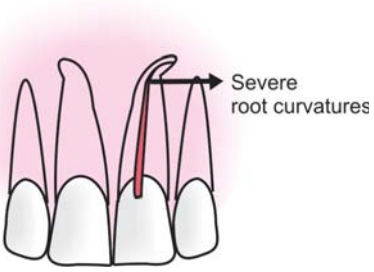
All cases of periapical radiolucencies or failed root canal treatment need not be an indication for this treatment.



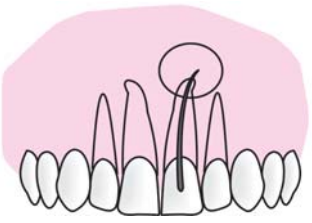
Indications

1. Calcified, constricted root canals, severe root curvatures that prevent instrumentation and obturation.

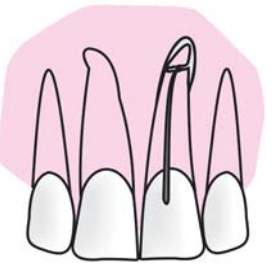




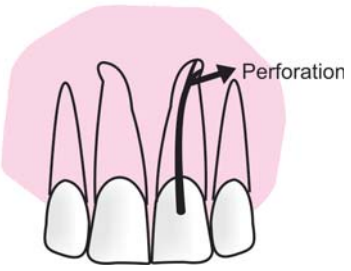
2. Large lesions that do not heal post root canal treatment. For example, periapical cyst.

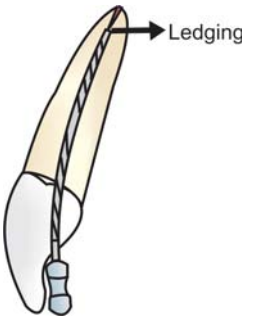


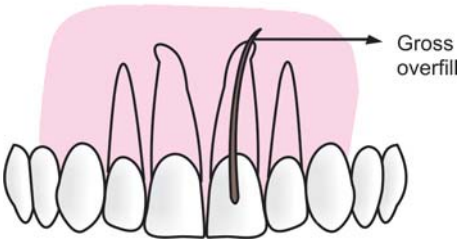
3. Horizontal root fracture at the apical third as this will not allow root canal filling into the fracture segment.



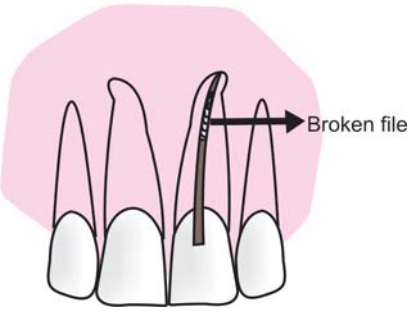
4. Errors committed during root canal treatment like ledging, gross over fills, perforations or broken instruments may all result in failure of root canal.





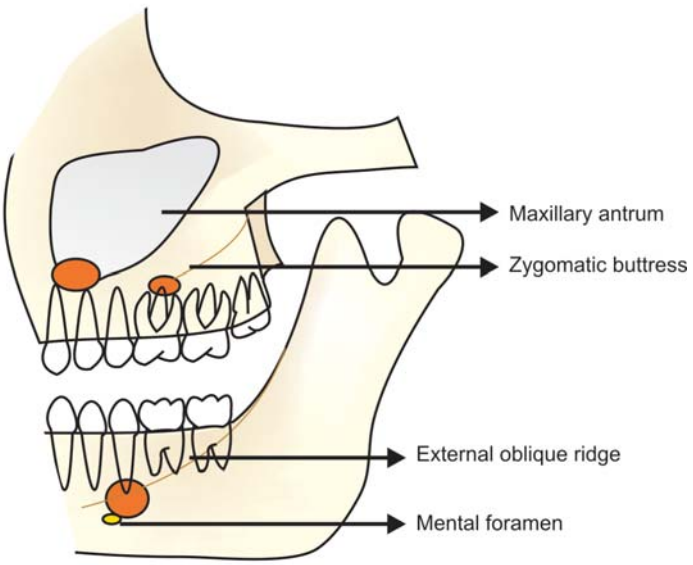


5. canals blocked by foreign bodies like segments of posts, broken root canal instruments, restorative materials.

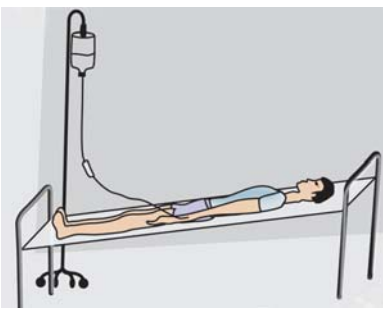


Contraindications

1. Every case of root canal failure is not an indication for this surgery. It is better to re-visit the root canals.
2. Anatomical structures like the maxillary sinus, zygomatic buttress, mental foramen, external oblique ridge can all be in the path and prevent complete or interfere with this method of treatment. though they are not an absolute contraindication for apicectomy. So the patient should be carefully evaluated for this treatment.

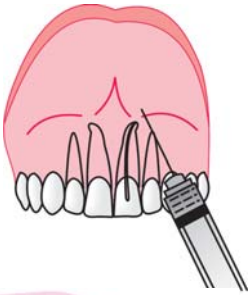


3. Medically compromised patients should not be taken up for this surgery.



4. Avoid apicectomy and root canal obturation in the same sitting, as this will not benefit the patient in any way but it will rather increase the chair side time.

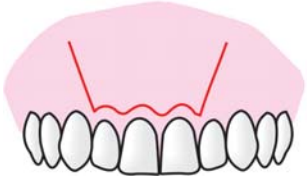
Surgical Procedure



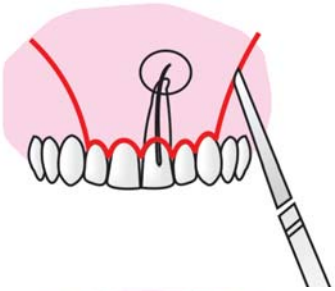
After the area is anesthetized, incision of surgeons choice is given the most commonly used incisions are:

- Semilunar
- Submarginal
- Trapezoidal flap

Semilunar incision

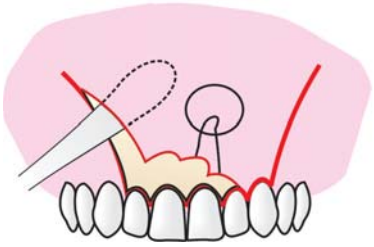


submarginal incision

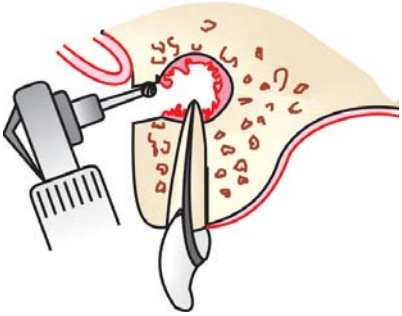


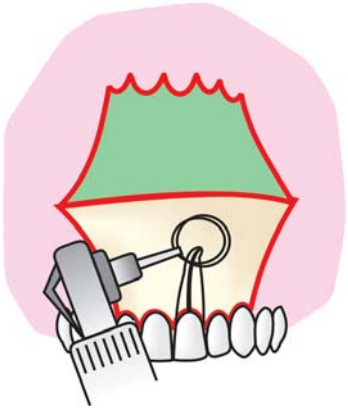
Trapezoidal

A full thickness mucoperiosteal flap is raised to expose the underlying bone.

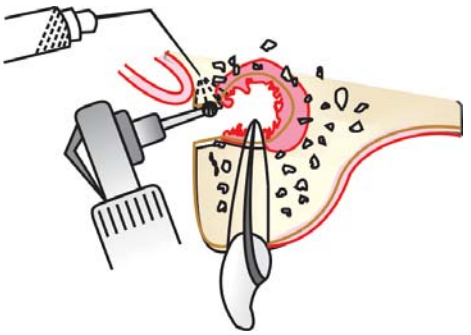


Most often there is perforation of the overlying bone of a large periapical pathology. This can be widened. Or a round surgical bur can be used to make an opening into the bone that can lead to the root apices.



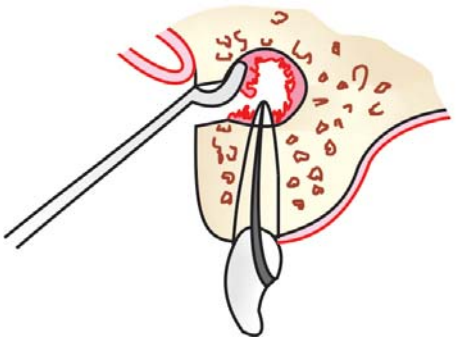


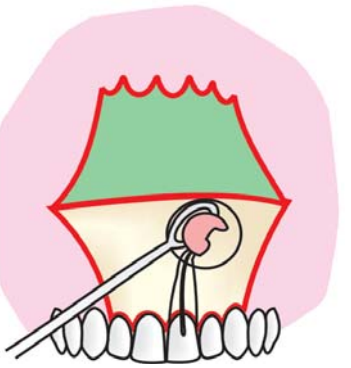
Care should be taken to make the orifice large enough to allow free movements of the instruments, so that complete curettage of the pathological lining can be done.



Care should also be taken not to heat the bone while the bony orifice is being enlarged. This can be done using a steady flow of a coolant.

Once an opening is done in the bone, a suitable sized curette is used to remove the pathological tissue. The concave portion of the curette should be facing the bone while the pathological lining is being separated from the bone. The curette can then be turned to scoop the lining out of the cavity.

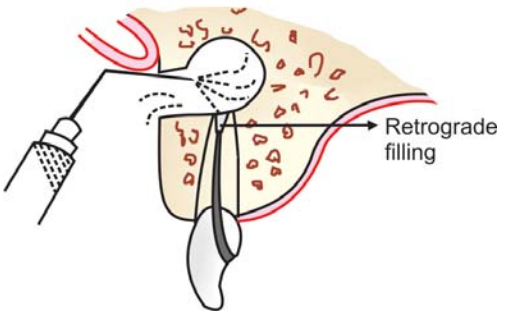


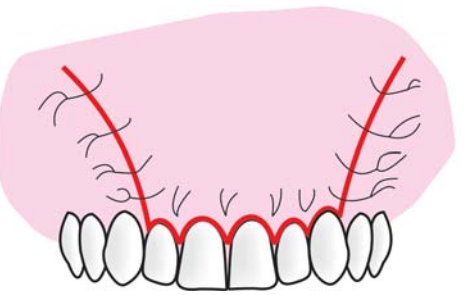


If some small amount of the pathological tissue can not be reached behind the root apex it should not cause great concern.

After the curettage is complete, a flat fissure bur is taken and the root apex cut, until the point where there is no unfilled or additional root canals. This should be at approximately one-third of the root length. Sometimes more.

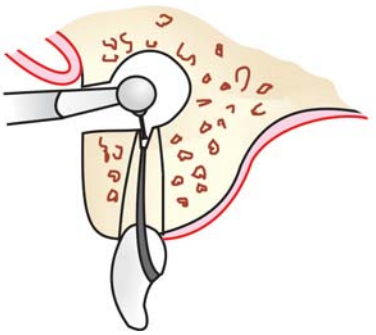
The surgical site is then irrigated and the flap sutured back into position.





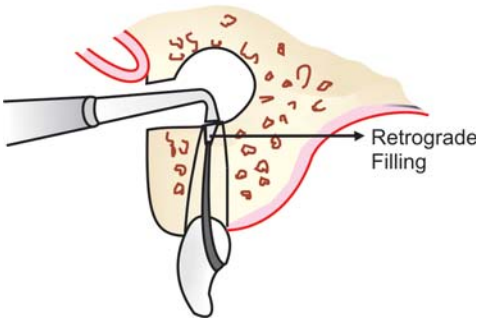
Retrograde Filling/root End Preparation and Filling

If retrograde filling is indicated, as in case of an inadequate apical seal, then after cutting of the root apex, the root end preparation may be done by using a slow speed, specially designed microhandpiece or by ultrasonic tips.



This prepared cavity is then filled with materials that seal well, are tissue tolerant, are easily inserted, they must also be stable and nonresorbable.

For example, Miniral Trioxide Aggregate (MTA), Super ethoxybenzoic acid (Super EBA) zinc free silver amalgam, gutta-percha, glass inomer cement etc.



After the retrograde filling is done the surgical site is cleaned of any debris or remnant filling materials and the mucoperiosteal flap sutured back.

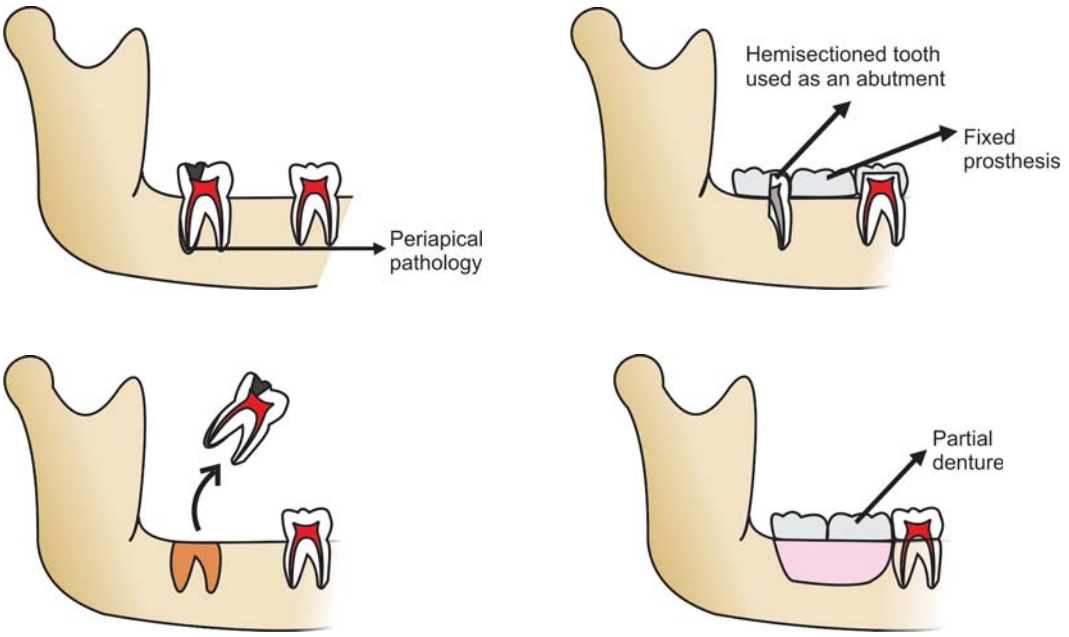
HEMISECTION/ROOT RESECTION/ROOT AMPUTATION

Root amputation is done in a molar tooth, with severe periodontal defect or a periapical defect caused due to root caries, root canal perforation etc. involving only one of its roots and its remaining roots are in good condition.

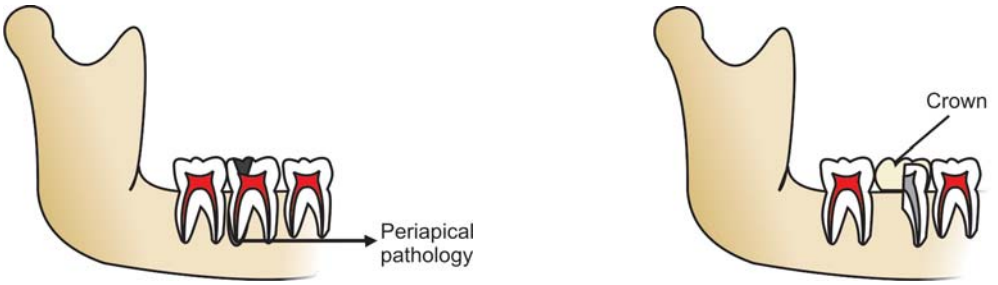
Advantage

The advantages of performing this type of surgeries are:

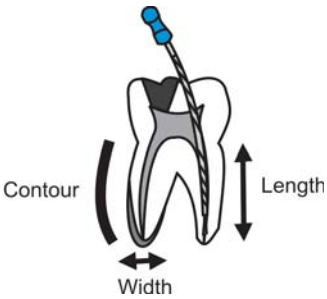
- If the tooth is the last standing molar in the dental arch, and if the preceding tooth is missing, then hemisection will enable the dentist to place a fixed prosthesis rather than the patient having to wear a removable partial denture.



- If the tooth is a first or a second molar, then hemisection will enable the dentist to place a crown over it rather than implant, fixed partial denture or a removable partial denture.



Surgical Procedure



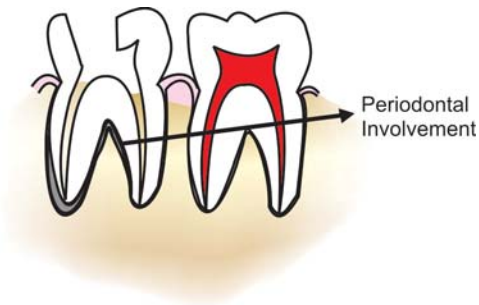
In this procedure either half the root, as seen in lower molars or one third of the root portion, as in the upper teeth is sacrificed, so that the remaining portion left is healthy and able to perform its role of mastication in the dental arch.

It is very important to note the length, width and height of the roots to get an idea of the remaining root strength.

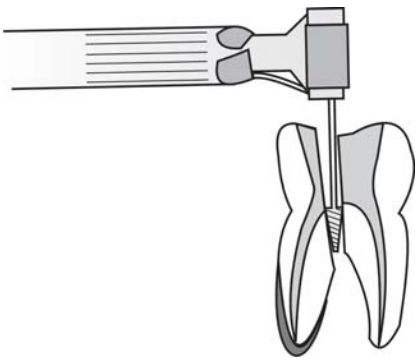
The tooth that is being subjected to hemisection should have its root canal filled prior to the surgery whenever possible. Also the occlusal height should be reduced so that heavy masticatory forces do not fall on the tooth soon after it is sectioned.

AMPUTATION IN MANDIBULAR TEETH

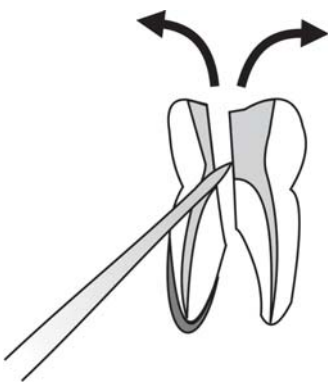
Teeth with Periodontal Defect



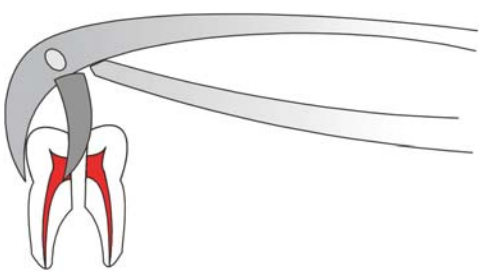
If the amputation is being done in a tooth that has periodontal defect.



It is not necessary to raise a mucoperiosteal flap. A flat fissure bur is used to vertically cut the tooth upto the furcation of the tooth.



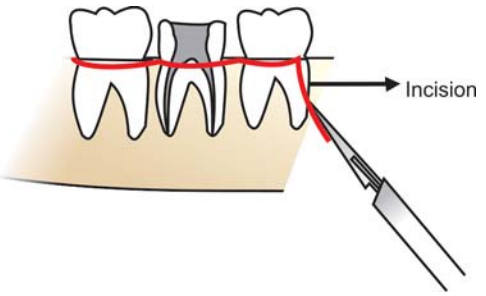
A straight elevator is then put in this cut and rotated. If both the segments move in the opposite direction it confirms complete separation of the tooth segments.

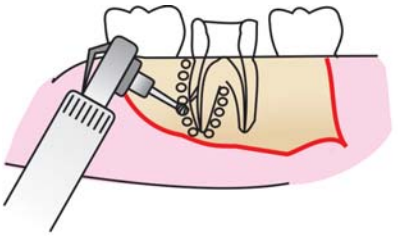


The root to be sacrificed can be elevated out of the socket using an angled elevator or an extraction forcep.

Tooth with Periapical Lesion

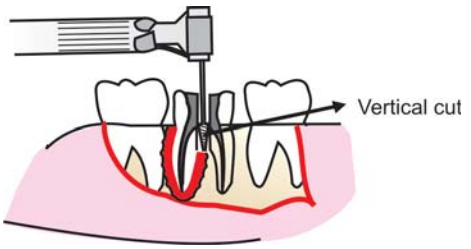
On the other hand if the root amputation is to be done in a tooth that has periapical lesion and a normal bone surrounding it, then a mucoperiostal flap is to be raised.

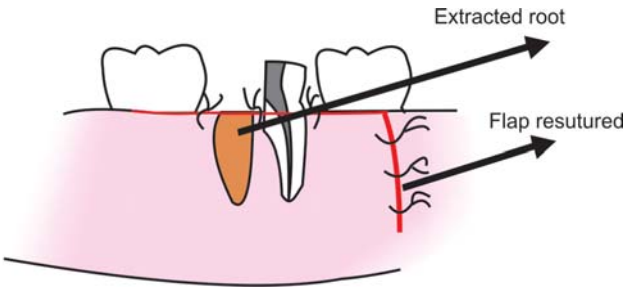




The bone surrounding the root to be amputated is removed using a bur and a steady flow of coolant like water or saline. The bone over the furcation of the tooth is also removed to enable direct visualization .

The tooth is then sectioned upto the furcation using a flat fissure bur. The complete separation of the roots should be confirmed using a straight elevator.

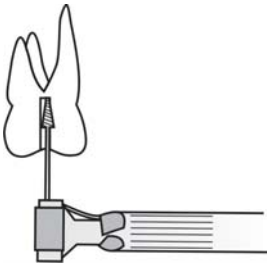




Once separated the amputated root should be removed. If there is obstruction while removal of the root, a further amount of bone can be removed in the direction of the root curvature to facilitate its removal without applying undue forces on the roots that are to be retained.

Amputation of the mandibular molar divides the tooth into two separate roots mesial and distal. One of these two roots is preserved.

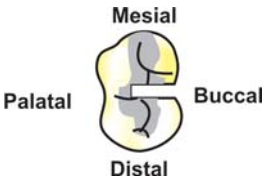
AMPUTATION IN MAXILLARY TOOTH



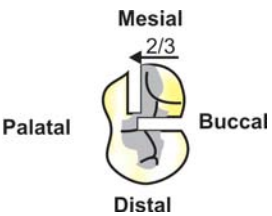
In case of a maxillary tooth one of the roots is sectioned out retaining the other two. Each of the three roots have a different position and so the sectioning is done differently for each one of the roots. The sectioning of the distobuccal root has the best prognosis.

1. For Amputation of the Mesiobuccal Root

A vertical buccal cut is made at the buccal groove. This is deepened a few millimeters towards the center of the tooth.

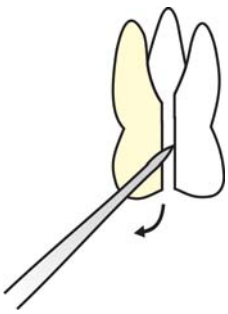


Then a mesial cut is made at about 2/3 of a distance away from the buccal surface. This cut is also carried a few millimeter towards the center of the tooth.



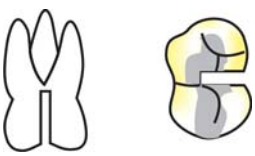
These two cuts are joined and deepened.

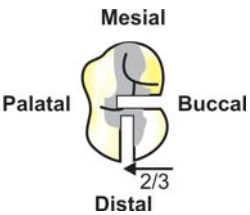
A straight elevator is used to confirm the separation. Once down the crown is contoured and the root is removed.

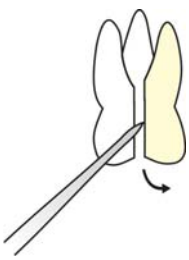


2. Amputation of Distobuccal Root

A vertical buccal cut is made at the buccal groove. Then the distal cut is placed half the distance between the buccal and palatal surface. These two cuts are connected is confirmed that portion of crown and root is removed.



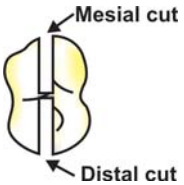


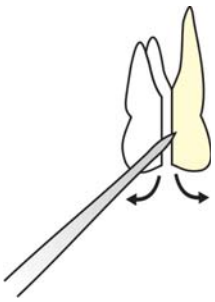


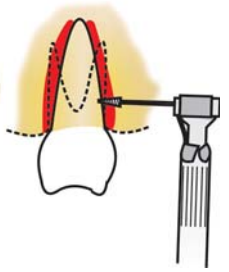
3. Amputant of a Palatal Root

A full thickness mucopostal flap is raised. Mesial and distal cuts are used to separate the palatal root from the buccal roots. The elevator to confirm the separation is used with care or the buccal roots might get loosened.

A tapered fissure carbide bur is used to remove the bone mesial and distal to the palatal root before trying to extract the palatal root.

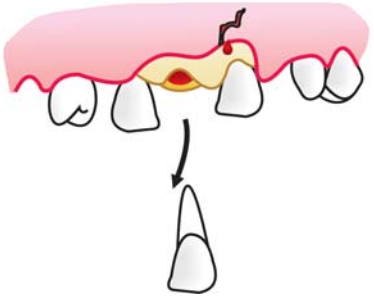


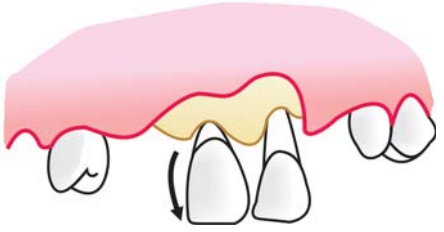




REIMPLANTATION

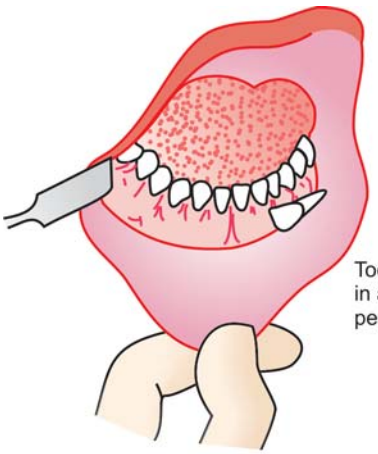
During trauma, it is the maxillary central incisor of both the primary and the permanent dentition that is most often avulsed out of the socket. Often it is just a single tooth but sometimes multiple teeth along with fracture of the alveolus and laceration of the mucosa is seen.



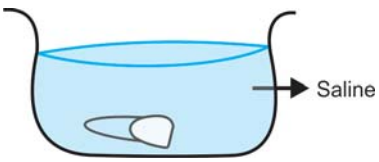


Avulsed teeth

If information about the injury is given before the patient is brought to the clinic, the patient or his attended should be asked to put the exfoliated tooth into the socket of the patient if he/she can do it. Otherwise the accompanying person should put it in his own mouth and rush the patient to the dental clinic.

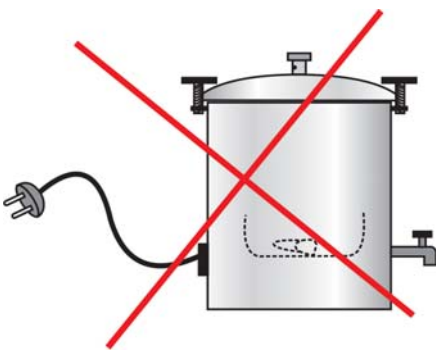


Tooth preserved in accompanying persons mouth

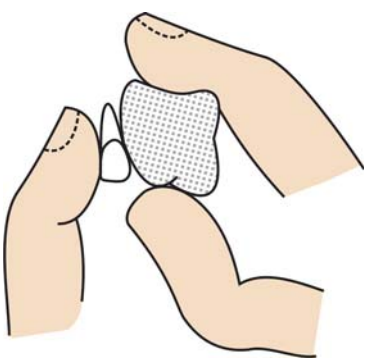


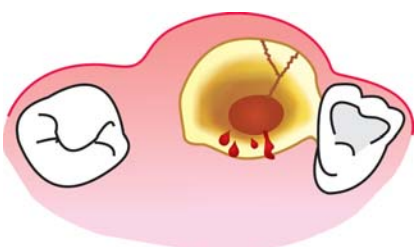
It is important to do the replantation procedure within two hours of injury. If it is decided that the tooth should be replanted, then it is to be placed in saline.

The tooth should not be scrubbed clean nor should it be sterilized as this would destroy vital periodontal tissue and cementum.

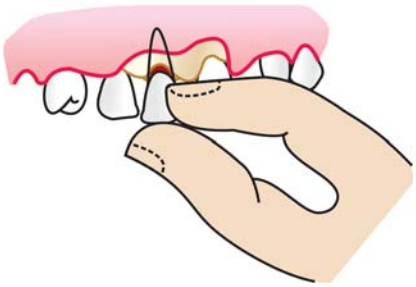


The tooth should only be cleaned with a gauze soaked in saline. The tooth socket should be examined carefully for any fracture or debris.

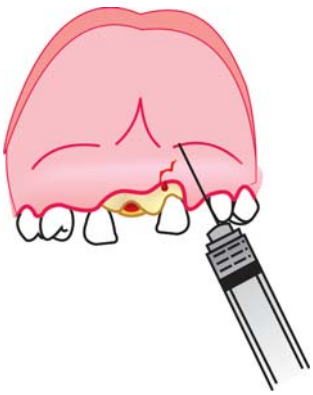




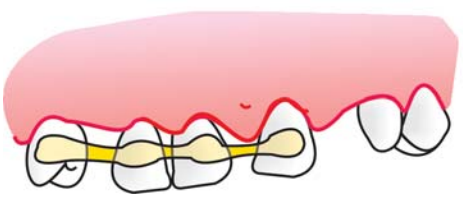
If fractured then the fractured segment should be repositioned. The avulsed tooth should then be carefully placed into the socket using digital pressure. It is not necessary to remove the blood clot as it escapes along the root surface during the replantation procedure.



Local anaesthesia will be required only if suturing is required.



The splinting of the tooth should be done for a short period of time. As long time period of immobilization will lead to root resorption. There are different types of splinting techniques available.



For example:

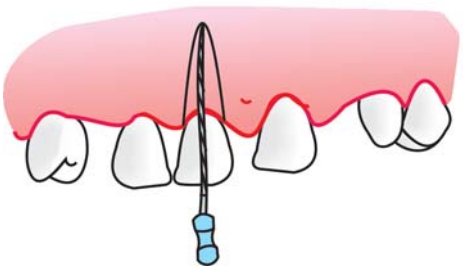
- Acid-etch/ resin splint
- Orthodontic band/bracket and resin splint
- Interdental wiring
- Arch bar
- Cast silver cap splint etc.

The position of the tooth in the arch and socket should be examined by postoperative radiograph and by checking occlusion.

After the splinting period is over it should be carefully removed as the tooth is still loose in its socket.

Nowadays endodontic treatment is started two weeks after replantation in order to halt the development of inflammatory resorption as well as allow re-formation of periodontal ligament fibers.

Postoperative radiographic follow-up should be done at regular intervals.



Chapter

17 Implant

DEFINITION

It is a device of biocompatible material(s) placed within or against the mandibular or maxillary bone to provide additional or enhanced support for a prosthesis or tooth.

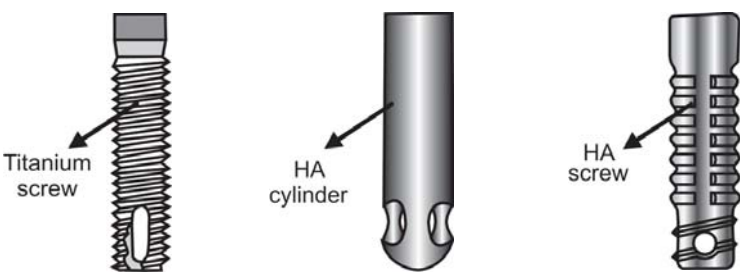
Different *commercial systems* are available. They are a specific line of implants e.g. Nobel Biocare/Steri-Oss, Innova, Friadent, Uni tie etc. Various implant configurations are found in each system. These modalities are root forms, plate/blade forms, subperiosteal, endodontic stabilizers, and intramucosal inserts.

Classification of Implants

I. Endosteal Implants
   i. Root Form
   ii. Plate/Blade Form
   iii. Endodontic Stabilizer Implants
   iv. Ramus Frame Implants
II. Subperiosteal Implants
III. Intramucosal Implants

1. Root Forms

Root form implants are designed to resemble the shape of a natural tooth root. They are circular in cross-section. They can be threaded, smooth, stepped, tapered or parallel



Some root types of implants

sided. They can be with or without coating, with or without grooves or a vent. Root forms must achieve osteointegration to succeed, therefore they are kept nonfunctional until healing and osteointegration has taken place. Therefore most root implants are two stage implants. Stage one, is submersion or semisubmersion for the afunctional healing and the 2nd stage is the attachment of an abutment or retention mechanism.

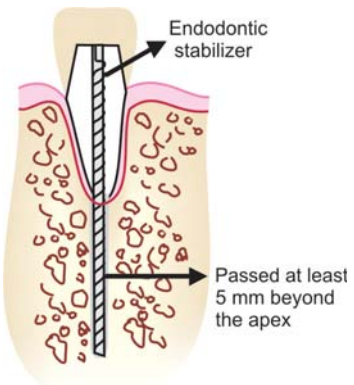
A root form can be placed anywhere in the mandible or maxilla where sufficient bone is available.

2. Plate/Blade Forms

The shape is similar to a metal plate or blade in cross-section. Some have a combination of parallel and tapered sides. These are of one stage or two stage varieties. The two stage blade implants use "osteointegration" mode of tissue integration whereas one stage types use "osteopreservation" mode of tissue integration. These implants can be placed in a wider range, especially in the posterior ridges.

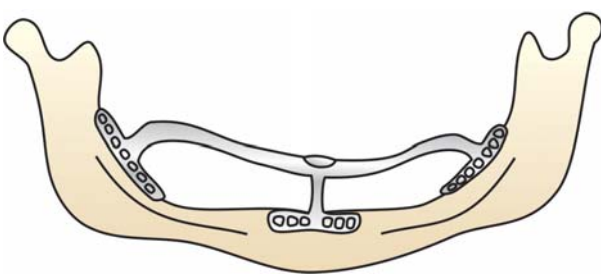
3. Endodontic Stabilizer Implants

Although they are endosteal implants they differ in that instead of providing additional abutment support they are used to extend the functional length of an existing tooth, root to improve its prognosis. These implants have been designed with parallel or tapered sides, smooth or threaded. It functions in osteopreservation mode because the tooth, root through which it is inserted is subjected to normal physiologic micromovements. This implant can be put in a single sitting as the final step of conventional endodontic treatment. They require at least 5 mm of bone beyond the apex of the tooth that is to be implanted.

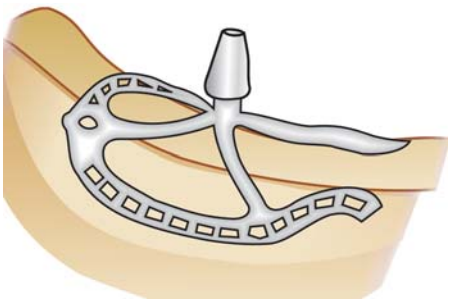


4. Ramus Frame Implants

They are used in patients with severe ridge resorption. Posteriorly on each side, an endosteal extension inserts into the available bone within each ascending ramus. Anteriorly the bar is continuous with a plate/blade form which is inserted in the available bone in the symphyseal region. These are very technique sensitive.

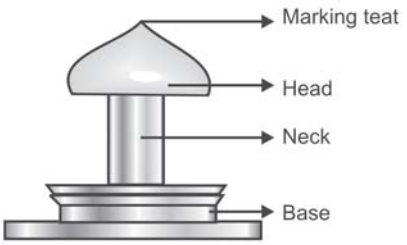


5. Subperiosteal Implants



These implants are placed under the periosteum and against the bone. These are used in patients with insufficient volume of bone. These implants can be used anteriorly and posteriorly in both the mandible and maxilla. These implants span a severely resorbed edentulous area between remaining natural teeth.

6. Intramucosal Inserts



These are mushroom shaped titanium projections that are attached to the tissue surface of a partial or total removable denture in the maxilla. They provide support for the prosthesis but do not provide abutments. These implants do not come in contact with the bone.

Indications

Any edentulous ridge. Patients having a single tooth lost or those with complete teeth loss.

Contraindications

i. Patients having uncontrolled diabetes mellitus.
ii. Patients maintaining very poor oral hygiene.
iii. Patients that are chain smokers.
iv. Patients with acute psychotic disorder.
v. Patients having a history of radiation less than a year back.
vi. Metabolic disorder.
vii. Underlying bone atrophy due to abnormal stress.
viii. Poor patient acceptance and co-operation.
ix. Patients with cardiovascular disease, taking blood thinning drugs and patients with uncontrolled hematological disease, such as anemia, hemophilia any other acquired coagulant disorder.
x. Patients with bone disease, Paget's disease, fibrous displasia etc.
xi. Granulomatous disease eg. Tuberculosis.
xii. Autoimune disease, patients on long term steroid are not absolute contraindications but should be assessed carefully.

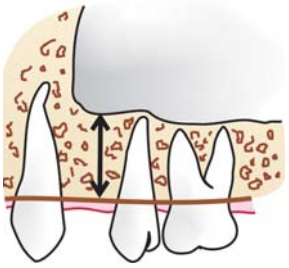
Diagnostic Aids

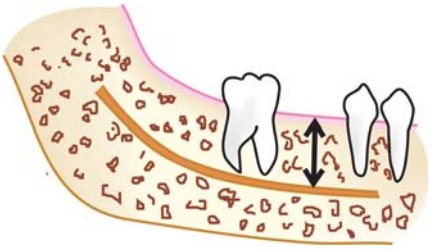
The basic diagnostic aids are IOPA X-Rays Orthopentamogram (OPG) X-Ray, Denta CT (denta scan).

TREATMENT PROTOCOL

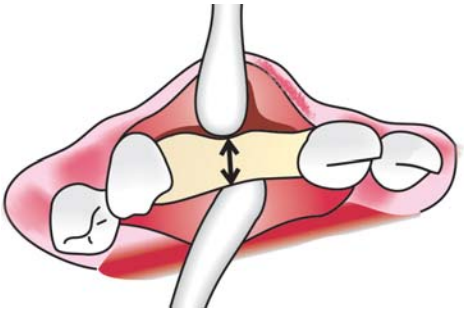
- Prophylaxis is recommended within 2 weeks before the insertion of the implant.
- Identify and quantify the volume of available bone. This is achieved with relevant radiographs, model studies etc.
- For selecting the right size of the implant, the bone should be examined for its height, width, length and angulation:

i. *Bone height:* It is the height of available bone from the crest of the edentulous ridge to the opposing landmark, like the maxillary antrum or the nasal aperture or inferior alveolar canal.

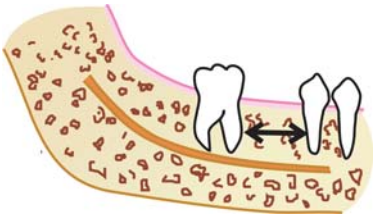




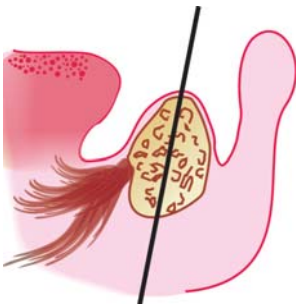
ii. *Bone width*: The bone width is measured at the crest where the implant is to be inserted. It is the labio-lingual bone size. It should be at least 1 mm more than the implant width, this is required so that at least 0.5 mm of crestal bone is available around the inserted implants.



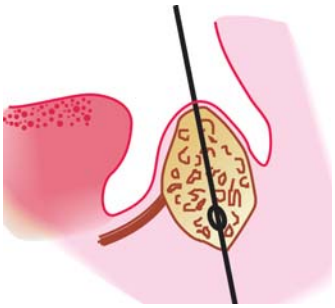
iii. *Bone length:* This is the mesio-distal length of the bone and is generally limited with the roots of the adjacent teeth. This measurement is also very important in selecting the size of the implant that can be inserted.



iv. *Bone angulation:* The angulation of the mandibular bone changes from region to region. At the premolar area it is more or less vertical, at the anterior region the crowns are more labially placed and the roots are inclined lingually. Whereas the molar crowns are inclined lingually.



Anterior region

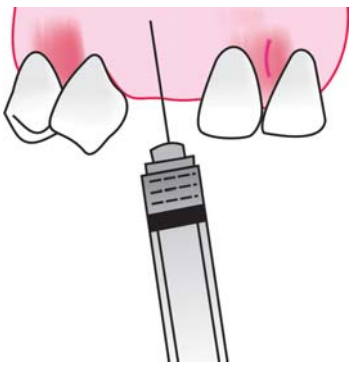


Molar region

SURGICAL TECHNIQUE

Anesthesia

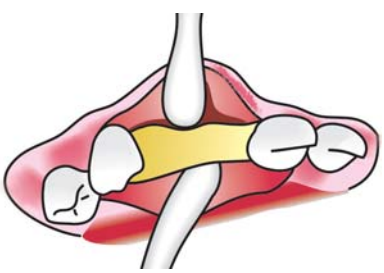
The area where the implant is inserted is anesthetized by giving an inferior alveolar nerve block and/or infiltration of local anesthesia.



Incision

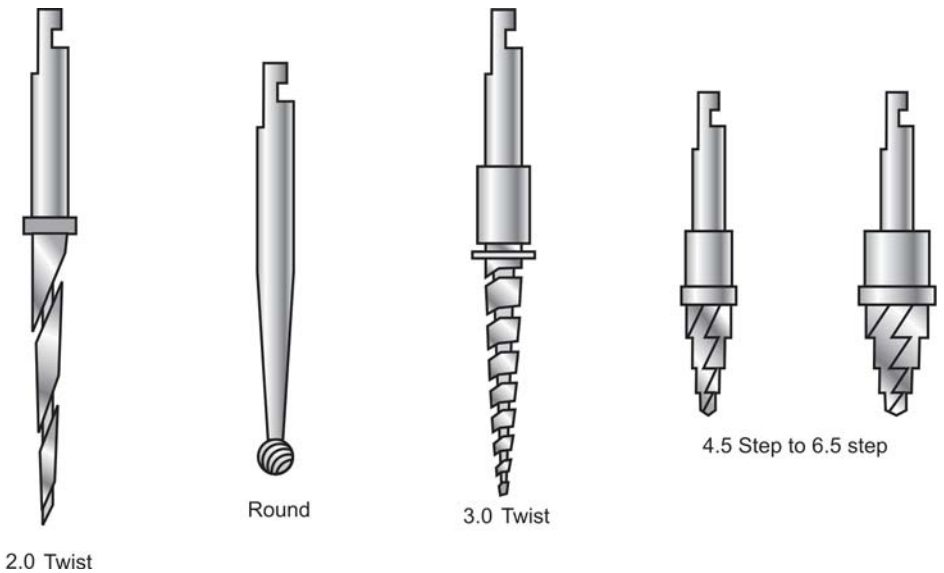
An incision is given on the attached gingiva on the buccal side. It should incise the periosteum. The extent of the incision should be between and through the gingival cuffs of the two adjacent teeth.

Care is taken to reflect the mucoperiosteum so that there is no tear in it. Labial flap is elevated 1st, next the lingual flap is raised. Once the implant is placed the lingual flap covers the implant to get sutured on buccal side.

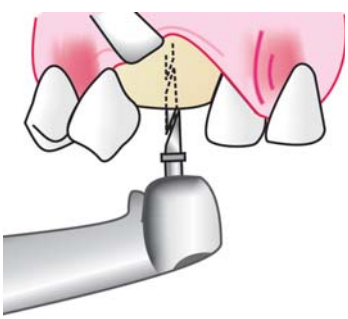


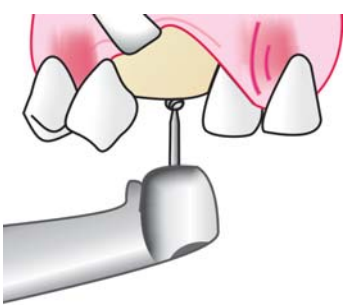
Drilling Considerations

- A high-quality, low-speed, high-torque drilling unit with control of speed and coolant is required.
- During the drilling procedure, care is taken not to exceed 2000 rpm at high speed and 40 to 50 rpm at low speed.
- Internal irrigation with normal saline is done so that the temperature of the bone being drilled does not rise, it should never exceed 43 degree, otherwise necrosis at the bone implant interface will take place.
- The osteotomy is done using a series of twist drills, pilot drills, depth drills, a counterbore, and a thread former.



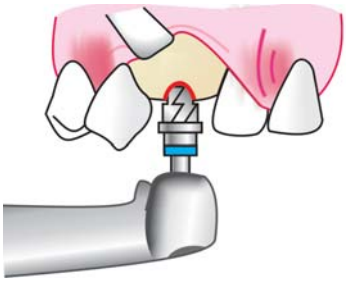
The twist drill 2.0 is inserted 1st this mentally establishes the angle at which the drill is to be held as it penetrates the bone.

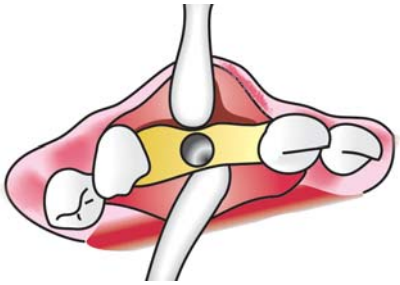




The round drill is positioned at the opening of the drill hole created by the twist drill. It is used at a speed of 800 to 1000 rpm upto the depth stop.

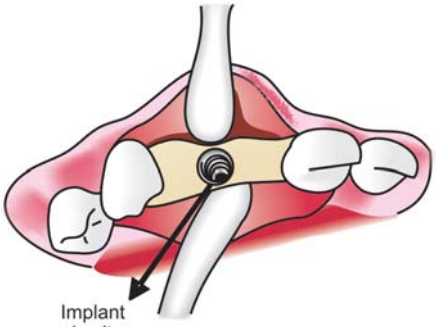
Then *the sequential sizes of the step drills* are used until the size of the implant to be inserted is achieved.

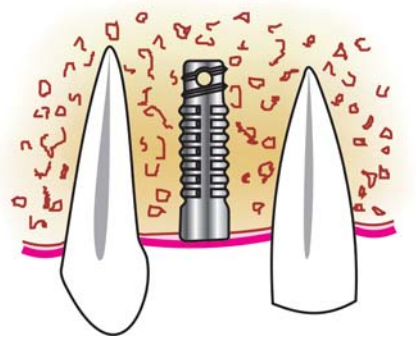




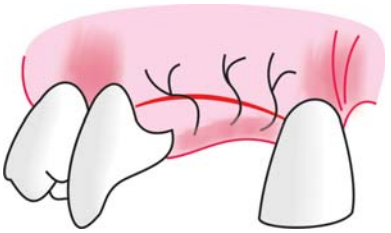
Insertion of root from implants: The implant is then withdrawn from the inner vial and placed in the prepared site. It should not be brought in contact with any other surface.

The implant is then seated with the help of a ratchet, by giving gentle clock wise rotation into its final position. If required the implant is then malleted into its final position with several sharp taps.





The sealing screw is then placed on the implant after the transfer assembly has been removed.



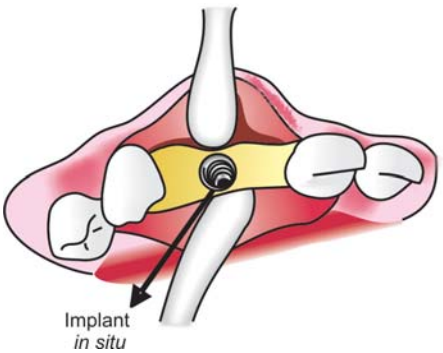
Suturing is then done to close the implant site.

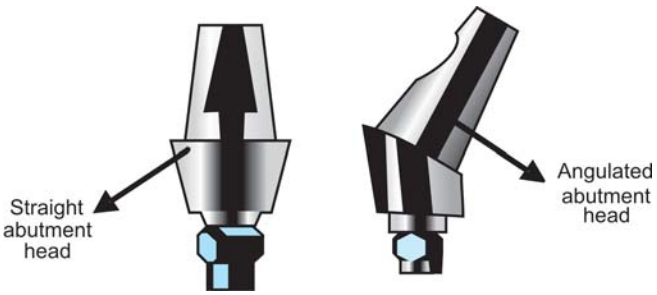
Postinsertion home care instructions are then given which include medication of antibiotics and analgesics. Patient is asked to maintain proper oral hygiene, have soft diet and avoid chewing on the implant site. Sutures are removed after healing of the mucosa takes place.

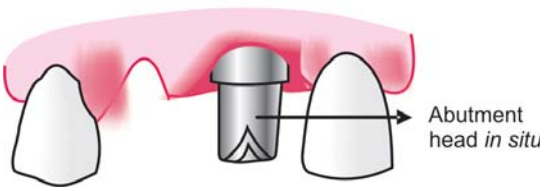
Restorative procedure is to be stared after a 24 weeks (4 months) healing period in mandible and 6 months in maxilla. The implant can then be exposed for the crown/bridge preparation.

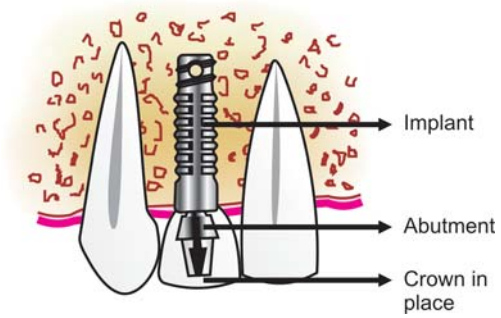
Local anesthesia is injected, the implant is exposed. Then the cover screw/healing collar is removed. Then the gingiva former is attached to the implant and is left in place for 15 days.

After which the gingiva former is removed and either straight or angulated abutment head is attached to the implant for the final loading.









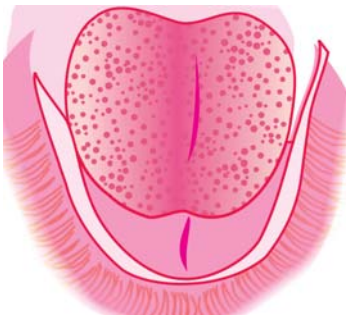
IMPLANTS FOR EDENTULOUS PATIENTS

In an edentulous patient, when an implant retained overdenture is required, methods that can be used are:

a. Bar-retained removable over denture
b. Ball and socket removable over denture
c. Cemented fixed bridge
d. Screwed-in fixed bridge

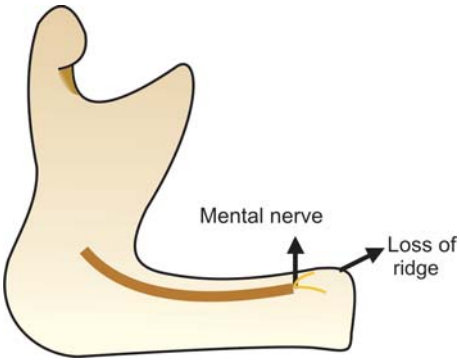
As these patients have a poor ridge.

BAR-RETAINED REMOVABLE OVER DENTURE



Indications

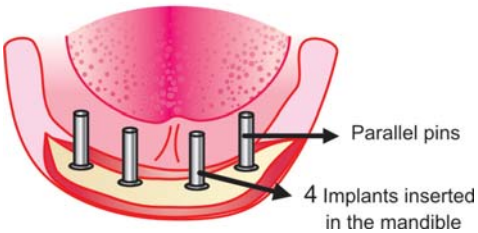
- Patients that have poor ridge, specially those that have difficulty in wearing denture (seen in lower denture).
- Those patients that have gagging sensation while using the upper denture.

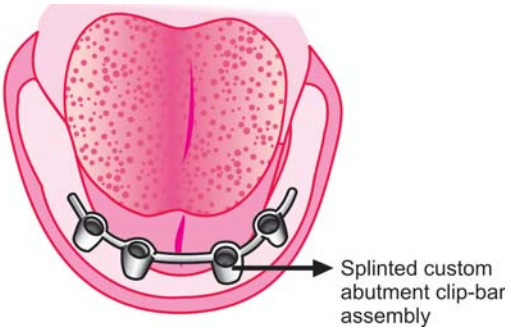


- Patients that are old denture wearers, sometimes have severe bone loss. These loose their alveolar ridge height such that the mental foramen comes to lie high up on the arch, which then causes pain, due to compression of the mental nerve on wearing conventional denture.

Features

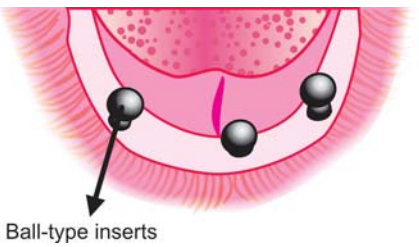
- For the placement of bar-retained overdenture it is necessary to implant 4-6 implants.
- It is important to try and maintain parallelism between them.
- Waiting period of 4-6 months is required. In the meantime, a temporary denture can be worn that does not put pressure on the healing implants.





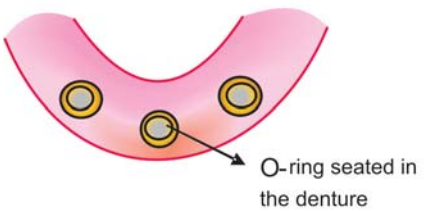
- Following trial seating, margins and adaption the splinted custom abutment clip bar assembly is fixed into position with coronal screw.

BALL AND SOCKET REMOVABLE OVER DENTURE



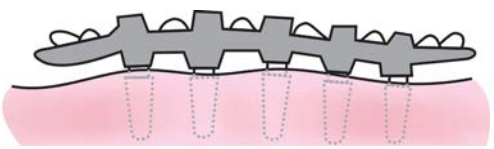
For this type of over denture 2 to 4 implants are required. It is better suited to mandible rather than maxillary denture. The implants have "ball-like" inserts that are screwed or cemented into them.

These inserts then fit into 'O-ring' that are the recipients that are fitted onto the inner surface of the denture. This ball and socket type of arrangement gives the patient a very stable removable denture.

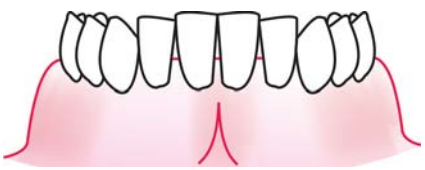


Cemented Fixed Bridge

In this type of prosthesis the patient is very comfortable as crowns are fitted on to the implants that give the patient a very comfortable feel. The number of implant needed are more.



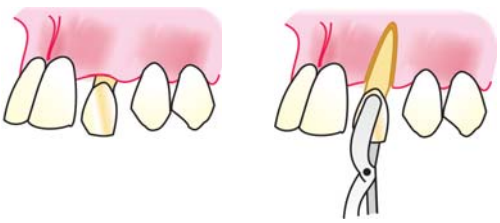
Bridge type implants for edentulous ridge

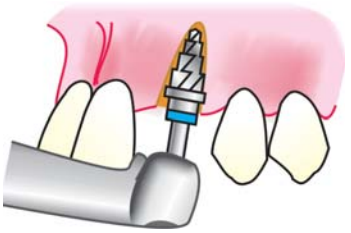


Cemented crowns

Implant Placed Immediately after Extraction

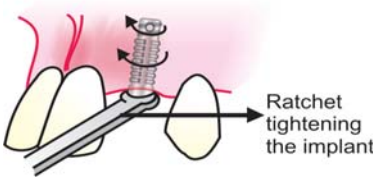
i. An atraumatic extraction is done, preserving the alveolar bone around the site of extraction.

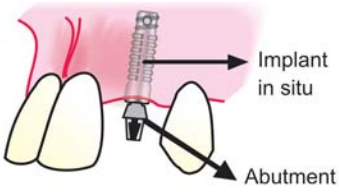




ii. Then the surgical site is prepared according to the sequence of drilling till the appropriate size has reached.

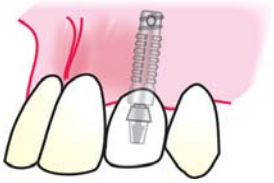
iii. Then the threaded implant is delivered into the osteotomy site and tightened using a ratchet.





iv. The selected abutment of appropriate emergence and angle is then seated onto the implant. This can only be done if the primary stability of the inserted implant is satisfactory.

v. Preparation of a provisional prosthesis is done. The screw holes of the implant are occluded and then the crown is fixed with a temporary cement. Care is to be taken not to have occlusal contact.



vi. Wait for 4 to 6 months, then remove the temporary crown. Record the final impression and send it to the lab for its fabrication. For the time being the temporary prosthesis is reseated.

Chapter

18

Orthognathic Surgery

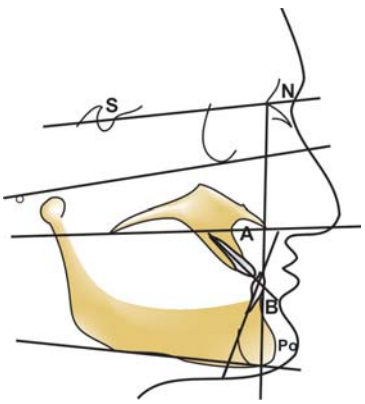
The word ortho means straight, nathic means face. Hence, the orthognathic surgery is the surgery of the facial skeleton that can radically alter function and appearance of the face; often undertaken in collaboration with specialists in orthodontics and prosthodontics.

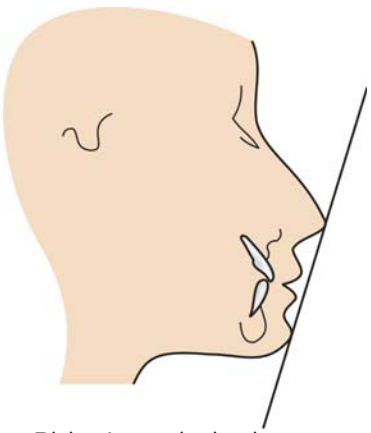
The purpose of orthognathic surgery are to:

- Improve the facial skeleton thereby improving the facial appearance.
- Correction of dental malocclusion.
- Long term stability.

For this purpose it is very important to do preoperative prediction for which different methods are available, some are listed:

1. *Cephalometry analysis:* Radiographs of the patient are taken and tracings of some fixed anatomical locations are drawn. Then these measurements are compared to the standards available. The areas of deficiencies or excesses are then calculated.

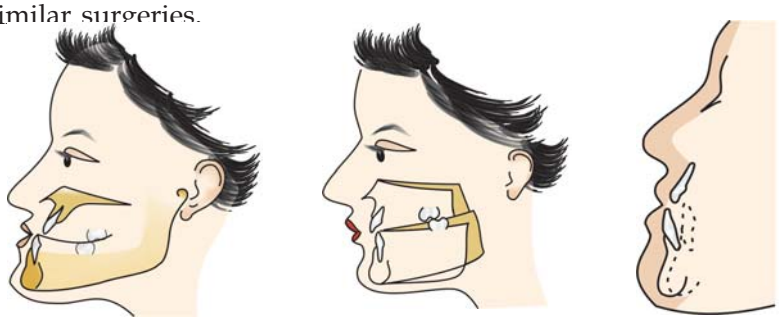




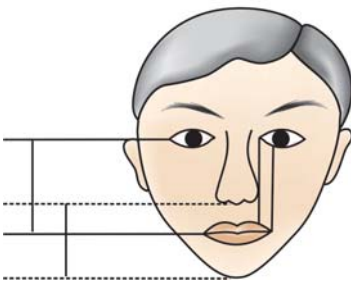
Rickett's aesthetic plane

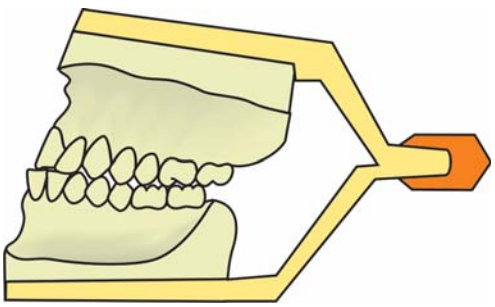
2. *Profile analysis:* The profile of the patient is compared to the standard profiles. Profile analyses of Ricketts, Steiner, etc. are based on good looking faces. Therefore this analyses will give a good idea of the defects of the patients face in profile.

3. *Photocephalometric prediction:* In this technique Cephalometry is applied on lateral photographs and prediction is made on the effects of different ostetotomy cuts. Profile planning is a reasoned prediction of the probable effects of alternative facial osteotomies on facial profile, and the use of the resulting predictions to formulate a treatment plan. These prediction of results are based on the study of previous similar surgeries.

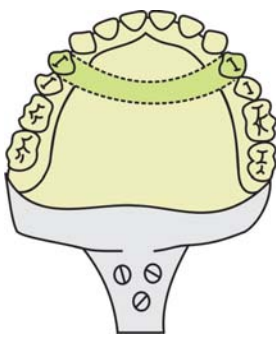


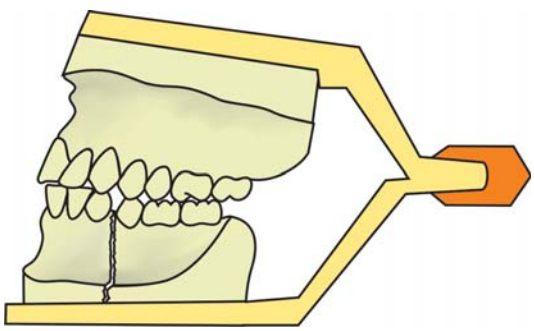
4. *Full face analysis:* The face is analyzed from the front. There are some clinical proportions that make the face appealing to the viewer and symmetrical in appearance, e.g. the distance from the outer canthus of the eye to the angle of the mouth should be equal to the distance from the nasal columella to the chin. Or that the lateral edge of the alar rim should lie vertically below the medial canthus of the eye, etc.



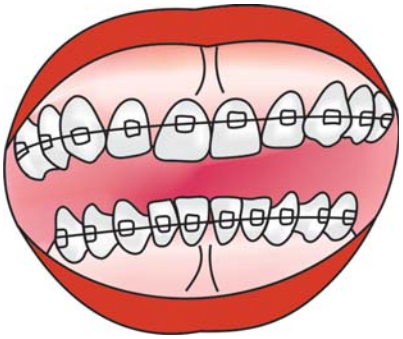


5. *Model planning:* It is another very important method used for presurgical analysis. In this patients full mandible and maxilla models are made, occlusion checked. Then mock surgeries are done on these models and predictions made on the effects of the different surgical procedures.





6. *Orthodontic prediction and role:* It is very essential that the orthodontist examines the patient and makes a plan for the stabilization of the occlusion. The orthodontic work can be started preoperatively, and will have to continue post-operatively.



VARIOUS OSTEOTOMY PROCEDURES

A. Mandibular body osteotomy
   1. i. Anterior body osteotomy
      ii. Posterior body osteotomy
      iii. Midsymphysis osteotomy
   2. Segmental subapical mandibular surgeries
      i. Anterior subapical mandibular osteotomy
      ii. Posterior subapical mandibular osteotomy
      iii. Total subapical mandibular osteotomy
   3. Genioplasties
      i. Augmentation
      ii. Reduction
      iii. Lengthening
      iv. Straightening

B. Mandibular ramus osteotomies
   1. Sagittal split osteotomy
   2. Subcondylar ramus osteotomy
      i. Extraoral
      ii. Intraoral
      iii. Arching or subsigmoid

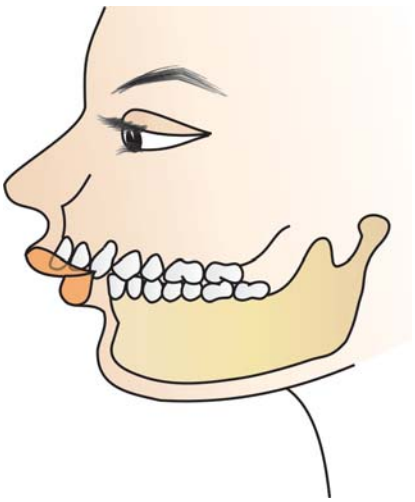
C. Maxillary osteotomy procedures
   1. Segmental maxillary osteotomy procedures
      i. Single tooth dento-osseous osteotomy
      ii. Interdental osteotomies
      iii. Anterior maxillary osteotomy
      iv. Posterior maxillary osteotomy
   2. Total maxillary osteotomy
      i. Lefort I osteotomy
      ii. Lefort II osteotomy
      iii. Lefort III osteotomy

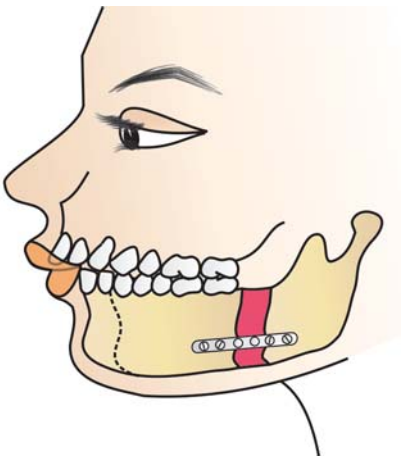
SAGITTAL SPLIT RAMUS OSTEOTOMY

Indications

1. Symmetric and asymmetric mandibular advancement.
2. Symmetric mandibular setback.
3. Minor asymmetric mandibular setback.
4. Vertical lengthening of ramus.

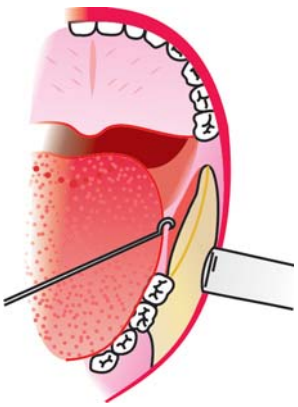
The basic principle of the modified sagittal osteotomy is to maintain the proximal portion of the ascending ramus in a normal anatomic position with virtually all the associated soft tissue remaining attached, yet permitting unrestricted anterior, posterior, and vertical movement of the distal segment. Significant, horizontal rotations are not recommended, because they cause asymmetric flaring of the proximal fragments.

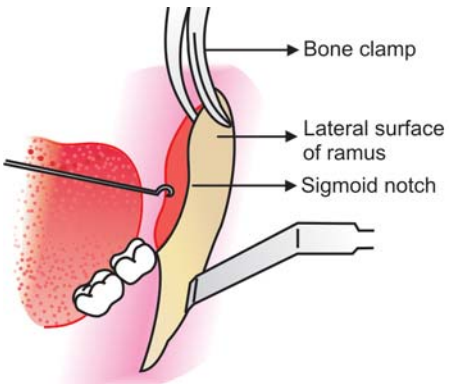




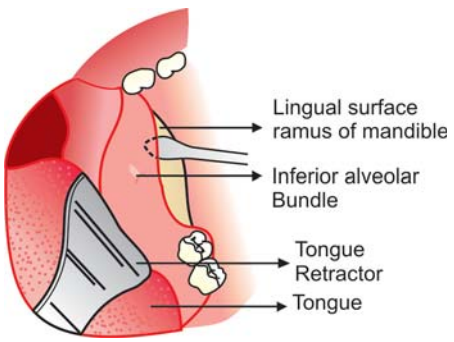
An incision is made down to the bone on the lateral aspect of the anterior border of the ramus approximately over the external oblique ridge from midway up the ascending ramus downward into the depth of the vestibule to about the mandibular 1st molar.

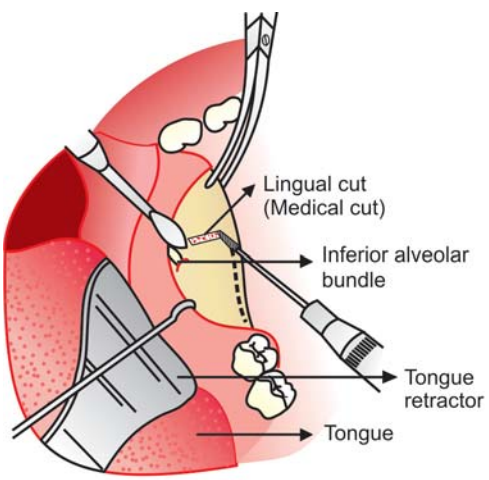
The soft tissue is dissected subperiosteally along the anterior border of ramus upto the coronoid process. The sigmoid notch is identified, and a bone clamp is placed high on the coronoid process to retract the soft tissue.



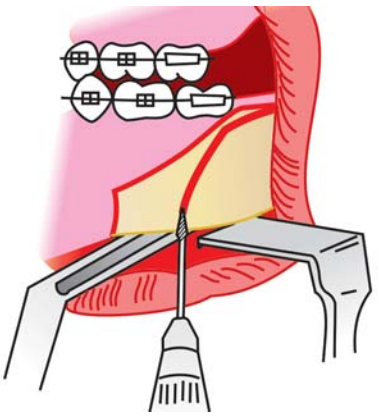


Medially the soft tissue are reflected subperiosteally until the lingula and inferior alveolar neurovascular bundle as it enters the mandibular foramen is identified.

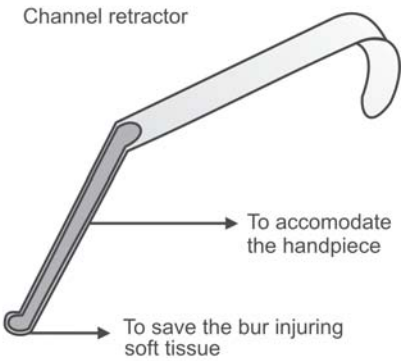


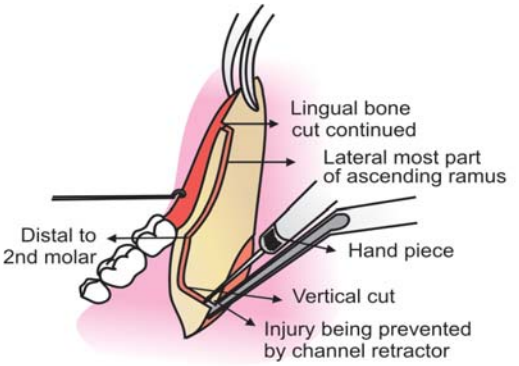


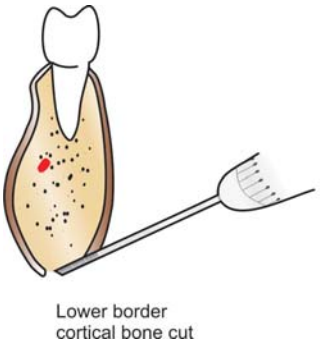
At this stage the medial bone cut is made through only the lingual cortex and extends just posterior and superior to the lingula. Care being taken to cut through the lingual cortex for a proper split. The bone cut is then continued down the lateral aspect of the anterior border of the ascending ramus to the region of the 2nd molar. This osteotomy is made parallel and directly adjacent to the lateral cortex.



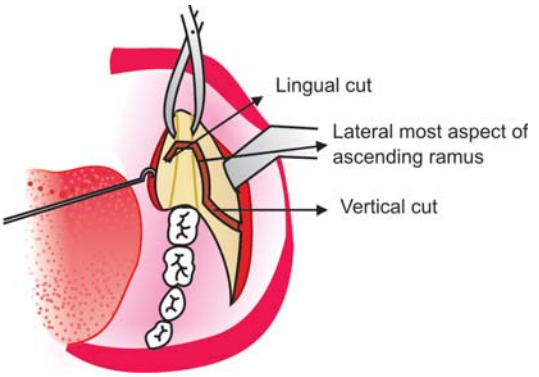
The periosteum is elevated from the lateral aspect of the mandible. A channel retractor is inserted beneath the inferior border of the mandible. Then the vertical osteotomy cut is made lateral to the second molar.





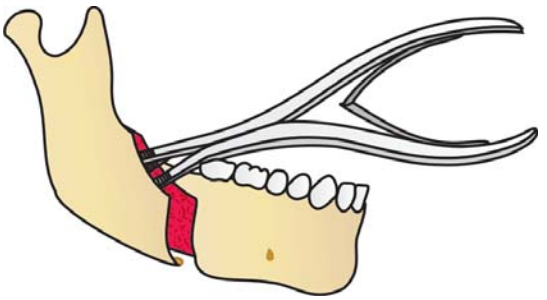


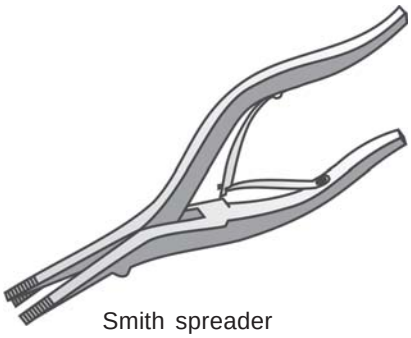
The cut is extended through both the cortical plates of the inferior border of the mandible.



All bone cuts are checked for their completeness.

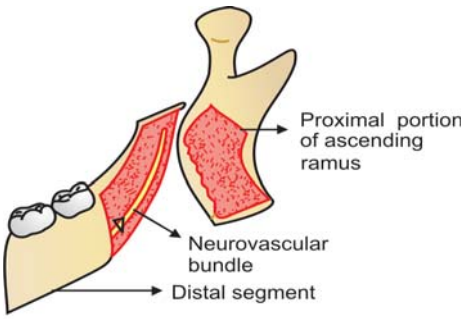
Then the Smith spreader is wedged into the cuts and the bones split carefully such that the two segments are separated along their entirety.



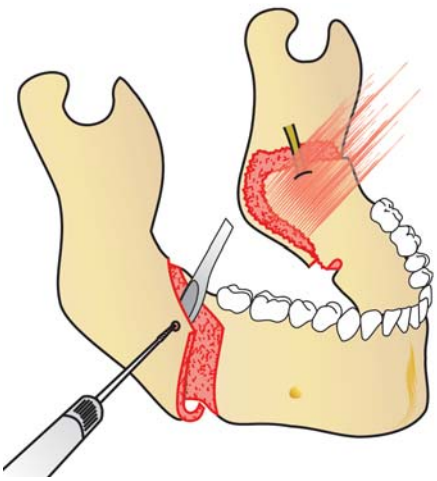


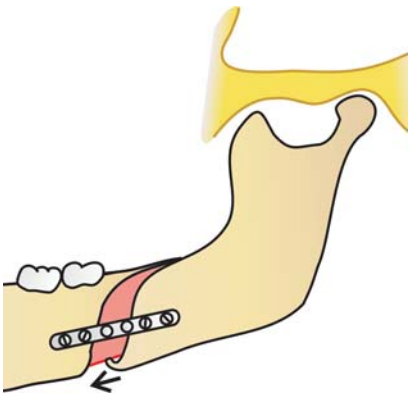
Smith spreader

A moist sponge is placed between the fragments, while the opposite side is similarly operated upon.



When deciding where the plate is to be placed, occlusal splint is inserted, intermaxillary fixation applied. Intraosseous holes are placed and plating done. IMF is maintained for 6 weeks.





GENIOPLASTY

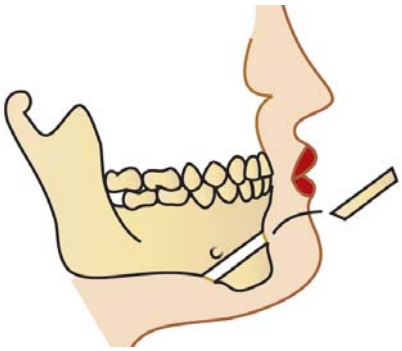
Definition

A surgical procedure designed to reshape the contour of the chin, usually by augmentation or reduction.

There are different types of surgeries that give different results such as:

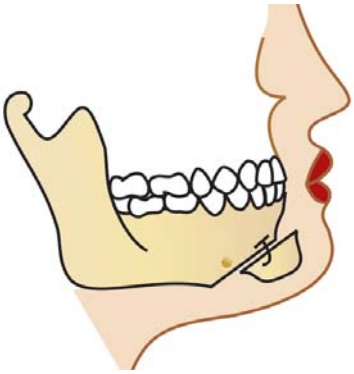
Lengthen

Vertical augmentation genioplasty



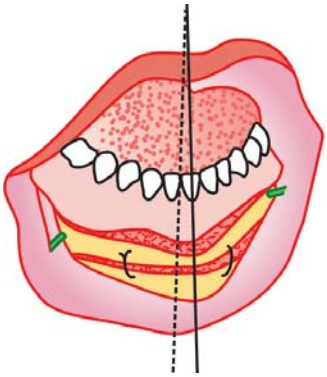
Reduce

Reduction genioplasty



Augmentation

(Advancement genioplasty)



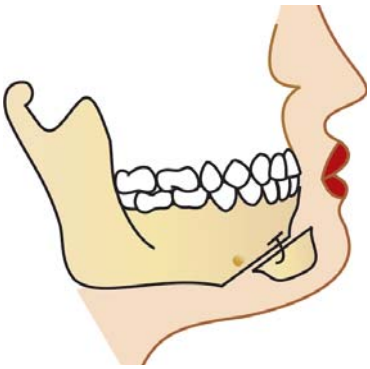
Straighten

(Rotation genioplasty for asymmetric chin)

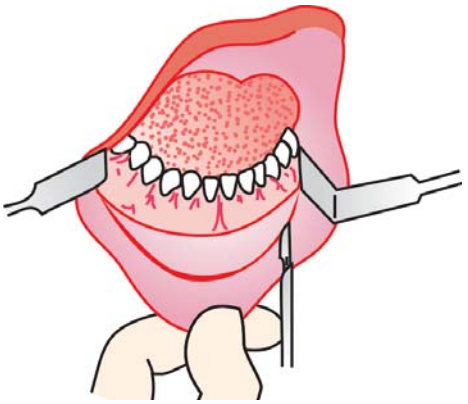
1. Advancement Genioplasty

Advancement is generally employed along with:

- Mandibular advancement surgery,
- Superior repositioning of the maxilla,
- Anterior maxillary surgeries,
- Mandibular subapical procedures
- Occasionally as an isolated procedure

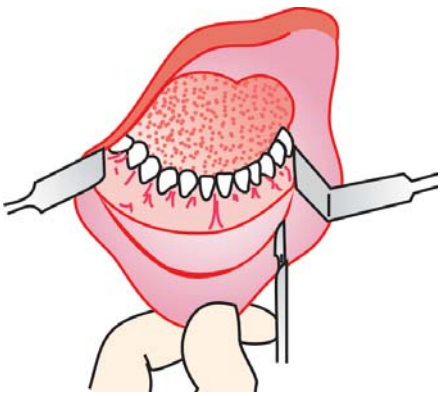


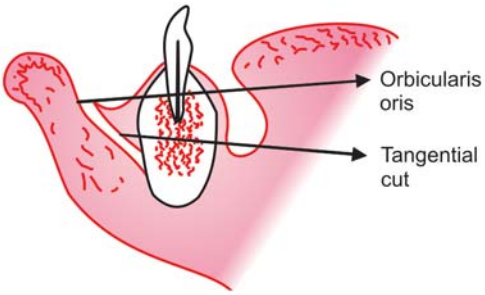
Surgical Procedure



The incision is made in the lower lip approximately 15 to 20 mm from the depth of the vestibule, in the midline with the lip extended.

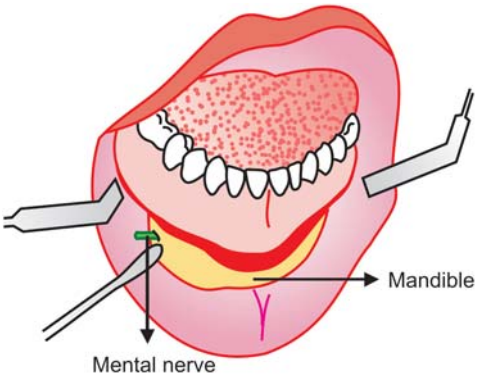
The incision extends laterally towards the depth of the vestibule in the cuspid area and is extended posteriorly, superior to the level of the mental foramen.

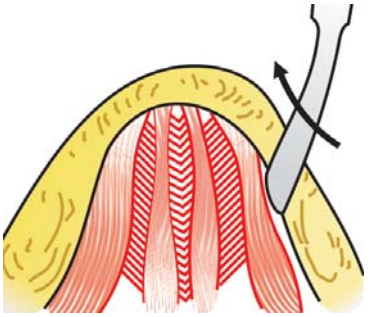




It is then carried into the orbicularis-oris muscle and then directed tangentially towards the mandible, this will permit for a two-layer soft-tissue closure later.

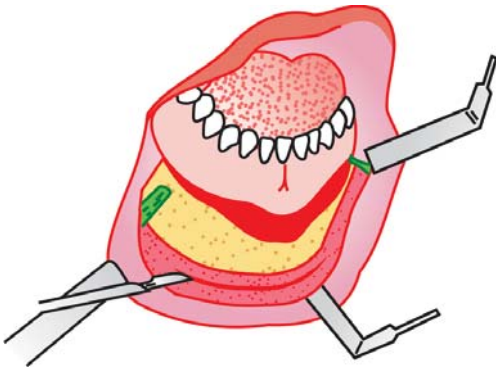
The entire inferior boarder of the symphysis is degloved by subperiosteal dissection. The mental nerves are exposed by dissecting posteriorly along the inferior border of the mandible in the bicuspid area and elevating the mucoperiosteum.

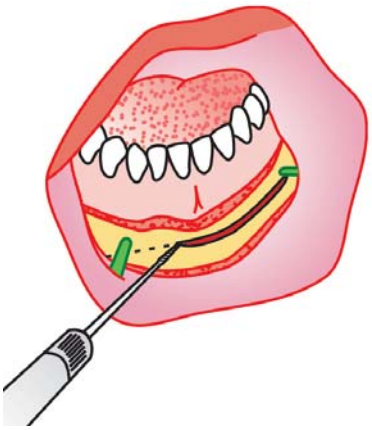




The digastric muscles may have to be rarely removed, only if the anterior sliding has to be too much. So as to reduce the muscle tension they otherwise would exert on the advanced bone.

The periosteum that has been reflected off the inferior border of the mandible is incised transversely to permit soft tissue relaxation to provide adequate coverage when the chin is advanced, so the lower lip height can be maintained.



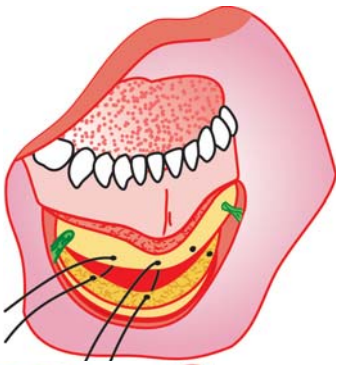


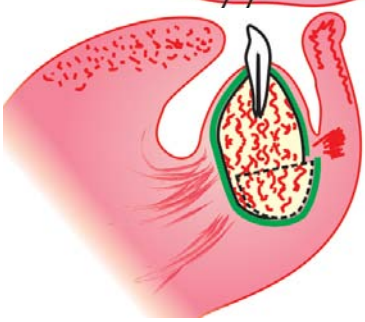
The horizontal osteotomy is made 4-5 mm below the apices of the cuspid and 3-4 mm below the level of the mental foramen.

The bone cut is completed through the labial cortex and the cancellous bone. The Smith spreader is then used to completely seprate the cut ends of the chin.

Any lingual cortical irregularities, which may prevent an even sliding, are removed under direct visualization.

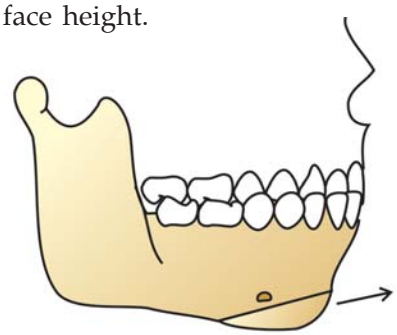
The segment is then stabilized. Holes are made through the lingual cortex of the mobilized segment and buccal cortex of the stable segment. The lateral holes in the inferior segment are placed distal to the superior holes, so the wire, as it is tightened, pulls the mobilized portion of the chin forward to the desired degree ***or*** plates are bent and adjusted according to the amount of forward movement of the inferior segment and then plating done.



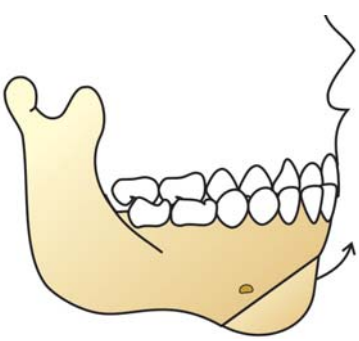


A supportive chin dressing is applied. The incision is closed in 2-3 layers.

The exact angle of the cut is planned from the cephalometric prediction tracing. Varying the angle of the cut can maintain, reduce, or even lengthen the lower third face height.

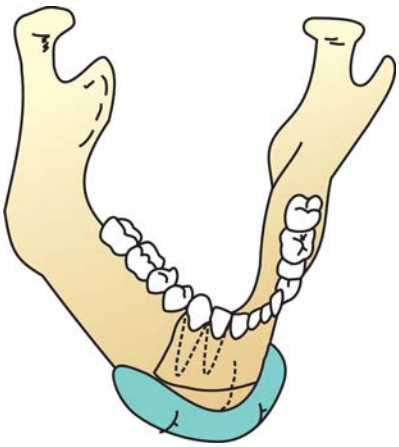


Maintain



Reduce

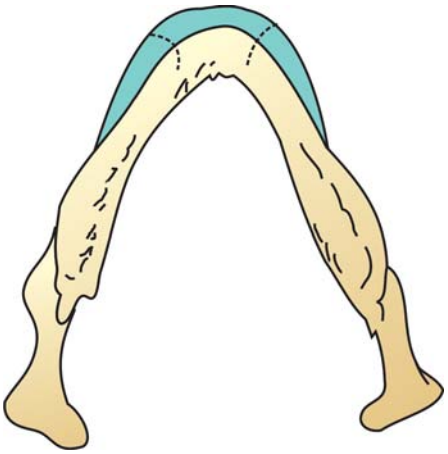
ALLOPLASTIC AUGMENTATION



Some of the alloplastic materials are:

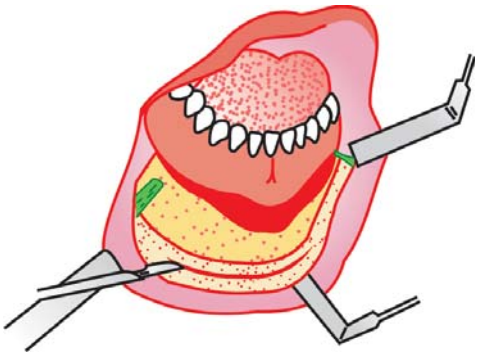
- Silicon-silastic
- Teflon
- Proplast etc.

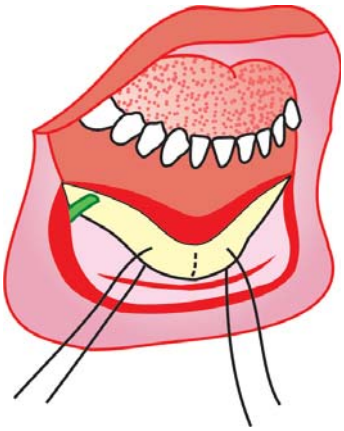
The use of an allpolast for chin augmentation is of advantage when a mandibular subapical procedure is done simultaneously.



Alloplasts are also useful when lateral augmentation of the symphysis is desired as well as for additional chin projection in persons with tapered chin.

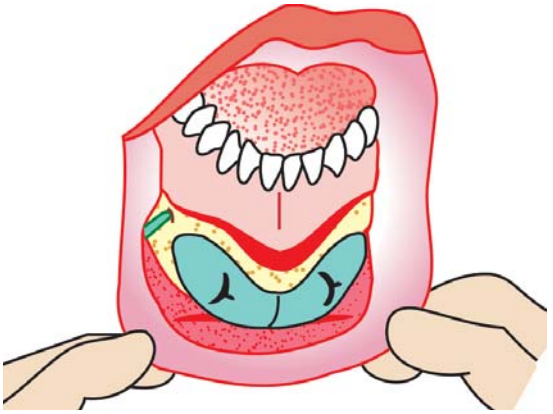
The incision and dissection is exactly as described for the horizontal osteotomy genioplasty.





The implant is shaped and placed temporarily in place for visual inspection of the external appearance and to test for adequate soft-tissue relaxation.

Two holes are then placed on each side of the mandibular symphysis at its inferior border and wire inserted to stabilize the implant.



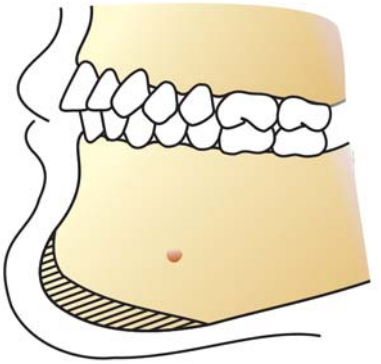
The wires are passed through the body of the implant at the desired super inferior position.

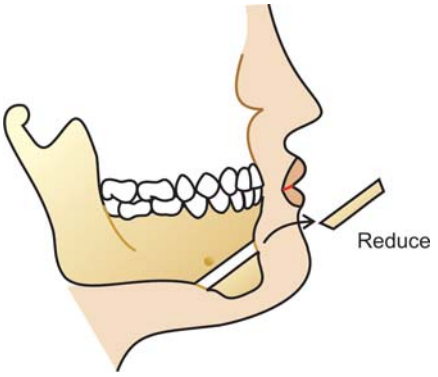
- Centring of the implant is done by marking the midline of the implant and aligning this with the facial, dental, or skeletal midline.

- The incision is closed in layers and supportive chin dressing applied.

2. Reduction Genioplasty

Is done when the vertical reduction of the height of the chin is indicated. The simplest method is to deglove the anterior mandible and reduce the lower border with a bur. Unfortunately this removes all or most of the cortical plate of the lower border and often results in poor contour and irregularity on palpation, also there can be irregular resorption.





The correct method is to remove a subapical wedge of bone and reposition the lower border superiorly. For this the surgical approach is the same. Except care is taken not to deglove the complete lower border, nor is the incision in the periosteum required.

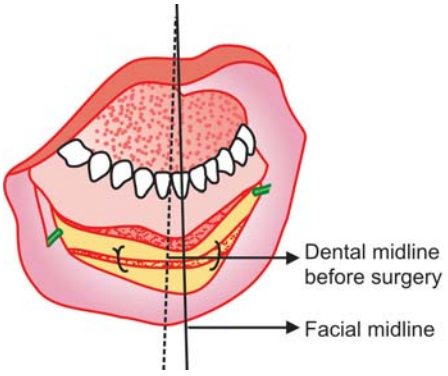
3. Lengthening or Vertical Augmentation Genioplasty

The surgical approach is the same as that for augmentation genioplasty. The soft tissue dissection should be done carefully, especially as the periosteum should not be reflected from the lower border.

Osteotomy cuts should be made as far posteriorly as possible, even upto the anterior aspect of the gonial notch.

Interosseous holes are made and wires passed but not tightened. Two or three blocks of cortical bone are shaped and placed between the two parts of the mandible and then the wires tightened.

4. Straightening Genioplasty Procedure



The basic surgery remaining same, the mandibular symphysis is not degloved. The midline of the symphysis is marked and the appropriate bone cut is made. The segment is repositioned and stabilized to match the facial midline.

Apertognathia or Open Bite

Is a condition in which the teeth of the upper and lower jaw do not occlude with each other, there is a gap between the maxillary and mandibular teeth.

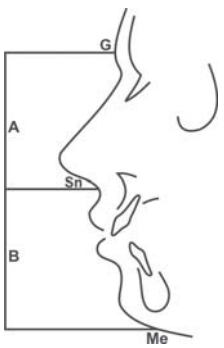
According to Subtelny and Sakuda 3 *etiologic factors* should be considered:

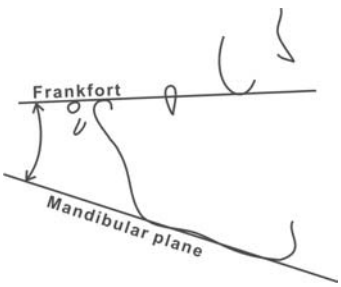
1. Vertical growth deficiency.
2. Disproportionate muscle growth or aberrant muscle function. The protrusive function of the tongue is thought to prevent full eruption of the anterior teeth or to exert a disfiguring influence on the molding of the anterior alveolar process.
3. Thumb sucking or finger sucking habit.

Clinically open bite is divided into "skeletal" or "non-skeletal" open bite. In non-skeletal open bite dentoalveolar or pseudoskeletal, open bite lies within the incisors and cuspids and is frequently associated with thumb sucking, tongue biting and forward protruding of the tongue. This is can be successfully treated by orthodontics and habit correction.

Clinical and Cephalometric Characteristics

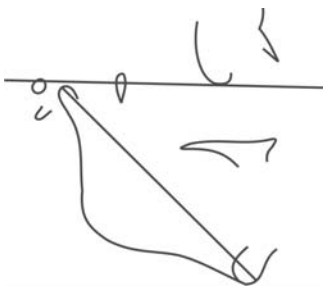
- Increased anterior facial height.
  G-Sn = Sn-Me
  G = Glabella
  Sn = Subnasal
  Me = Menton

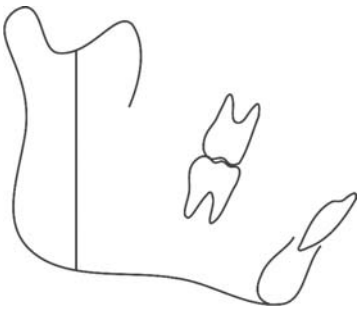




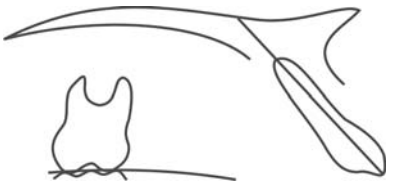
- Steep mandibular plane angle.

- Normal mandibular body length.

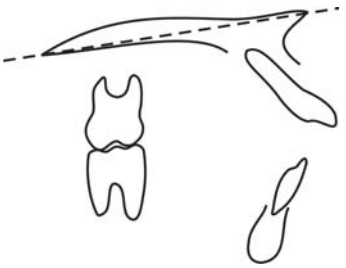




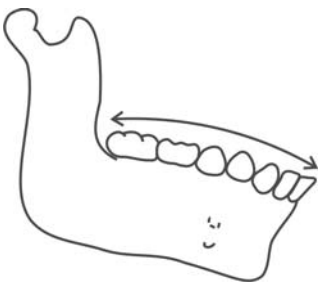
- Normal or decreased ascending ramus height.



- Increased distance from nasal floor to maxillary teeth apices.



- Tipped palatal plane, higher anteriorly than posteriorly.



- Low position of mental foramen.
- Decreased posterior cranial base.
- Flat or reverse curve of mandibular occlusal plane.

To analyze the dental component of the open bite, four dentoskeletal relationships must be considered, the apertognathia may affect any one of these or a combination of these relationships.

- Maxillary incisor to nasal floor.
- Maxillary molar to nasal floor.
- Mandibular incisor to lower border of the mandible.
- Mandibular molars to the lower border of the mandible.

The treatment should be different for the different underlying problems.

Classification of Severity

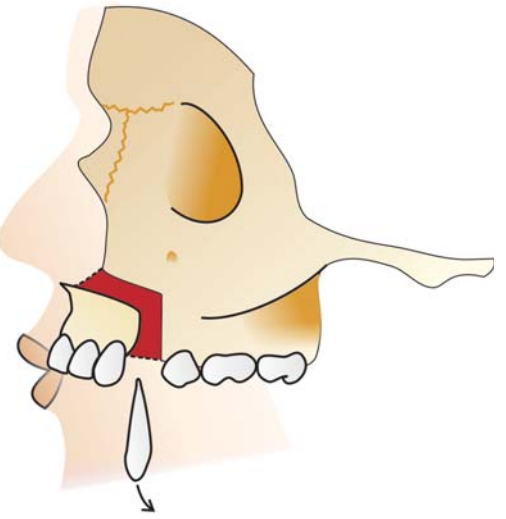
The severity of the open bite influences the decision as to when and how it should be treated. Differentiations are commonly made on the basis of diagnosis

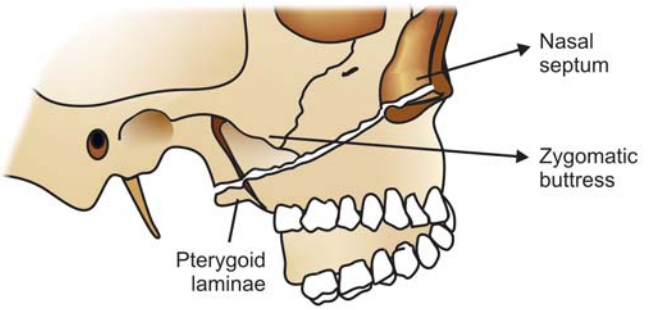
1. Skeletal involvement, i.e. distortion of the facial proportions
2. Dental involvement, i.e. vertical displacement of teeth
3. Neuromuscular involvement.

Surgical Treatment

The different problems can be treated by:

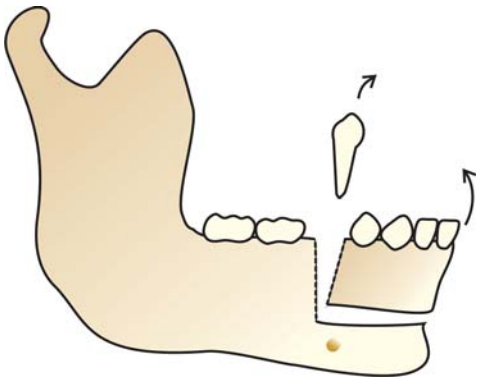
- Anterior maxillary subapical osteotomy.



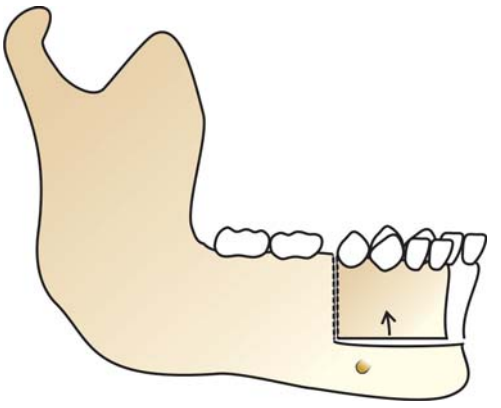


- Le Fort I osteotomy.

- Mandibular subapical osteotomy.

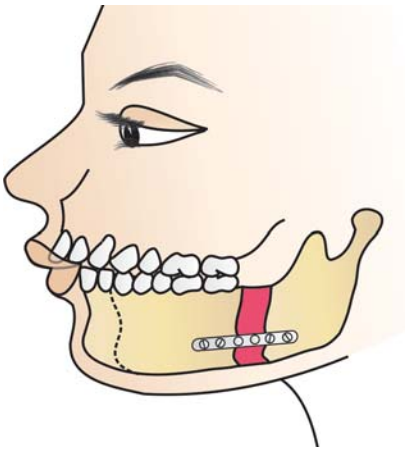


Subapical osteotomy with extraction

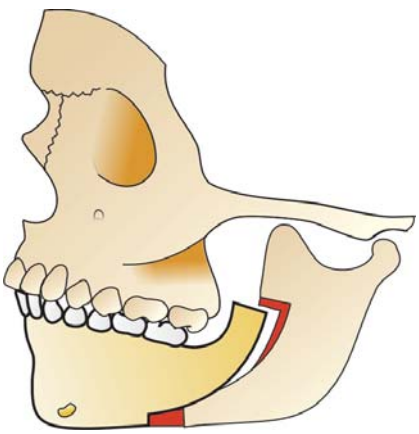


without extraction

- Sagittal split osteotomy.



- Closure of open bite by surgery in the ascending ramus, i.e. inverted "L" osteotomy of ramus with bone graft.



Chapter

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Distraction Osteogenesis

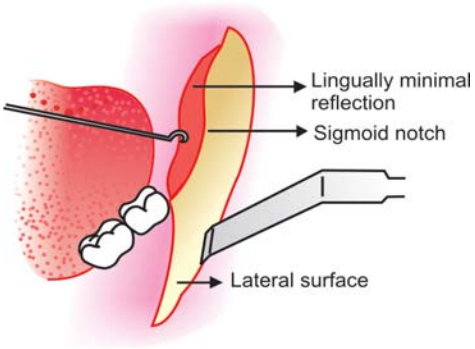
This procedure was 1st introduced by Dr GA Ilizarov and is used by the oral surgeon for correcting deficiencies of mandible and maxilla. In contrast to conventional surgeries, in distraction osteogenesis, both the bone and soft tissues are expanded simultaneously.

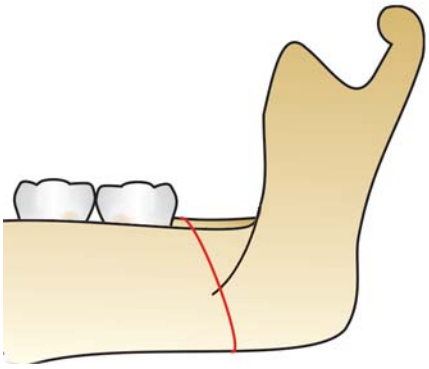
This is a simple technique in which a corticotomy and osteotomy is created in the deficient part of the bone and a distractor is then applied. The distractor is then activated daily, advancing the bone segment by 1mm, to induce the formation of new bone and soft tissue. The newly created bone is formed in the distracted gap which is then allowed to ossify.

Surgical Technique

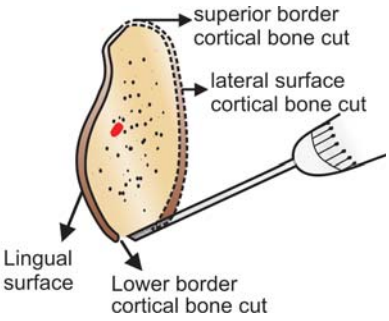
An incision is made in the mucosa and a full thickness mucoperiosteal flap is raised. The lateral aspect of the mandible is exposed revealing the area of bone deficiency.

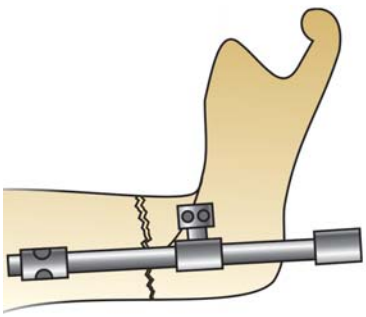
A minimum mucoperiosteal flap is developed on the lingual aspect.





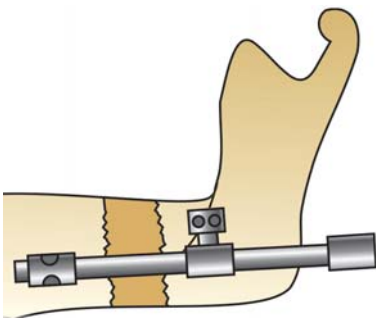
Using a bur a corticotomy is created in the lateral aspect of the mandible. The bone cut is extended through the lower border and superior border lingually. It is important that the cortical cuts are complete, especially in the inferior border.

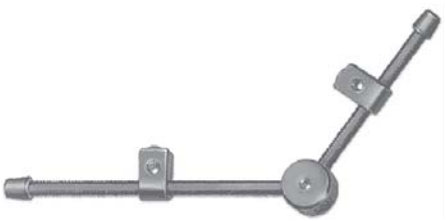




The distractor is then applied, with the help of self-drilling pins placed slowly by hand. Before fixing, the distractor is opened 2-3 mm.

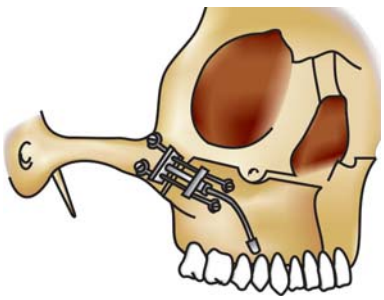
The corticotomy is then completed to osteotomy. This 2-3 mm gap is left on the distractor so that once the distractor is placed and osteotomy completed, the device can be deactivated closing the osteotomy site and allowing the bone edges to touch. A latency period of 5 to 7 days is observed before activation of the appliance. The distractor is activated to separate the cut ends of the bone by 1 mm/day. Continuous application of the distraction force is ideal.





Once the regenerate has been created the distraction device is held in neutral fixation allowing the destracted bone to ossify for approximately 6-8 weeks. Thus, creating a new bone at the deficiency site.

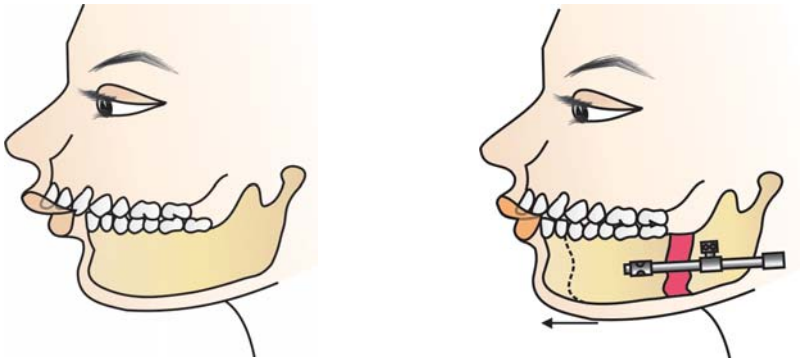
Distractors can also be used to increase the bone bi-directionally. Example the length of the ramus (height) and the length of the body (antero-posterior) can be increased simultaneously using a distractor that functions in both direction.



Similarly distraction can be done of the maxilla, by making Le Forte I or Le Forte II cuts and moving the premaxilla or the maxilla anteriorly by using extra-oral distractors fixed in a halo frame, or by intra-oral distractors.

Smaller forms of distractors are available to improve the bone height for the placement of implants.

Lots of work is still being done in this field, and better distractors are being developed with wonderful results.



Whenever thou presentest thyself at the bed of a patient turn thy face toward the Lord of the kingdom and supplicate assistance from the Holy Spirit and heal the ailments of the sick one – "Baha'i Writings".

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