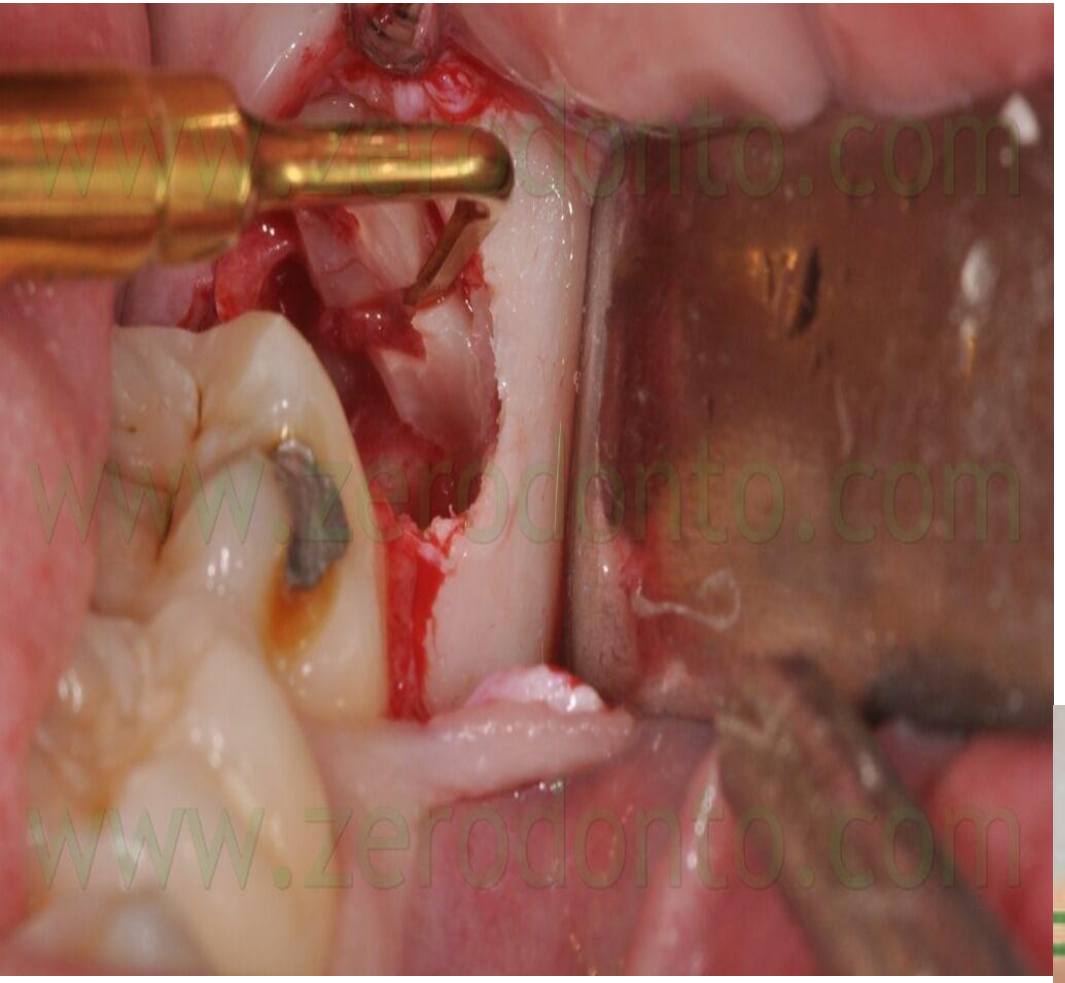
TRANSALVEOLAR EXTRACTION



PROF.ABBAS AY TAHER

Transalveolar extraction :

Extraction of a tooth is a procedure that combines the principles of surgery and elementary physical mechanics. When these principles are applied correctly, a tooth can usually be removed from the alveolar process even by someone without great strength and without untoward force or sequelae.

Proper tooth removal does not require a large amount of strength, instead, when done properly, it is **accomplished with finesse**.

Removal of an erupted tooth involves the use of controlled force in a manner such that the tooth is not pulled from bone, but instead, it is gently removed from its socket.

During pre-extraction planning, the degree of difficulty anticipated for removing a particular tooth is assessed.

If that assessment leads the surgeon to believe that the degree of difficulty will be high or if initial attempts at tooth **removal confirm this**, a **deliberate surgical approach—not an application of excessive force**—should be taken.

Excessive force may injure local soft tissue and damage the surrounding bone and teeth. Such force may cause fracture of the crown, usually making the extraction substantially more difficult than it would have been otherwise. Moreover, excessive force and haste during an extraction heightens intraoperative and postoperative patient discomfort and anxiety.

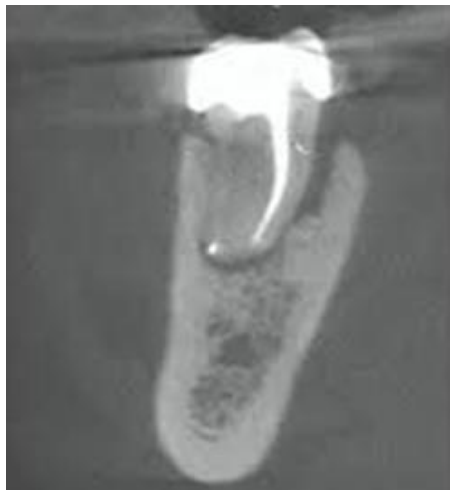
Removal of a tooth, even if it is loose can cause pain. Thus, local anesthesia is required.
Local anesthesia must be absolutely profound to eliminate sensation from the pulp, **periodontal ligament**, and **adjacent soft tissues**. Even with local anesthesia, patients will **still experience discomfort from pressure placed on the tooth, the surrounding tissues**, and **the jaw joints during most extractions.**

It is equally important for the dentist to recognize the anxiety that usually exists in patients about to undergo tooth extraction.

Before Surgery

Pre-operative dental x-rays are **mandatory before a surgical extraction**. A dental x-ray gives the complete picture of the tooth anatomy, surrounding vital structures and presence of possible complications. The other pre-extraction assessments include identifying the presence of an infection, tooth accessibility and mouth opening assessment of the patient.

If an infection is present at the site of the surgery, the use of antibiotics is recommended and the surgery delayed until the infection is under control. Not only can an infection reduce the effects of anesthetics but there is also a possibility of the infection spreading and causing complications.



Few patients face this procedure with tranquility, and even stoic patients are likely to have internal feelings of distress.
Profound local anesthesia is needed if the tooth is to be removed; therefore, it is essential that the surgeon remember the precise innervations of all teeth and surrounding soft tissue, as well as the kinds of injection necessary to anesthetize those nerves completely.
Trans alveolar extraction is commonly known as surgical extraction or an open extraction of a tooth. The method is employed when normal forceps extraction is not possible due to various difficulties. Generally if a tooth fractures during regular extraction, surgical approach is necessary to remove the root fragment

Indications:

A trans alveolar extraction is conducted when :
•Any tooth that can not be extracted by normal use of forceps or elevators.
•A tooth with previous history of attempted and failed extraction.
•Extraction of the tooth that has undergone root canal therapy.
•Fractured or retained tooth that are not approachable to dental forceps.
•The tooth is ankylosed to the underlying bone (fused tooth).
•Tooth with irregular and curved roots that is more likely to fracture during a regular extraction.
•Sclerosis of bone.
•Impacted teeth or embedded teeth that are partially emerged in oral cavity- most commonly the wisdom tooth.
•Teeth associated with diseases such as dental cysts, tumors , periapical granulomas.
•Grossly decayed teeth with root caries or internal resorption
•Teeth lie very close to major dental nerves where the nerve damage is possible during a forceps extraction

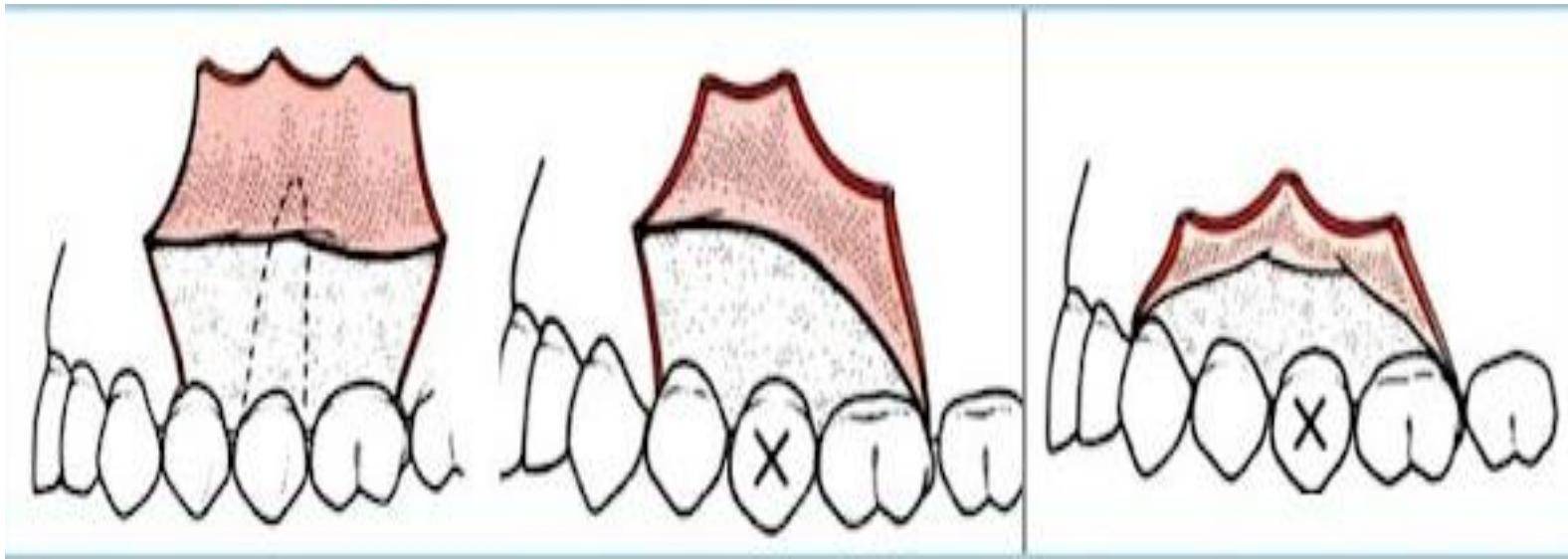
Principles of Flap Design and Closure:

Many oral-surgery procedures require **development of a surgical flap to gain access to the surgical site**.
Flaps are necessary to **facilitate surgical tooth removal**, **treat pathology** and **create access for bone-** and **tissueaugmentation procedures**.
The type of flap used affects how easily primary closure can be achieved, how quickly the site heals and the risk of complications.

Poorly designed surgical flaps can break down, **become necrotic** and **increase the risk of graft failure**.

Once the surgical procedure is completed, **reapproximation of the soft tissues is indicated**.

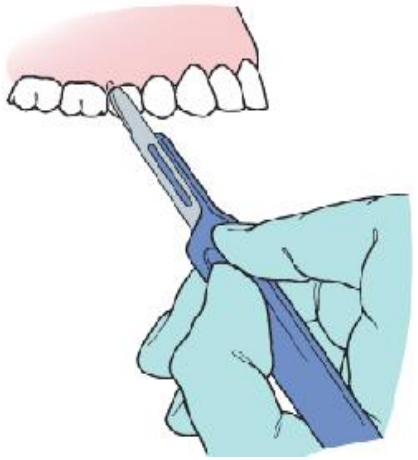
Various suture materials and techniques have been developed for different procedures and purposes.
Knowing which suture to use in which situations, and how to use it properly, is critical for clinicians if they perform surgical procedures.



Flap

Flap is simply defined as a section of soft tissue that is outlined by surgical incisions, carries its own blood supply, allows surgical access to underlying tissues, can be replaced as required on its original position, maintained with sutures and is expected to heal.

Most of the oral surgical procedures require the reflection of a full mucoperiostial flap incorporating mucosa, submucosa and periosteum to gain access to the area that is the object of surgery.



Prichard Periosteal Elevator

Freer Periosteal Elevator

Goldman-Fox Periosteal Elevator

Sinus Implant Periotome

Buser Periosteal Elevator

Allen Molt # 9 Periosteal Elevator

Incision It is simply defined as a cut or wound made by cutting with a sharp instrument.

The basic principles of incisions in oral surgery include:

- A blade number **15** is suitable for most oral surgical procedures. Sometimes a blade number **12** is used.

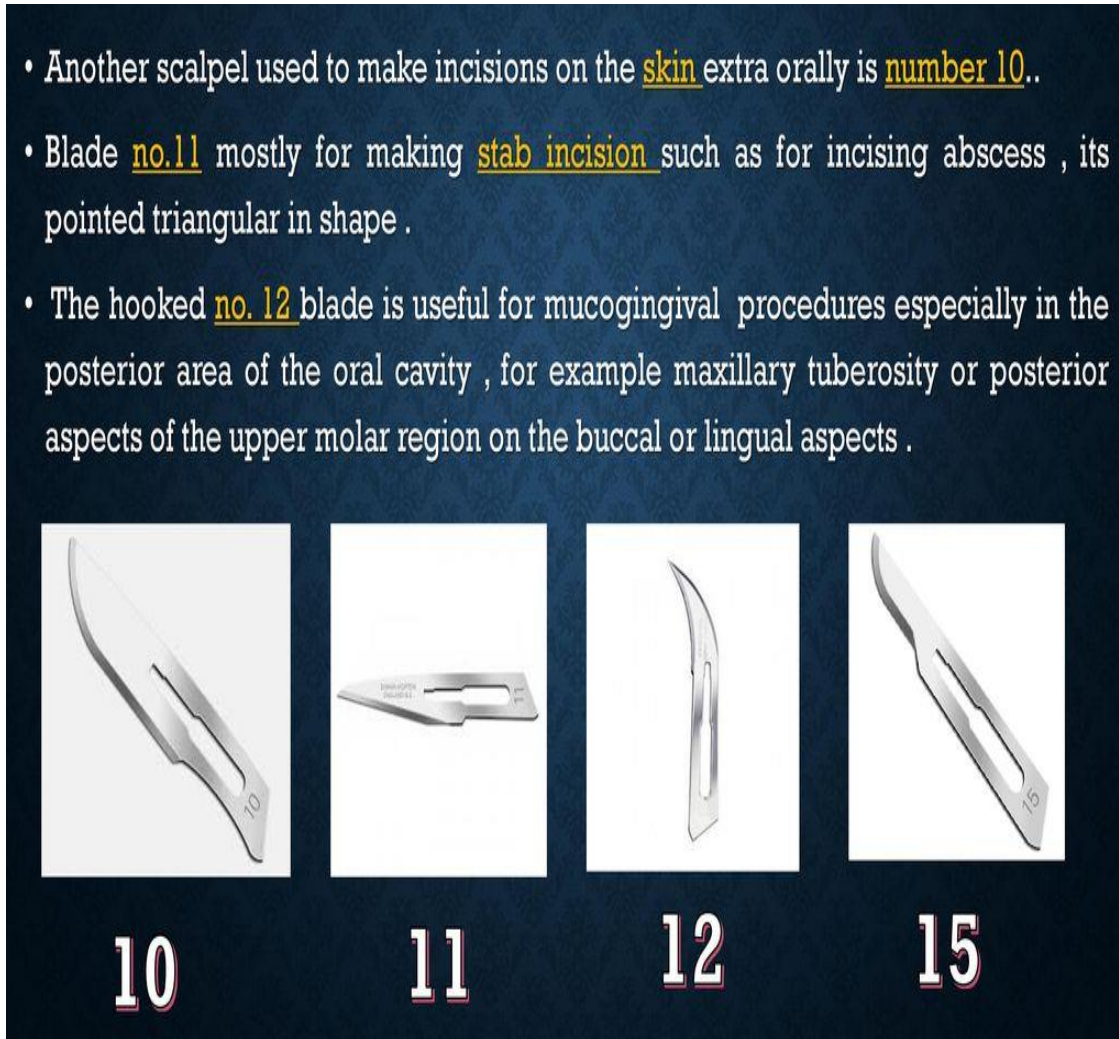
- A new and sterile blade should be used for each patient and it should be replaced with a new one intraoperatively if its cutting edge becomes blunted when necessary.

- The scalpel blade is mounted on the scalpel-handle with the help of a needle holder, or hemostat, with which it slides into the slotted receiver with the beveled end parallel to that of the handle.

- The scalpel is grasped in a pen grasp for maximum control and tactile sensitivity.

- The incision should be made at right angle to the underlying bone to ensure good healing when the tissues are re-apposed.

- The scalpel should move at uniform speed and with sufficient firmness to cut through not only the mucosal surface but also the periosteum overlying the bone. It should be made, ideally, with a single movement, repeated strokes at the same place should be avoided as they may impair healing.



Flap design:

Flap is simply defined as a section of soft tissue that is outlined by surgical incisions, carries its own blood supply, allows surgical access to underlying tissues, can be replaced as required on its original position, maintained with sutures and is expected to heal. Most of the oral surgical procedures require the reflection of a full mucoperiostial flap incorporating mucosa, submucosa and periosteum to gain access to the area that is the object of surgery.

The essential points that should be considered include:

 Flap design and incision should be carried out in such a way that injury of anatomic structures is avoided, such as: the mental neurovascular bundle, palatal vessels emerging from the greater palatine foramen and incisive foramen, lingual nerve, submandibular duct, facial artery and vein. So thorough knowledge of the anatomy of the orofacial region is essential

 The base of the flap should be wider than its apex (free gingival margin) to ensure adequate blood supply for better healing.

 The flap should be of adequate width for good visualization and accessibility of the operative field without subjecting the flap to tension and trauma during manipulation.

 When planning the flap, the care should be given to the fact that the flap should be wider than the anticipated bony defect after completion of the procedure so that the flap margins, when sutured, should rest on intact and healthy bone to prevent wound dehiscence and poor healing.

 Delicate handling of the flap during the surgical procedure without excessive tension of crushing in order not to compromise the blood supply which leads to delayed healing.

Technique for Open Extraction of Single-Rooted Tooth

The technique for open extraction of a single-rooted tooth is straight forward but requires attention to detail because several decisions must be made during the operation.

The technique is essentially the same for single-rooted teeth that have resisted attempts at closed extraction or that have fractured at the cervical line and, therefore, exist only as a root.

The first step is to provide adequate visualization and access by reflecting a sufficiently large mucoperiosteal flap.

In most situations, an envelope flap that is extended two teeth anterior and one tooth posterior to the tooth to be removed is sufficient. If a releasing incision is necessary, it should be placed at least one tooth anterior to the extraction site. Once an adequate flap has been reflected and is held in its proper position by a periosteal elevator, the surgeon must **determine the need for bone removal**.

Several options are available:

First, the surgeon may attempt to reseat the **extraction forceps under direct visualization** and, thus, achieve a better mechanical advantage and **remove the tooth with no surgical bone removal at all**.

The second option is to grasp a bit of buccal bone under the buccal beak of the forceps to obtain a better mechanical advantage and grasp of the tooth root. This may allow the surgeon to luxate the tooth sufficiently to remove it without any additional bone removal

A small amount of buccal bone is pinched off and removed with the tooth.

Types of Mucoperiosteal Flaps :

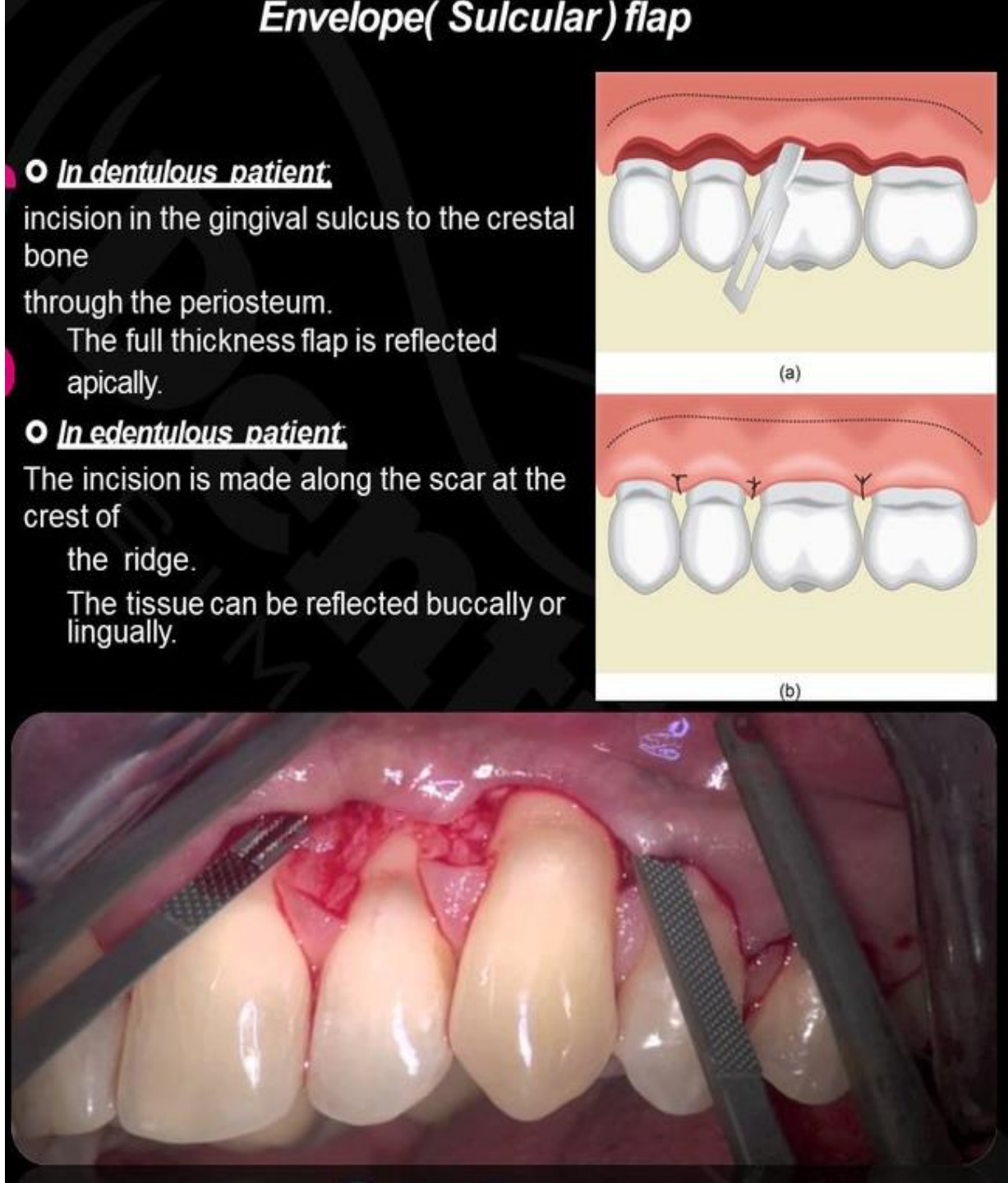
Envelope Flaps

This type of flaps is made by a horizontal incision through gingival sulcus for the teeth or through the alveolar mucosa of the edentulous area with no vertical releasing incisions. The envelope flap is used for surgery of incisors, premolars and molars, on the labial or buccal and palatal or lingual surfaces.

The main indications of this type of flaps include: surgical extraction of **impacted mandibular third molars**, **palatal approach to impacted maxillary canines** or **removal of mandibular tori**.

The main advantages of this flap are; easy re-approximation to original position, good blood supply and it can easily **modified to two-sided** or **three sided flap** by adding **vertical releasing incisions** to **either ends of the flap when necessary**.

Disadvantages of this flap are the limited accessibility and visualization, difficulty in reflection with greater tension that can result in tearing at the ends of the flap, in addition to defect in attached gingival and the possibility of injury to the greater palatine artery during reflection of palatal flap.



Two-sided Flap (Triangular Flap)

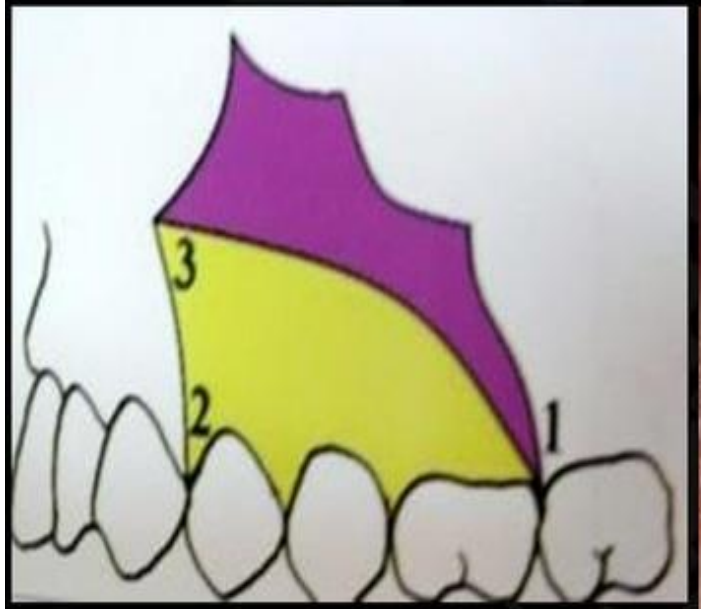
This flap is the made with a horizontal incision along the gingival sulcus or alveolar ridge mucosa and a vertical releasing incision.
The vertical incision begins approximately at the vestibular fold and extends to the interdental papilla of the gingiva.

This flap is performed labially or buccally on both jaws and is indicated in the surgical removal of root tips, impacted teeth, small cysts, and apicectomies.
Advantages are; it ensures an adequate blood supply, satisfactory visualization and accessibility, good re-approximation; it can be easily modified to a three sided flap, or even lengthening of the horizontal incision

Disadvantages are; limited access, tension when flap is retracted and it may result in defect of attached gingiva

Three-cornered flap

- Is an envelope incision that has a vertical releasing incision.
- The three cornered are at posterior end of the envelop incision, at inferior aspect of the vertical incision, at the superior aspect of the vertical releasing incision.



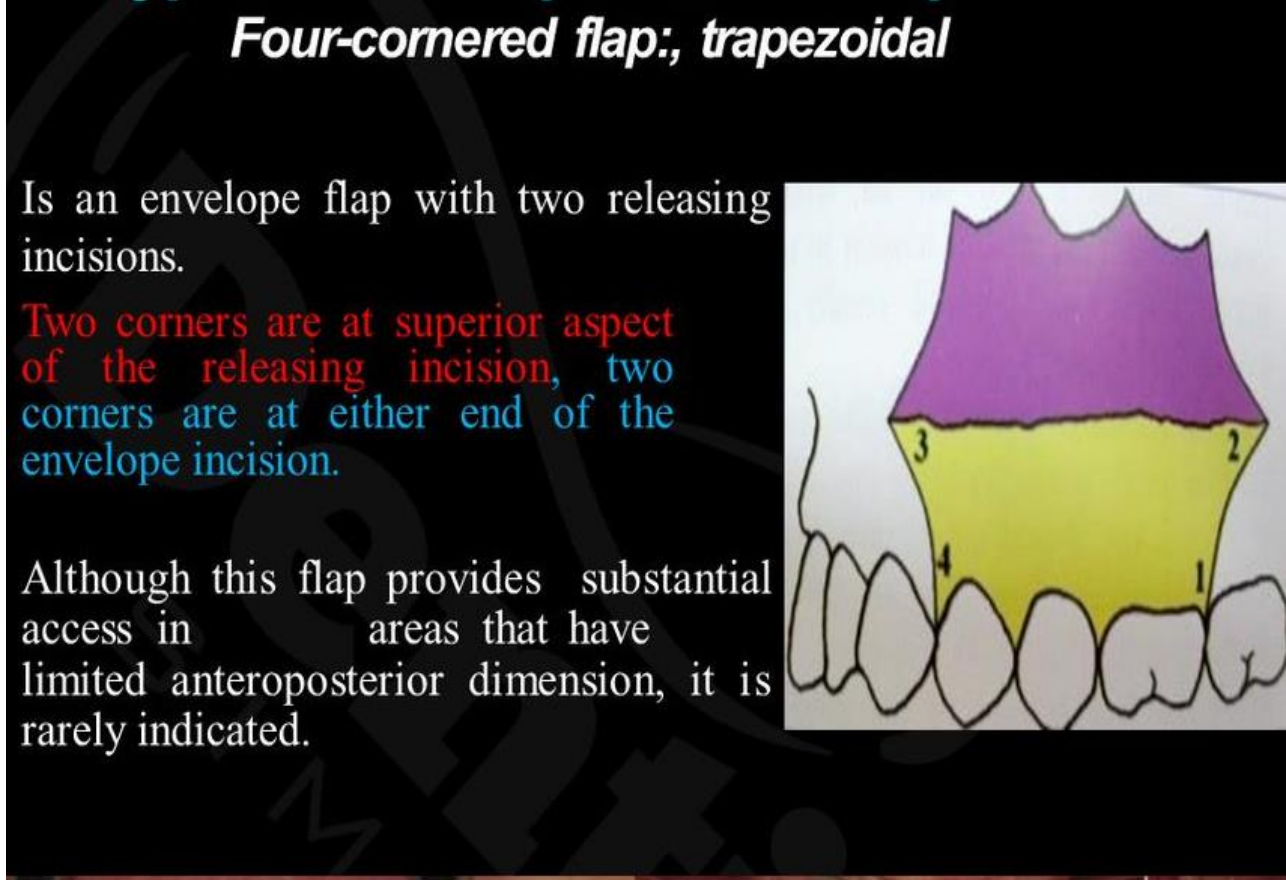
- This flap is frequently necessary when greater access is necessary
- in apical direction, especially in the posterior aspect of the mouth.

Three-sided Flap (Trapezoidal Flap) :

This flap consists of a horizontal incision along the gingival or alveolar ridge mucosa and 2 vertical releasing incisions, this flap is indicated when an extensive surgical field exposure is required especially when two-sided flap is inadequate.

The main advantages include; very good accessibility and visualization of the surgical field with minimal tension on the tissue, and good reapproximation of tissue to the original position.

The disadvantages are the possibility of producing an attached gingival defect. This flap cannot be lengthened or modified once reflected.

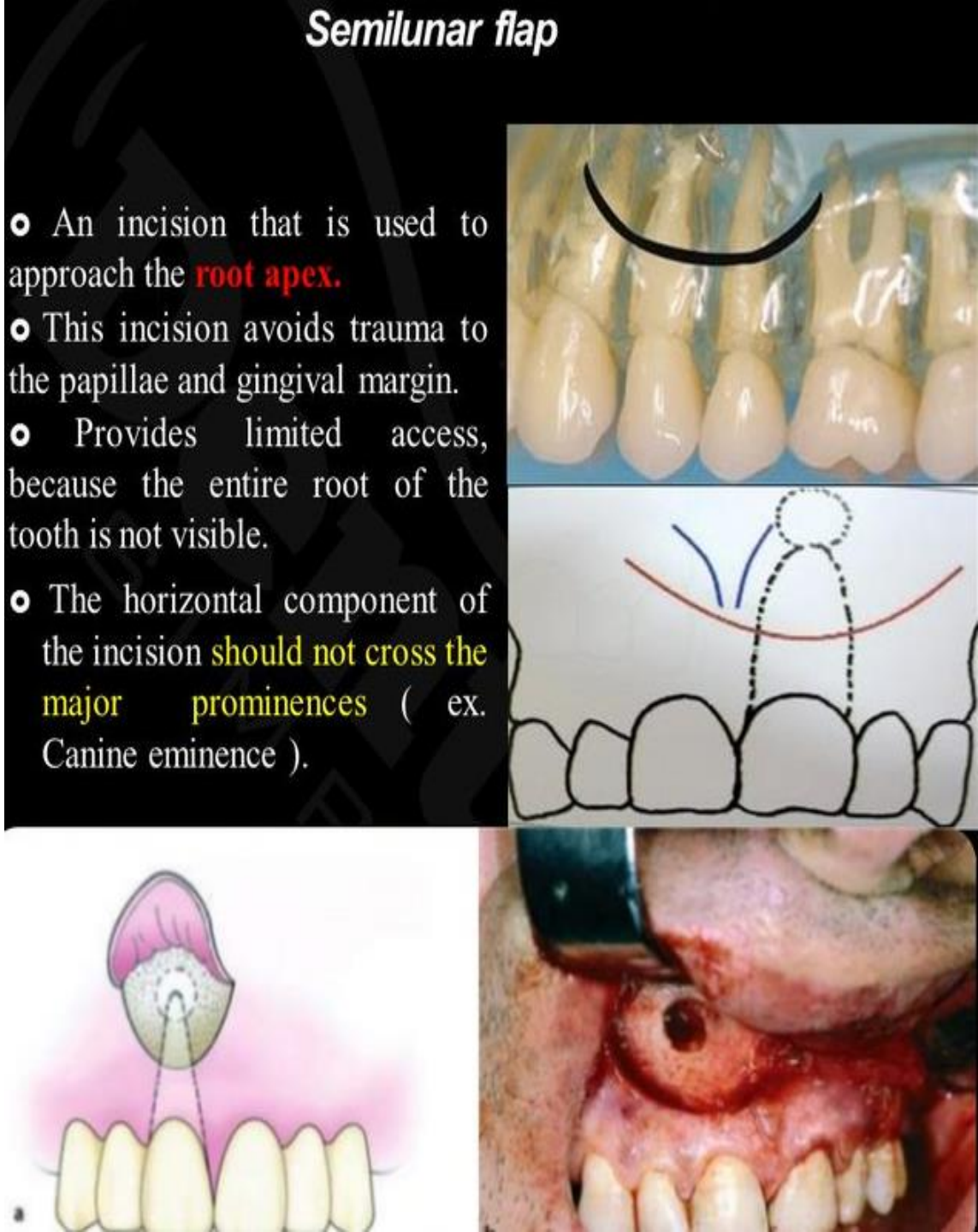


Semilunar Flap :

This flap is the result of a curved incision, which begins just beneath the vestibular fold and has a bow shaped course with the convex part towards the attached gingiva. The lowest point of the incision must be at least 0.5 cm from the gingival margin, so that the blood supply is not compromised. Each end of the incision must extend at least one tooth over on each side of the area of bone removal. The semilunar flap is used in apicoectomies and removal of small cysts and root tips.

Advantages of this flap are small incision, easy reflection, no attached gingival defect especially around prosthetic appliances (crowns and bridges) and easy oral hygiene.

Disadvantages of this flap are limited accessibility and visualization of the surgical field, re-approximation may be difficult due to the absence of reference points, tendency to tear due to excessive tension on reflection and the possibility that the flap may made over defective bone as a result of inadequate planning or underestimation of the size of the bony defect so that the margins of the flap will not rest on intact bone leading to collapse of the flap and wound dehiscence.



Suturing :

After completion of the surgical procedure, thorough irrigation of the surgical field using sterile normal saline follows. Then the flap is repositioned to its original position and held in place using sutures to protect the underlying tissues from infection and irritating factors and prevent postoperative hemorrhage.

Sutures are also used to repair soft tissue lacerations, ligation of vessels and control of bleeding, immobilization of flaps in their new position, and stabilization of drains in place.

Suture diameters vary from 0.02 to 0.8 mm. This corresponds to **10/0 to 5 on the British Pharmacopoeia (BP) system**.

The finest suture that will hold the wound secure, without it breaking should be chosen. The amount of suture material used should be **kept to a minimum**, particularly when **braided**, to reduce **bacterial colonization**.

Suture material can be a nidus for infection, and **knots can be the focus of a persistent** and **chronic inflammatory reaction (suture knot sinus).**

Suture Materials :

Suture materials are classified as either **absorbable** or **non-absorbable** material depending on whether the body tissues will **degrade the suture material** and **absorb it over time**. **Absorption takes place either by Hydrolysis** or by **proteolytic enzymatic degradation depending on the material used**.

They can also be classified as monofilament or multifilament.

? Absorbable Sutures

They are **used** in suturing of **deep layers of wounds** when **multilayered suturing is required**, they are also used in **children**, **mentally handicapped patients** and in **patients who cannot return to the clinic to have their sutures removed**.

They can cause inflammatory tissue reaction that can impede tissue healing. Some of the popular absorbable sutures include:

Plain Catgut: it is made from collagen derived from healthy sheep or cattle intestine, its tensile strength is lost within 7-10 days, its absorption is through phagocytosis and enzymatic degradation which occurs within 7-10 days producing high tissue reaction. It is used for suturing subcutaneous tissues that do not require prolonged support. It is not suitable for suturing in oral surgery.

 Chromic Catgut: it is made from collagen derived from healthy sheep or cattle intestine tanned with Chromium salts to facilitate handling and resist tissue degradation. It tensile strength is lost within18-2ldays, its absorption is like that of the plain Catgut but it takes longer time and with moderate tissue reaction. It has the same indication as for the plain Catgut and it is not suitable in oral surgery.

Polyglactin (Vicryl)

Synthetic suture made of copolymer of lactide and glycolide coated with polyglactin and calcium stearate. It is braided multifilament suture, 60% of its tensile strength remains for 2 weeks, and about 30% for 3 weeks. Its absorption is through hydrolysis with complete absorption taking place within 60-90 days, it induces mild tissue reaction. This suture is widely used in surgical practice but it is not advised for use where prolonged approximation under tension is required.

 Polydioxanone (PDS)

Supplied as monofilament dyed or undyed, it is made of polyester polymer, 70% of its tensile strength remains at 2 weeks, 50% at 4 weeks and 14% at 8 weeks. Absorption occurs through hydrolysis which is complete in about 180 days, it is used when slight longer wound support is required

Non-absorbable sutures :

These sutures remain in the tissues and are not absorbed, but have to be cut and removed **about 7 days after their placement**. Commonly used **sutures include**:

- **Silk:** it is made of **raw silk from silkworms**, and it is supplied as **braided** or twisted, **dyed or undyed**, **coated with wax** or **silicon** or **uncoated**.

80%-100% of its tensile strength is lost within 6 months.

Fibrous encapsulation occurs in the body within 2-3 weeks, **it causes moderate to high tissue reaction**.

It is used in **ligation and suturing when long term tissue support is needed**. Silk sutures are the easiest to use and the **most economical**, and have a satisfactory ability to make a secure knot.

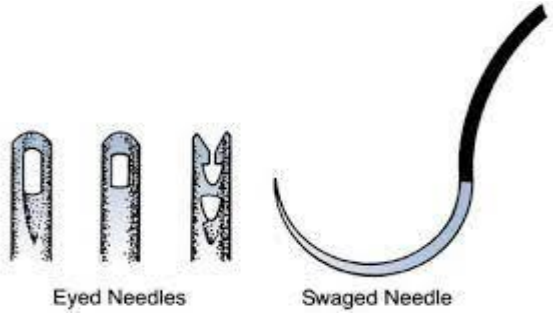
- **Nylon** it is made of **polyamide polymer** and it is **supplied usually as monofilament**. It **loses 15%-20% of its tensile strength per year**. It causes mild tissue reaction and it is used mainly for skin, in plastic surgery, neurosurgery, and ophthalmic surgery. Know it is more widely used in oral surgery.

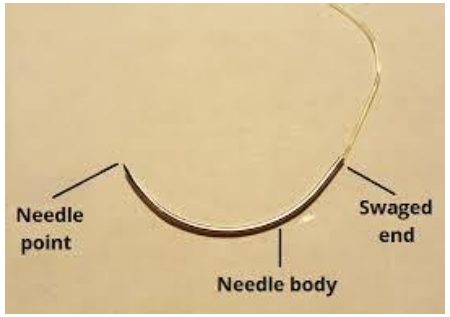
One of the most commonly used suture for the oral cavity is 3/0 black silk. The size 3/0 has the **appropriate amount of strength**; **the multifilament nature of the silk makes it easy to tie** and **well tolerated by the patient's soft tissues**.

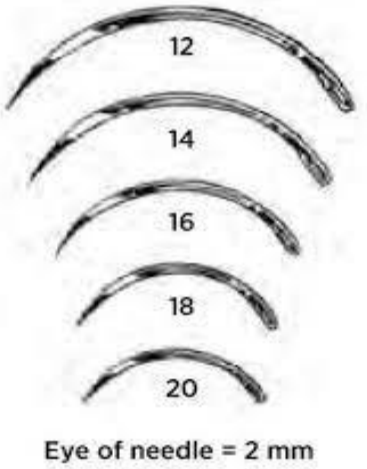
The color makes the suture easy to be seen when the patient returns for suture removal. However, because of the multiple filaments, they tend to **"wick"** oral fluids along the suture to the underlying tissues. **This wicking action may carry bacteria along with the saliva.**

Sutures that are holding mucosa together usually stay no longer than 5 to 7 days, so the **wicking action** is of little clinical significance.

Needles







Needles are usually made of stainless steel which is strong and flexible material. There are different shapes, sizes and cross sections of needles.

Needles of 18-26 mm in length are suitable for use in oral surgery.

There are two basic needle types:

Those that **have the hole at the suture side of the needle and that need to be threaded with suture are "eyed."** Conversely, those that have the suture attached to the needle are **"eyeless"** or **"swaged."** The **advantages of the swaged needles include:**

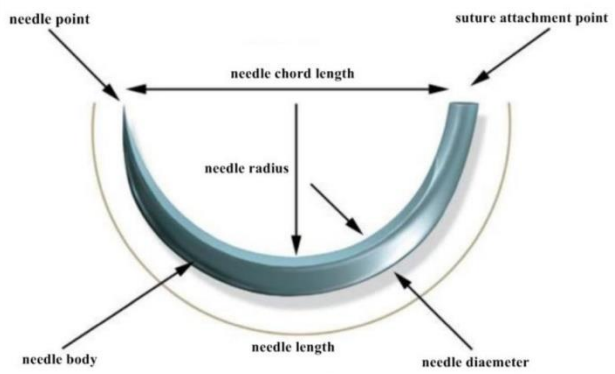
- **The eyeless needle is composed of a single use needle and suture**. This avoids the loss of sharpness that occurs with reusable needles.
- There is only a single strand of suture that is pulled through the tissues, and the gap that is created by the needle is fully plugged by the suture.

This reduces potential leakage through the suture line.

- **There is no re-threading of an eyeless needle**, and its use is more time efficient. As compared to a regular circle, needles are either**; 1/4 circle, 1/2 circle, ¾ circle, 3/8 circle, or 1/8 circle** or **they can have different shapes like straight needles, J needles, or compound curve needles**.

According to the cross section of the needles, there are:

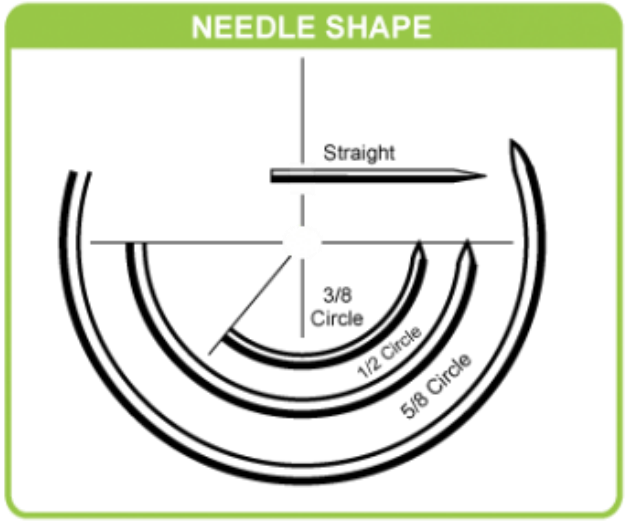
- **Needles with round or oval cross section which are considered atraumatic and are mainly used for suturing thin mucosa**.



Their disadvantage is that great pressure is required when passing through the tissues, which may make suturing the wound harder. They are used in oral surgery especially in areas of thin mucosa they are also used in suturing of peritoneum, bowel, muscles and fat.

- **Needles with triangular cross section**; these are either **cutting** or **reverse cutting needles**. The difference is that in addition to the two cutting edges of the triangle, cutting needles have a third cutting edge on the inside of the curvature while the reverse cutting needles the third cutting edge is on the outer convex curvature of the needle.

These designs allow minimal soft tissue trauma during needle insertion as they cut a path through the soft tissues and do not therefore require excessive force on the part of the operator.



The passage of a needle through tissue should follow its curvature.

This minimizes tissue damage and the appropriate size and shape of **cutting**, or **round-bodied atraumatic needle, needs to be chosen for the least traumatic passage through tissue**.

Instrument for Suturing includes:

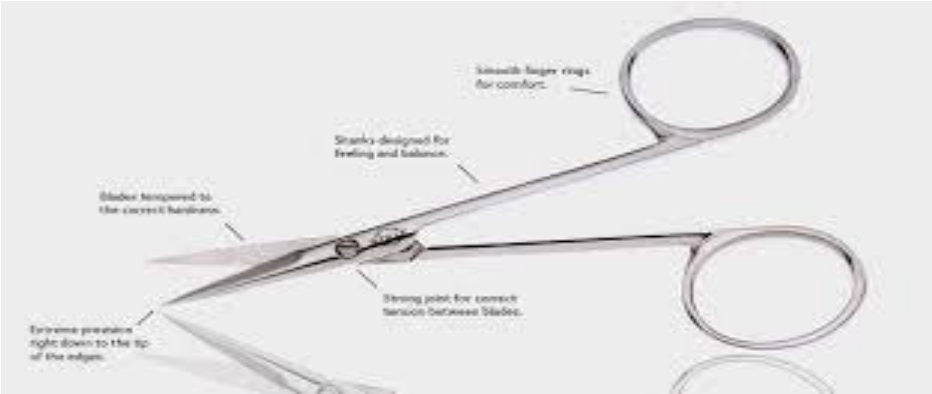
Needle Holder

These instruments come in a variety of sizes and design.
In general, they have a locking handles allowing the needle to be locked into the beaks of the instrument. They resemble Hemostats but with few differences: The beaks of the hemostat are longer and thinner than that of the needle holder. The internal surface of the short beaks of the needle holder is grooved and crosshatched, permitting a firm and stable grasp of the needle, while the short beaks of the hemostat have parallel grooves which are perpendicular to the long axis of the instrument.

Tissue Forceps

Sometimes known as **dissecting forceps**, the important requirement is that they hold the soft tissues **atraumatically** so avoiding crushing and with little chance of slippage.
This is achieved by a toothed design in the form of **a wedge-shaped projection or tooth on one** side, and a receptor on the other, which fit into each other when the handles are locked, although possibly causing tiny puncture points, is ideal for the purposes of suturing and holding soft tissues generally.
The use of non-toothed forceps **will result in crushing of the tissues as**, to prevent tissue slippage from grasp, the instrument must be held too tightly.

Suture Scissor



Principles of suturing:

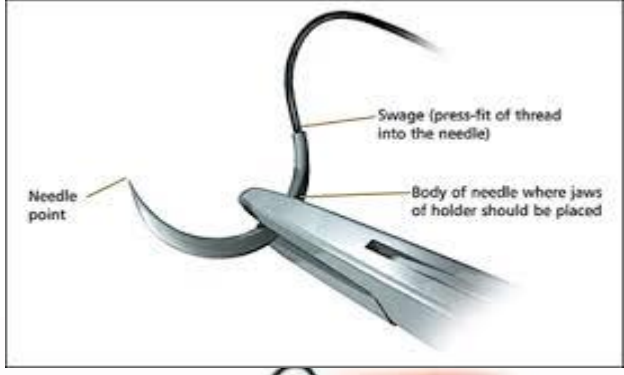
- Suturing should be undertaken using a **no-touch techniq**ue to reduce the risk of a **needle-stick injury** and **the fewer the number of sutures used to produce the desired result**, the better.

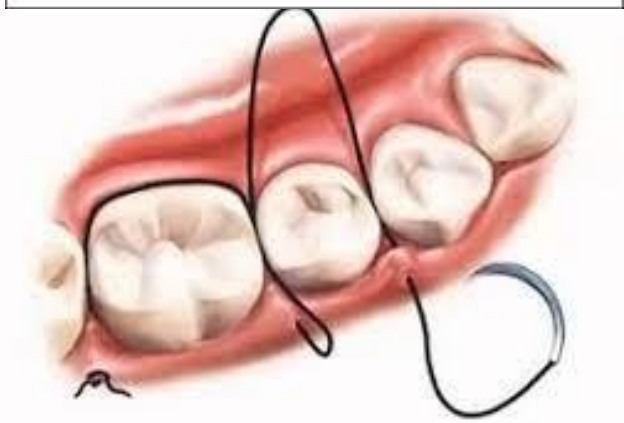
Insertion of too many sutures tears the tissue unnecessarily, and the resulting tangle of suture thread tends to accumulate plaque and promote inflammation.

- **Before the sutures are inserted the non-flap side of the incision should be undermined to facilitate the insertion of the needle**.

- When re-approximating the flap, the suture is passed first through the mobile (usually facial) tissue, the needle is re-grasped with the needle holder and is passed through the attached tissue of the lingual papilla.

But if the two margins of the wound are close together, the surgeon may be able to insert the needle through both sides of the wound in a single pass. However, for better precision it is **better to use two passes in most situations.**





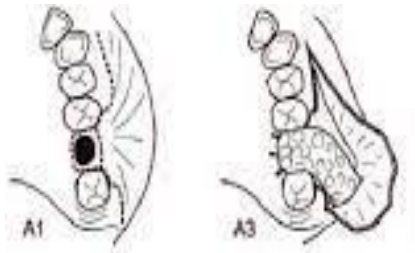
Other types of flaps:

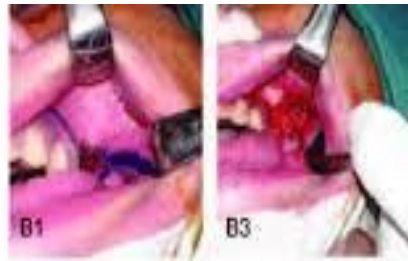
 A flap with a Y-shaped incision. This flap used in surgical procedures of the palate, mainly for **removal of exostoses (torus palatinus).**

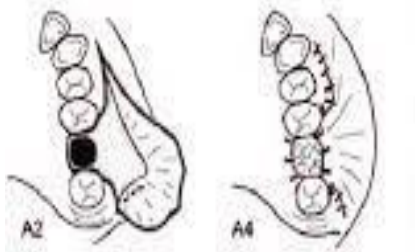
The first flap consists of an incision along the midline of the palate with **2 anterolateral incisions made anterior to the canines**, additional posterolateral incisions can be added to improve accessibility indicated in large tori, but care should be taken **not to sever the greater palatine vessels**.

The major disadvantage of **these flaps is that they can easily tear as the mucosa overlying palatine tori can be fairly thin**.

 Flaps that are used for closure of oroantral fistula or communication include;







Buccal Advancement Flap which is in essence a three-sided flap that after reflection the periosteum is transversely incised so that the flap remains pedicled only by the mucosa allowing it to be advanced and sutured to the palatal tissues.

The other flap is the Palatal Transpositional Flap that incorporates the greater palatine vessel, it is rotated and sutured to the buccal tissues.

Flap reflection The mucoperiosteal flap is reflected from the underlying bone using periosteal elevators. There are many any types of mucoperiosteal elevators like Howarth, Ash, the no.9 Molt, Seldin, or Freer types.

The third option is to use the straight elevator, pushing it down the periodontal ligament space of the tooth.

The index finger of the surgeon's hand must support the force of the elevator so that the total movement is controlled and no slippage of the elevator occurs**. A small** to and fro motion should be used to help expand the periodontal ligament space, which allows the small straight elevator to enter the space and act as a wedge to displace the root occlusally. This approach continues with the use of larger straight elevators until the tooth is successfully luxated.

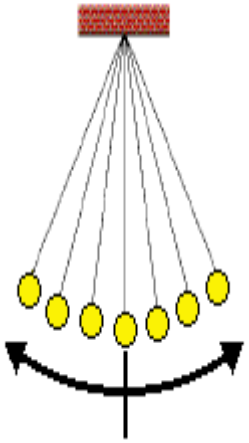


Fig.1 Intact extraction socket

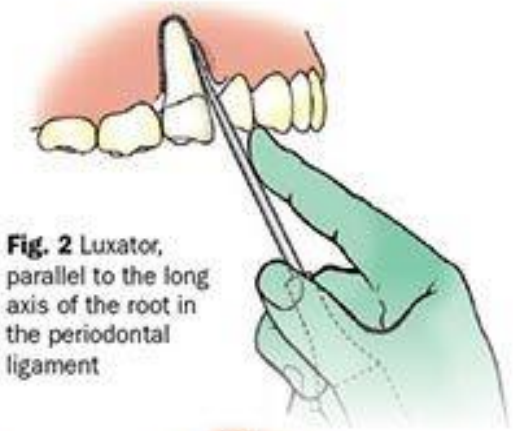


Fig. 2 Luxator, parallel to the long axis of the root in the periodontal ligament

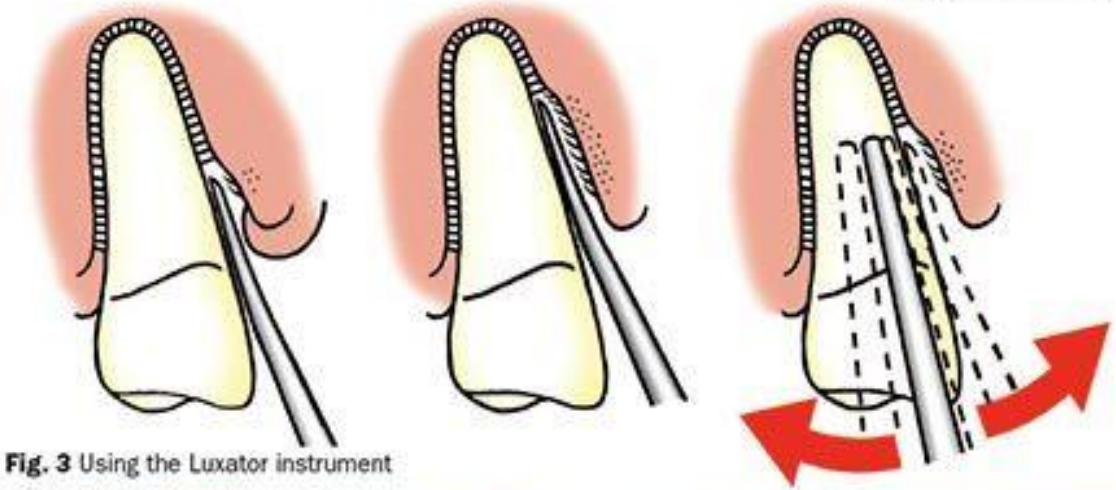
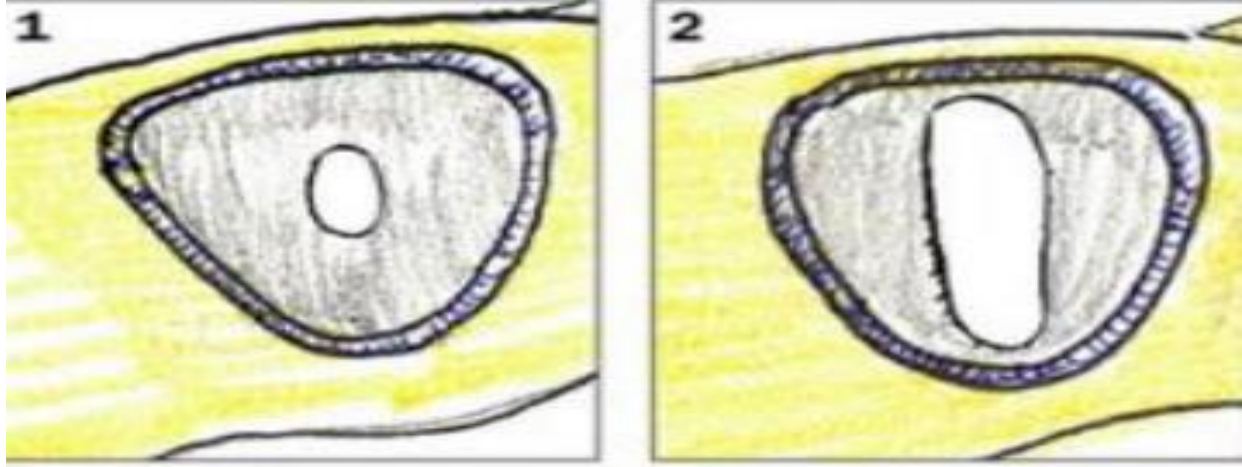


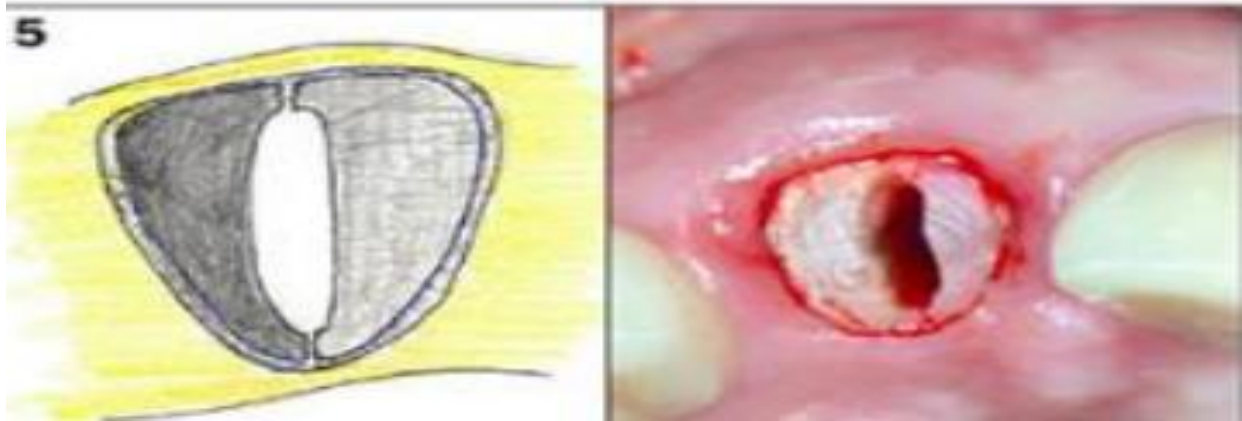
Fig. 3 Using the Luxator instrument

Fig. 4 Luxator in the apical third of the alveolar socket

Fig. 5 Use similar to an elevator but different mode of action

The fourth option is by sectioning through the root trunk, each individual root cone (along with its respective residual portion of the root trunk still attached following sectioning) could then be elevated off adjacent teeth and one another, providing more **sources of leverage**. Such a technique can also be achieved in the anterior, albeit with some modification.





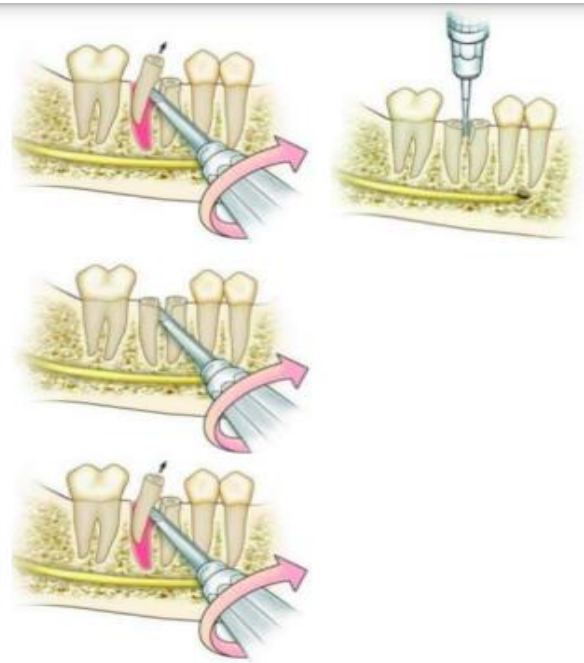
The final option is to proceed with surgical bone removal over the area of the tooth.
Most surgeons prefer to use a bur to remove the bone, along with ample irrigation.
The width of buccal bone that is removed is essentially the same width as the tooth in a mesiodistal direction.
In a vertical dimension, bone should be removed approximately one half to two thirds the length of the tooth root.
This amount of bone removal sufficiently reduces the amount of force necessary to displace the tooth and makes removal relatively easy.
A small straight elevator or **forceps can be used to remove the tooth**.
If the tooth is still difficult to extract after the removal of bone**, a purchase point can be made in the root with the bur at the most apical portion of the area of bone removal**.
Care should be taken to limit bone removal to only that needed to remove the root to preserve bone for possible implant placement.

The purchase point hole should be about 3 mm in diameter and deep enough to allow the insertion of an instrument. A heavy elevator such as a **Crane pick** can be used to elevate or lever the tooth from its socket. **Soft tissue is repositioned and sutured**.

Technique for Open Extraction of Multirooted Teeth

If the decision is made to perform **an open extraction of a multirooted tooth** such as a mandibular or maxillary molar, the same surgical technique used for the single-rooted tooth is generally used.
The major difference is that the tooth **may be divided with a bur to convert a multirooted tooth into two or three single-rooted teeth**.
If the crown of the tooth remains intact, **the crown portion is sectioned in such a way as to facilitate removal of roots.**
If the crown portion of the tooth is missing and only the roots remain, the goal is to separate the roots to **make them easier to elevate.**

Removal of the lower first molar with an intact crown is usually done by sectioning the tooth **buccolingually**, thereby dividing the tooth into a **mesial half** (with mesial root and half of the crown) and a **distal half**.



An envelope incision is also made, and a **small amount of crestal bone is removed**.
Once the tooth is sectioned, it is luxated with straight elevators to begin the mobilization process.
The sectioned tooth is treated as a lower premolar tooth and is removed with a lower universal forceps The flap is repositioned and sutured.

Tooth should be divided. Tooth sectioning is usually accomplished with a **straight handpiece** with **a straight bur**, **round bur and copious irrigation**.
Once the tooth is sectioned, the **small straight elevator is used to luxate and mobilize the sectioned roots**. The straight elevator may be used to deliver the mobilized sectioned tooth. If the crown of the tooth is sectioned, upper or lower universal forceps are used to remove the individual portions of the sectioned tooth.
If the crown is missing, then **straight and triangular elevators** are used to elevate the tooth roots from the sockets.
Sometimes, a remaining root may be difficult to remove, and additional bone removal (as is described for a single-rooted tooth) may be necessary.
Occasionally, it is necessary to **prepare a purchase point** with the **bur and to use an elevator such as the Crane pick to elevate the remaining root**.
After the tooth and all the root fragments have been removed, the flap is repositioned and the surgical area is palpated for sharp bony edges. If any sharp edges are present, they are smoothed with a bone file.
The wound is thoroughly irrigated and débrided of loose fragments of tooth, bone, calculus, and other debris.
The flap is repositioned and sutured in the usual fashion.

An alternative method for removing the lower first molar is to reflect the soft tissue flap and remove sufficient buccal bone to expose the bifurcation. Then the bur is used to section the **mesial root from the tooth and convert the molar into two single-rooted teeth**.
The crown with the mesial root intact is extracted. The remaining mesial root is elevated from the socket with a Cryer elevator
The elevator is inserted into the empty tooth socket and rotated, using the wheel-and-axle principle. The sharp tip of the elevator engages the cementum of the remaining root, which is elevated occlusally from the socket. If the interradicular bone is heavy, the first rotation or two of the Cryer elevator removes bone, which allows the elevator to engage the cementum of the tooth on the second or third rotation. If the crown of the mandibular molar has been lost, the procedure again begins with the reflection of an envelope flap and removal of a small amount of crestal bone.

The bur is used to section the two roots into mesial and distal components. The small straight elevator is used to mobilize and luxate the mesial root, which is delivered from its socket by insertion of the Cryer elevator into the slot prepared by the dental bur.

The Cryer elevator is rotated in the wheel-and-axle manner, and the mesial root is delivered occlusally from the tooth socket. The opposite member of the paired Cryer instruments is inserted into the empty root socket and rotated through the interradicular bone to engage and deliver the remaining root.

Extraction of maxillary molars with widely divergent buccal and palatal roots that require excessive force to extract can be done more prudently by dividing the root into several sections. **This three rooted tooth must be divided in a pattern different from that of the two rooted mandibular molar.**

If the crown of the tooth is intact, the **two buccal roots are sectioned from the tooth and the crown is removed along with the palatal root.**

The standard envelope flap is reflected, and a small portion of crestal bone if needed can be removed to expose the trifurcation area. The bur is used to section off the mesiobuccal and distobuccal roots. With gentle but firm bucco-occlusal pressure, the upper molar forceps deliver the crown and palatal root along the long axis of the root. No palatal force should be delivered with the forceps to the crown portion because this results in fracture of the palatal root. The entire delivery force should be in the buccal direction.

A small straight elevator is then used to luxate the buccal roots, which can then be delivered with a Cryer elevator used in the usual fashion or with a straight elevator. If straight elevators are used, the surgeon should remember that the **maxillary sinus might be close to these roots**, so apically directed forces must be kept to a minimum and carefully controlled

The entire force of the straight elevator should be in a mesiodistal direction or toward the palate, and only slight pressure should be applied apically.

If the crown of the **maxillary molar is missing or fractured**, the roots should **be divided into two buccal roots and a palatal root**. The same general approach as before is used.

An envelope flap is reflected and retracted with a periosteal elevator. A moderate amount of buccal bone is removed to expose the tooth for sectioning.

The roots are sectioned into two buccal roots and a single palatal root. Next, the roots are luxated with a straight elevator and delivered with Cryer elevators, according to the preference of the surgeon.

Occasionally, enough access to the roots exists so that a maxillary root forceps or upper universal forceps can be used to deliver the roots independently.

Finally, the palatal root is delivered after the two buccal roots have been removed. Often, much of interradicular bone is lost by this time; therefore, the small straight elevator can be used efficiently. The elevator is forced down the periodontal ligament space on the palatal aspect with gentle,

Removal of Root Fragments and Tips

If fracture of the **apical one third (3 to 4 mm)** of the root occurs during a closed extraction, an orderly procedure should be used to remove the root tip from the socket.

Initial attempts should be made to extract the root fragment by **a closed technique**, but the surgeon should begin a surgical technique **if the closed technique is not immediately successful**.

Whichever technique is chosen, two requirements for extraction are critically important: (1) **excellent light** and (2) **excellent suction,** preferably with a suction tip of small diameter.

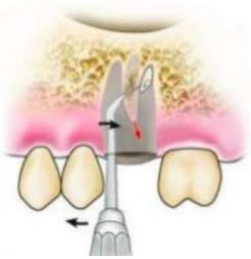
Removal of a small root tip fragment is **difficult unless the surgeon can clearly visualize it**. It is also important that an **irrigation syringe be available to flush blood** and **debris from around the root tip so that it can be clearly seen**.

The closed technique for root tip retrieval is defined as any technique that does not require reflection of soft tissue flaps and **removal of bone**. Closed techniques are most useful when the tooth was well **luxated** and **mobile** before the root tip fractured. **If sufficient luxation occurred before the fracture**, the root tip often is mobile and can **be removed with the closed technique**

However, **if the tooth was not well mobilized before the fracture**, the closed technique is less likely to be successful. **The closed technique is also less likely to be successful if the clinician finds a bulbous hypercementosed root with bony interferences that prevent extraction of the root tip fragment**.

In addition, **severe dilaceration of the root end may prevent the use of the closed technique**.

Once the fracture has occurred, the patient should be **repositioned so that adequate visualization (with proper lighting), irrigation, and suction are achieved**.
The tooth socket should be irrigated vigorously and suctioned with a small suction tip because the loose tooth fragment occasionally can be irrigated from the socket. Once irrigation and suction are completed, the surgeon should inspect the tooth socket carefully to assess whether the root has been removed from the socket.
The extracted tooth should also be examined to see whether and how much of a root remains.
If the irrigation-suction technique is unsuccessful, the next step is to tease the root apex from the **socket with a root tip pick**. A root tip pick is a delicate instrument and cannot be used in the same manner as the Cryer elevator can **to remove bone and elevate entire roots**. The root tip pick is inserted into the **periodontal ligament space**, and the root is teased out of the socket.
Neither excessive apical force nor excessive lateral force should be applied to the root tip pick.
Excessive apical force could result in displacement of the root tip into other **anatomic locations such as the maxillary sinus** or **the mandibular canal**.
Excessive lateral force could result in the bending or fracture of the delicate end of the root tip pick.
The root tip also can be removed with the small straight elevator. This technique is indicated more often for the removal of larger root fragments. The technique is similar to that of the root tip pick because the small straight elevator is **wedged into the periodontal ligament space**, where it acts like a wedge to deliver the tooth **fragment toward the occlusal plane**.
Strong apical pressure should be avoided because it may force the root into underlying tissues.
Displacement of root tips into the maxillary sinus can occur in the maxillary premolar and molar areas. **When the straight elevator is used to remove small root tips** in this fashion, the surgeon's hand must always be supported on an adjacent tooth or a solid bony prominence.



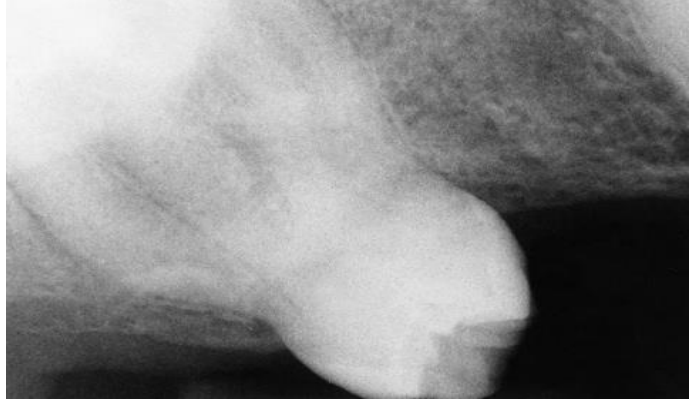
This support allows the surgeon to deliver carefully controlled force and to decrease the possibility of displacing tooth fragments or the instrument tip into an unwanted place.

The surgeon must be able to visualize the top of the fractured root clearly to see the periodontal ligament space. The straight elevator must be inserted into this space and not blindly pushed down into the socket. **If the closed technique is unsuccessful**, the **surgeon should switch, without delay,** to the **open technique**. It is important for the surgeon to recognize that a smooth, efficient, properly performed open retrieval of a root fragment is less traumatic than a prolonged, time consuming, frustrating attempt at closed retrieval. Two main open techniques are used to remove root tips.

The first is simply an extension of the technique described for surgical removal of single-rooted teeth. A soft tissue flap with a releasing incision is reflected and retracted with a periosteal elevator. **Bone is removed with a bur to expose** the buccal surface of the tooth root.

The root is buccally delivered through the opening with a small straight elevator. The wound is irrigated and the flap is repositioned and sutured.fragment is located. A dental bur is used to remove the bone overlying the apex of the tooth, exposing the root fragment. A root tip pick or small elevator is then inserted into the window, and the tooth is guided out of the socket.

The preferred flap technique is **the three-cornered flap because** of a need for more extensive exposure of the apical areas.



Widely divergent roots increase the likelihood of fracture of bone, fracture of tooth root, or both

Severe dilaceration of roots may result in fracture of the root unless surgical extraction is performed

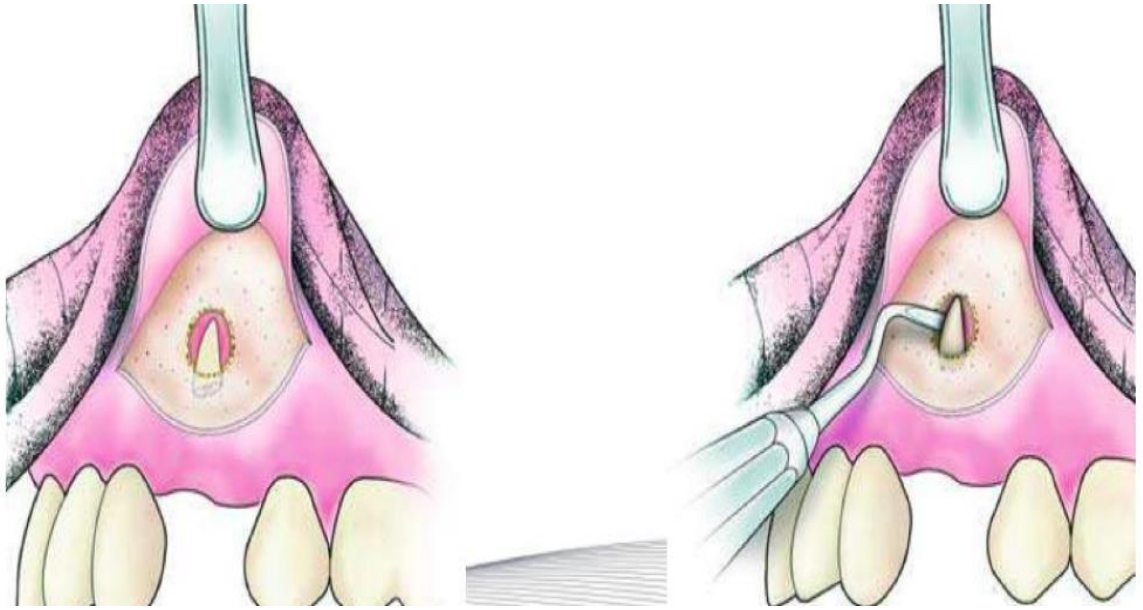
Large caries or large restorations may lead to fracture of the crown of the tooth and thus to more difficult extraction

The open window approach is especially indicated when the **buccocrestal bone must be left intact**, such as in the removal of maxillary premolars for orthodontic purposes, especially in adults.

A modification of the open technique just described can be performed to deliver the root fragment without excessive removal of the buccal plate overlying the tooth.

This technique is known as the **open window technique**.

A soft tissue flap is reflected in the same fashion as for the approach just discussed, and the apical area of the tooth.



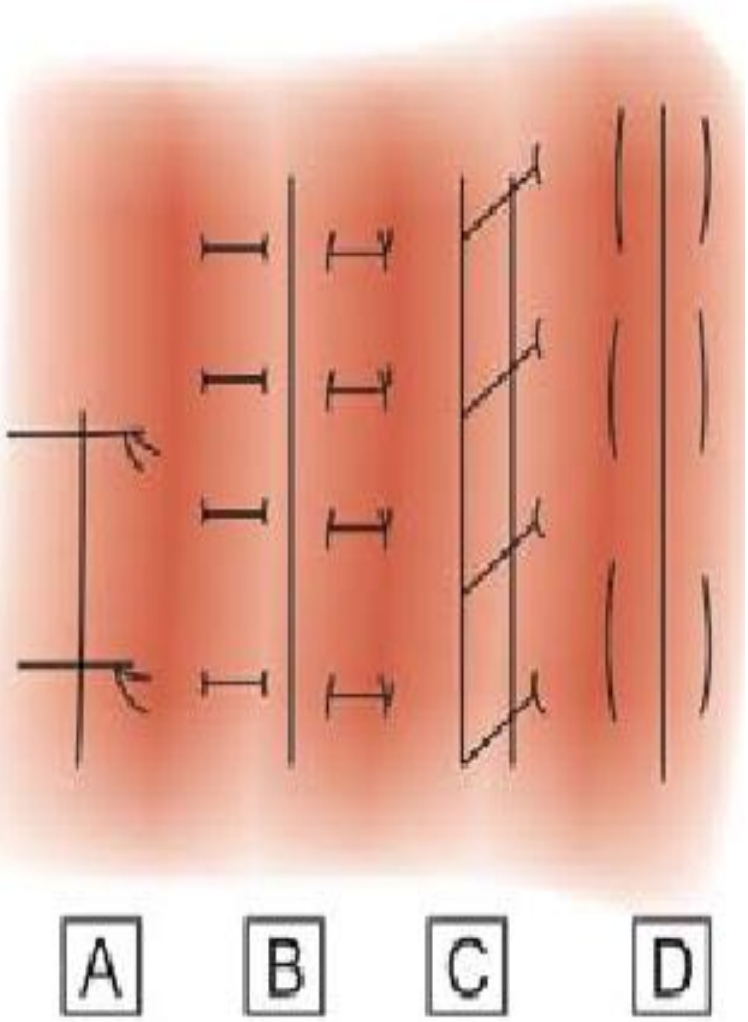
The bone edges should be checked; if sharp, they should be smoothed with a bone file. **By replacing the soft tissue flap** and **gently palpating it with a finger**, **the clinician can check edge sharpness**.

Removal of bone with a **rongeur is rarely indicated because a rongeur tends to remove too much bone in such circumstance**s. Once the tooth is delivered, the entire surgical field should be thoroughly irrigated with copious amounts of sterile saline. **Special attention should be directed toward the most inferior portion of the flap (where it joins the bone) because this is a common place for debris to settle, especially in mandibular extractions.**

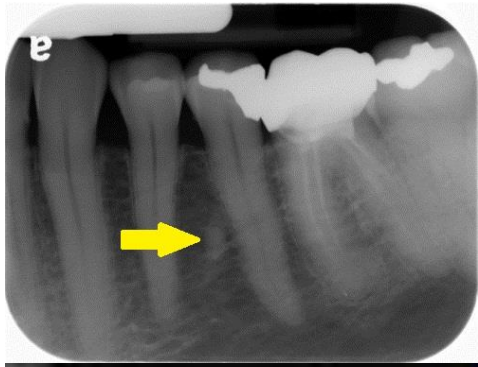
If the debris is not removed carefully by curettage or irrigation, it can cause delayed healing or even a small subperiosteal abscess in the ensuing 3 to 4 weeks.

The flap is then set in its original position and sutured into place.

If the incision was properly planned and executed, the suture line will be supported on healthy, intact bone



Indications for leaving root fragments :



When a root tip has fractured and approaches of removal have been unsuccessful, and **when the open surgical approach may be excessively traumatic**, the surgeon may **consider leaving the root in place**. As with any surgical approach, the **surgeon must balance** the **benefits against the risks of surgery**.

In some situations, **the risks of removing a small root tip may outweigh the benefits**.

The conditions that must exist for a tooth root to be left in the alveolar process are:

- The root fragment must be small, **usually no more than 4 to 5 mm in length**.
- The root must be **deeply embedded in bone and not superficial,** to prevent subsequent bone resorption from exposing the tooth root and interfering with any prosthesis that will be constructed over the edentulous area.
- The tooth involved **must not be infected**, and there must be **no radiolucency around the root apex**. This lessens the likelihood that subsequent infections will result from leaving the root in position.
- **The root should not be mobile.**
- **If the surgeon elects to leave a root tip in place the patient must be informed that**, in the surgeon's judgment, leaving the root in its position **will do less harm than surgery**. In addition, radiographic documentation of the presence and **position of the root tip must be obtained and retained in the patient's record**, the patient should be **recalled for follow-ups to track the fate of this root.**
- The patient should be instructed to contact the surgeon immediately should any problems develop in the area of the retained root.

Multiple Extractions

If multiple adjacent teeth are t o b e extracted at a single session the surgeon should determine **if there is need for interim partial immediate dentures**, any **type of soft tissue surgery**, such as **tuberosity reduction or the removal of undercuts or tori in critical areas**.

If dental implants are to be placed at a later time, it **may also be desirable to limit bone trimming** and **socket compression**. **In some situations, dental implants may be placed at the same time as the teeth are removed**, which would **require the preparation of a surgical guide stent to assist in aligning the implants appropriately**.

Extraction sequencing

Maxillary teeth should usually be **removed first for several reasons:**

- **Infiltration anesthetic has a more rapid onset and also disappears more rapidly**. This means that the surgeon can begin the surgical procedure sooner after the injections have been given.
- **Surgery should not be delayed because profound anesthesia is lost more quickly in the maxilla**.
- During the extraction process, debris such as portions of amalgams, fractured crowns, and bone chips may fall into the empty sockets of the lower teeth if the lower surgery is performed first.
- **Maxillary teeth are removed with a major component of buccal force**. Little or no vertical traction force is used in removal of these teeth, as is commonly required with mandibular teeth.

A single minor disadvantage for extracting maxillary teeth first is that if hemorrhage is not controlled in the maxilla before mandibular teeth are extracted, the hemorrhage may interfere with visualization during mandibular surgery but this is **usually not a major problem because hemostasis should be achieved in one area before the surgeon turns attention to another area of surgery**, and the surgical assistant should be able to keep the surgical field free **from blood with adequate suction.**

Posterior teeth are extracted first, this allows for the more effective use of **dental elevators and forceps to extract the teeth**.
After extraction the **buccolingual plates are pressed with firm pressure** and the **soft tissues are repositioned**, **sharp spicules of bone should be removed** and **smoothed with bone nibbler (Rongeur) and bone file**, the area should be **thoroughly irrigated with normal saline and the papillae in position.**

After Surgery

The post extraction care includes the use of **analgesics** and **antibiotics**.
The patient is advised to maintain good oral hygiene to avoid any infection at the site of incision. Immediate consumption of hot beverages or coarse foods is to be avoided as it may trigger bleeding.
The patient is also advised to abstain from use of straws, vigorous tooth brushing and rinsing the mouth for next few hours. Smoking should also be avoided till the sutures are removed and wounds are healed as it may lead to delayed wound healing.