

Maxillofacial Trauma - Midface Fractures/P.I

Key Points

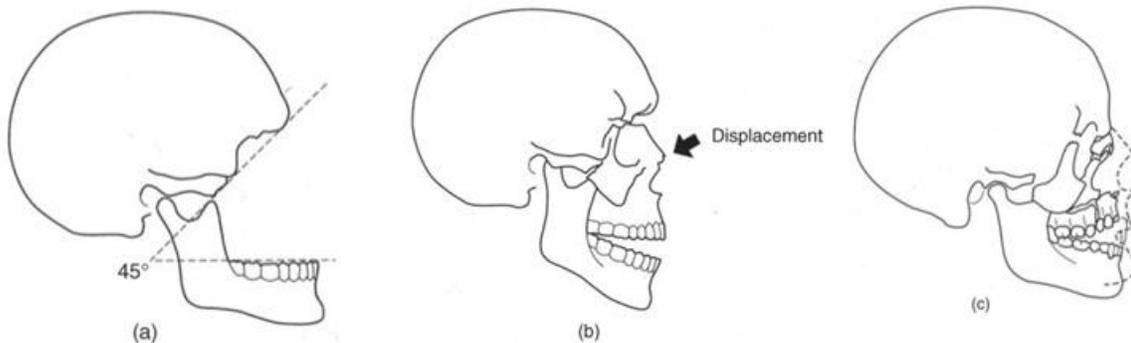
I. The skeleton of the skull

It consists of 22 bones: **8 cranial bones** (1 frontal, 1 occipital, 1 ethmoid, 1 sphenoid, 2 temporal and 2 parietal bones) and **14 facial bones** (2 zygomatic bones, 2 maxillae, 2 nasal bones, 2 lacrimal bones, 2 palatine bones, 2 inferior conchae, 1 mandible and 1 vomer bone).

The upper facial skeleton is chiefly the frontal bone, making up the superior orbital margins and orbital roof.

The midfacial skeleton (middle 3rd of facial skeleton) extend from the frontozygomatic suture to frontozygomatic suture on the other side and downward to the maxillary occlusal plane

- The base of the skull (**where the frontal bone articulates with the sphenoid**) extends backwards and angled downwards at approximately **45° to the occlusal plane** of the upper teeth.
In certain types of extensive fractures; the midfacial bones are crushed or sheared off the cranial base and there will be backward displacement along the inclined skull base, this allows for the posterior teeth of the maxillae contact the posterior mandibular teeth prematurely and produce an anterior open bite. Occasionally this displacement is sufficient to cause **lengthening of the face**. This inward crushing produces the characteristic '**dish-face**' deformity.



A conscious patient will be able to compensate and survive whatever the severity of facial fractures. The real danger to life exists when there is coincident head injury and depression of the level of consciousness, the patient will rapidly suffocate unless the airway is protected, or the patient placed in a **lateral or prone position**.

- As an incidence: the **nasal bones are least resistant**, followed by the **zygoma** and then **the maxilla**.
- The bones of the midface can be thought of as a series of vertical and horizontal bony struts or '**buttresses**' surrounding the sinuses, eyes and uppermost part of the respiratory tract. Joining these buttresses together is wafer-thin bone. The buttresses also define the three dimensional shape of

the face, therefore in treatment planning the plates should be placed on these buttresses during fixation to restore the normal contour of the facial skeleton.

II. CSF leakage through the nose (CSF Rhinorrhea), occurs in:

- Comminution of the ethmoid bones (which lies in anterior cranial fossa); occurs with high level fractures (**lefort II, III**) and some severe fractures of the nasal complex as **NasoOrbitoEthmoidal fractures (NOE #)**.
- Fractures involving the **posterior wall of the frontal sinus**.

Clinically/

- CSF rhinorrhoea is often **unilateral**.
- When the blood clot from the epistaxis dries and the flow of CSF continues; it forms a classical (**tram line**) pattern.
- It also forms **classical ring** around the clotted blood on the pillow (**halo on pillow**)
- If the patient in supine position; the CSF will pass in the pharynx giving **metallic salty taste**.

Clinical detection of CSF rhinorrhoea may be complicated by the presence of lacrimal fluid, blood and nasal secretions. Testing the discharge for **beta-2 transferrin**, a brain specific variant of transferrin, is the best available diagnostic method.

III. Involvement of the nerves

- Damage to the **infraorbital** and **zygomatic nerves** may occur with fractures that involve the orbital floor resulting in anaesthesia or paraesthesia of the skin of the cheek and upper lip.
- The **anterior, middle** and **posterior superior alveolar nerves** are also frequently damaged leading to anaesthesia of the upper teeth and gingiva.
- The cranial nerves within the **superior orbital fissure (Oculomotor III, trochlear IV, Ophthalmic division of Trigeminal V and Abducens VI)** may be damaged in zygomatic and high midface fractures (lefort III). **The sixth cranial nerve is most frequently involved** resulting in loss of abduction of the eye. Sometimes all of the contents damaged (superior orbital fissure syndrome), in which case **ptosis** (dropped upper lid), **ophthalmoplegia** (fixed immobile eye ball) and anaesthesia within the distribution of the ophthalmic branch of the fifth cranial nerve are noted.
- The globe of the eye and the optic nerve are remarkably well protected by the physical structure and arrangement of the bones of the orbit. Rupture of the globe or tearing of the optic nerve is therefore fortunately rarely found.

IV. The paranasal sinuses

- In most midface fractures the paranasal sinuses are involved, particularly the maxillary sinus.
- The thin bony walls are often grossly comminuted with bleeding into the cavity, which results in appearing opaque on radiological examination.

Apart from the routine reduction and repositioning of the fracture, no other special treatment is required and the radiological appearance of the sinuses will return to normal within about 6 weeks.

- Following a fracture extending into paranasal air sinus; air may escape into the soft tissues of the face. This surgical **emphysema** usually affects the flaccid tissues of the eyelids and gives rise to the physical sign of ‘**crepitation**’ of the soft tissues when they are palpated. The treatment involves antibiotics (air is contaminated), avoid nose blowing and observation.

THE LE FORT CLASSIFICATION

This classification was described by Guérin (1866) and Le Fort (1901). The Le Fort classification in the modern context is becoming more of historical interest rather than practical value. Nevertheless, the Le Fort terminology is still useful and remains in common use.

Le Fort I (also called Guerin fracture or low level fracture)

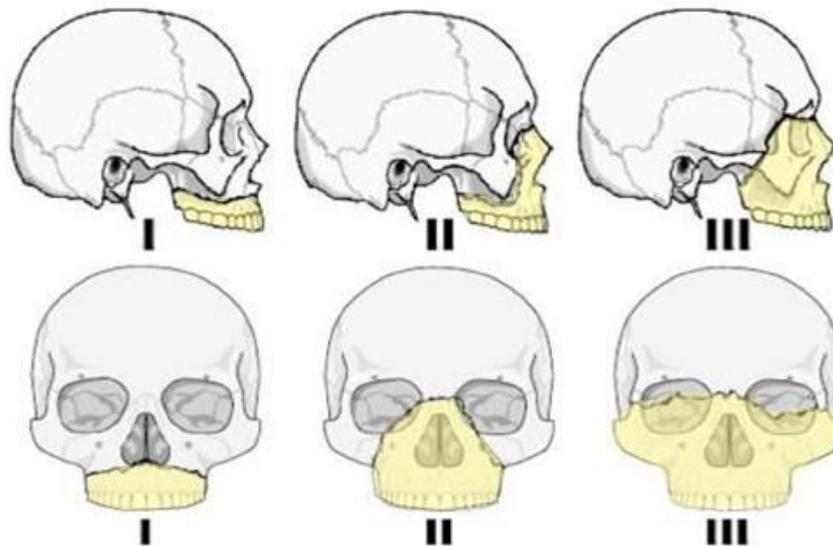
It is caused by a force delivered above the apices of the teeth. The fracture occurs at the level of the piriform aperture and involves the anterior and lateral walls of the maxillary sinus, lateral nasal walls and pterygoid plates at the junction of the lower one-third with the upper two-third. A unilateral maxillary fracture may also occur, with the fracture coursing through the palatal suture line or adjacent to it.

Le Fort II (Pyramidal or Sub-Zygomatic fracture)

This fracture involves the midnasal bones, medial orbital wall and downward to zygomaticomaxillary suture and posteriorly to the pterygoid plates half way. It can be unilateral or bilateral.

Le Fort III Level (craniofacial disjunction)

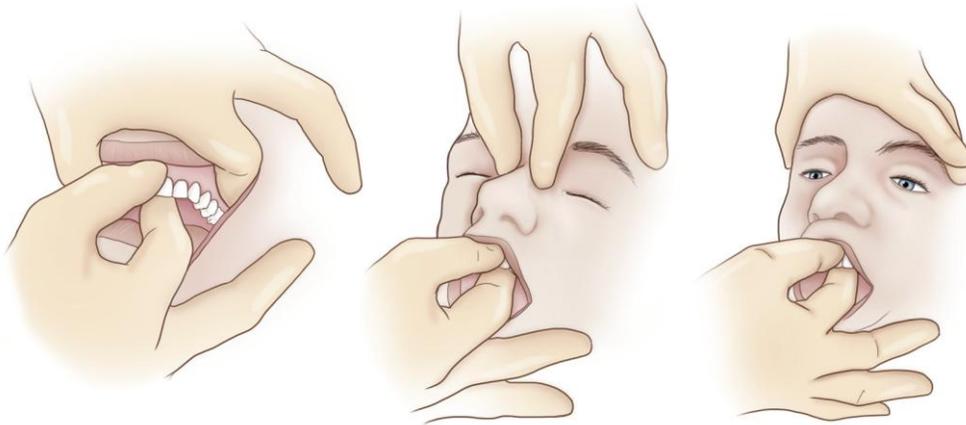
It starts at the frontonasal suture, runs through the frontomaxillary suture, over the medial orbital wall to involve the lacrimal bone and the lamina papyracea of the ethmoid bone, the fracture line passes posteriorly to fracture the pterygoid plates at the root, thus separating them from the cranial base.



Clinical examination of Lefort Fractures

Examination should include firmly grasping the maxillary arch with the index finger and thumb facially and palatally and attempting displacement of the maxilla in three dimensions, as well as compression and expansion of the maxillary arch.

The left hand should be used for palpation the nasal, inferior and lateral orbital rims to detect which sutures are involved in the fracture line.



Signs and Symptoms of Lefort I Fracture

- ✓ Swelling of the upper lip
- ✓ Ecchymosis and tenderness over the zygomaticomaxillary buttress and noted in the buccal sulcus beneath each zygomatic arch
- ✓ The occlusion is disturbed
- ✓ Variable amount of mobility of the whole dentoalveolar segment. The fragment may drop and the patient has to keep the mouth open to accommodate the increased vertical dimension of the bite.
- ✓ The impacted type of fracture may be almost immobile and associated with fractured cusps of teeth.
- ✓ Split in the palate, palatal ecchymosis (**Guerin Sign**)
- ✓ Percussion of the upper teeth results in a distinctive ‘cracked-pot’ sound, similar to that produced when cracked china is tapped with a spoon. This sign is present whenever there is a fracture of the central middle third of the face, but is particularly valuable in the diagnosis of Le Fort I fractures.



On the left: Guerine sign
On the right: 3D CT of lefort I fracture

Signs and symptoms common to Le Fort II and III fractures

- ✓ Gross oedema of the soft tissues, giving rise to the characteristic 'moon-face' appearance.
- ✓ Bilateral circumorbital ecchymosis (**raccoon eye or panda eye**).
- ✓ Rapid swelling of the eyelids.
- ✓ Subconjunctival ecchymosis (Subconjunctival haemorrhage).
- ✓ Oedema of the conjunctiva, known as chemosis. This causes the swollen conjunctiva to bulge out from between the eyelids.
- ✓ Flattening of the nasal bridge and spreading of the intercanthal distance.
- ✓ **Diplopia** (double vision) is usually present:
 - Is typically caused by interference with the action of extraocular muscles; caused by oedema and haemorrhage in and around the muscles (temporary diplopia), or entrapment of the extraocular muscles (as in the fractures), or nerve damage (prolonged diplopia and could be permanent).
- ✓ Both fracture types may extend backwards to involve the cribriform plate. There may be a discharge of straw coloured fluid from the nose, suggesting a CSF leak mixed with serum (it is more common with lefort III, classical Lefort II does not involve the cribriform plate of the ethmoid).
- ✓ The bones of the middle third of the face have been separated from the inclined plane of the base of the skull and forced downwards and backwards to a variable degree. In such cases there will be retrusion of the midface with lengthening of the whole face (dish face deformity).
- ✓ Palatal split is common in unilateral types
- ✓ Tapping of the upper teeth will give the characteristic 'cracked pot sound'



on the right

Dish face (concave profile)

On the Left

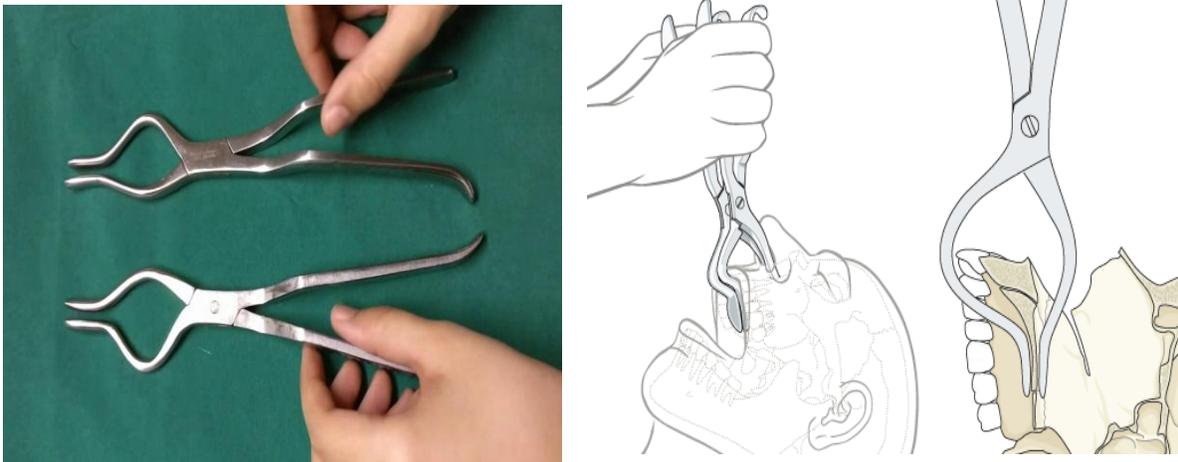
Moon Face with Raccoon eyes

The differences between the two types of fractures:

lefort II passing through the floor of orbit; making the whole fractured segment pyramidal in shape and causing damage to infraorbital N. resulting in parasthesia, while in **Lefot III** the fracture line pass through the orbital roof and make the separation at the frontozygomatic buttress instead of infraorbital one.

Treatment

- **Observation;** A soft diet for several weeks with Follow-up. It is indicated for:-
 1. Non-mobile or minimally mobile linear fractures with unaffected occlusion.
 2. Edentulous patients with atrophic maxilla
 3. When general medical conditions do not allow surgical intervention.
- **Surgical Treatment**
 - ☒ **Reduction**
 - Manual (for simple cases)
 - Rowe's disimpaction forceps: in the figure below

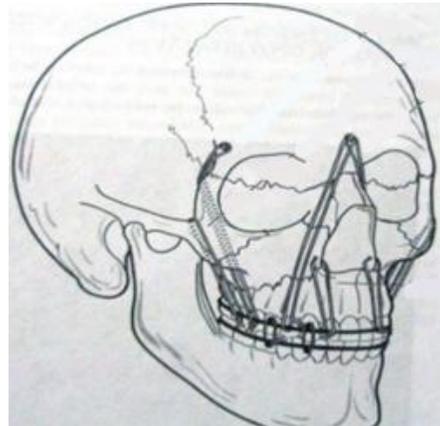
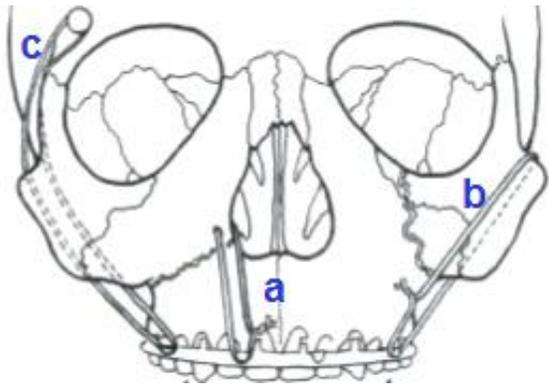


☒ Fixation

After applying IMF using the mandible as a guide to accurate occlusal reduction, the middle third must be immobilized by attaching it to the adjacent facial bones superior to the fracture line. This can be achieved by **wire suspension**; recently it has been superseded by **ORIF** with the use of miniplates.

Common Methods of internal wire suspension include:

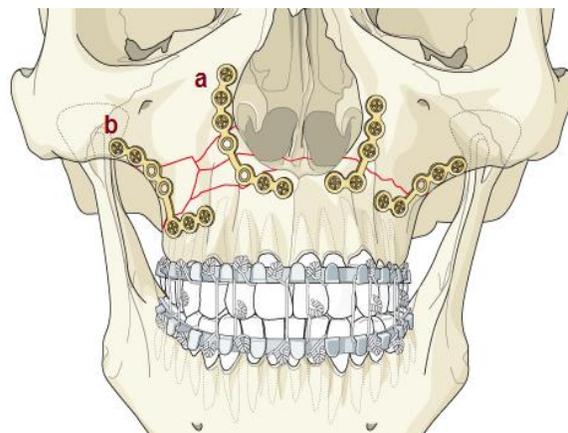
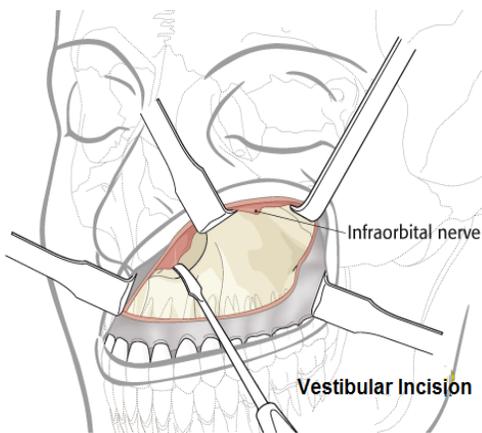
- ✓ Pyramidal fossa suspension wiring (a).
- ✓ Circumzygomatic suspension wiring (b)
- ✓ Supraorbital rim suspension wiring - frontal wire suspension- (c)



Open reduction and internal fixation (ORIF)

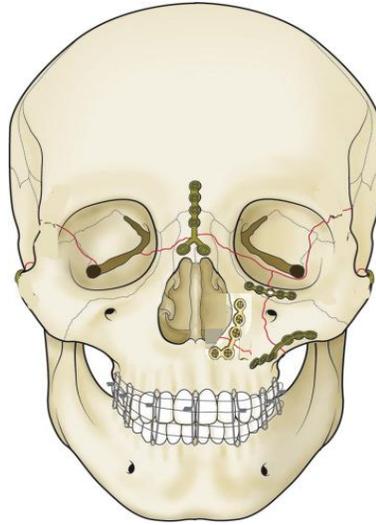
The current method of choice is internal fixation with miniplates, microplates, three-dimensional meshes, and screws. With this method, it is possible to fix even the smallest fragments and to stably bridge areas of comminuted fragments in the buttress regions until the fractures have consolidated. The patient is first placed in IMF to re establish the pre traumatic occlusal relationship.

For **lefort I** through intra oral **vestibular incision**, 4 miniplates are placed, along the **piriform (nasomaxillary) - (a)** and **zygomaticomaxillary buttresses-(b)**

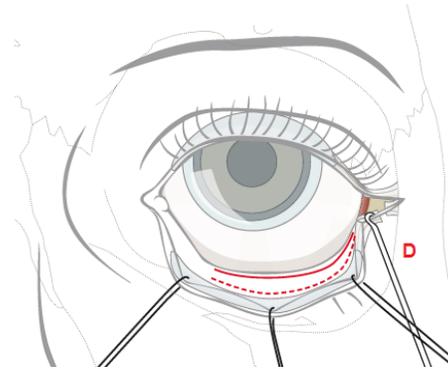
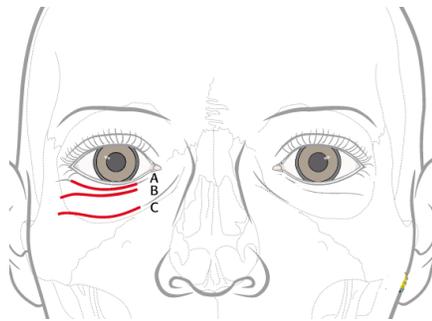


In cases of mobile **Le Fort II fractures**:

- Fixation of **zygomaticomaxillary buttress** through intra oral approach, as mentioned earlier



- Fixation of the **orbital rim** is required, this is achieved by one of the following:
 - Subciliary incision- (a).
 - Subtarsal or mid-lower lid incision- (b).
 - Infraorbital incision (easiest but least cosmetic) – (c).
 - Transconjunctival Incision (most cosmetic and most difficult)- (d).



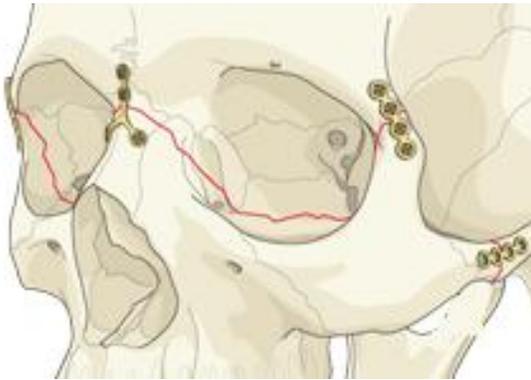
- Fixation of frontonasal suture through
 - Local flaps
 - Existing laceration
 - Coronal Flap

In **Le Fort III** cases, the sutures that need fixation are: fronto nasal, frontozygomatic and zygomaticotemporal sutures.

All can be approached by coronal approach.

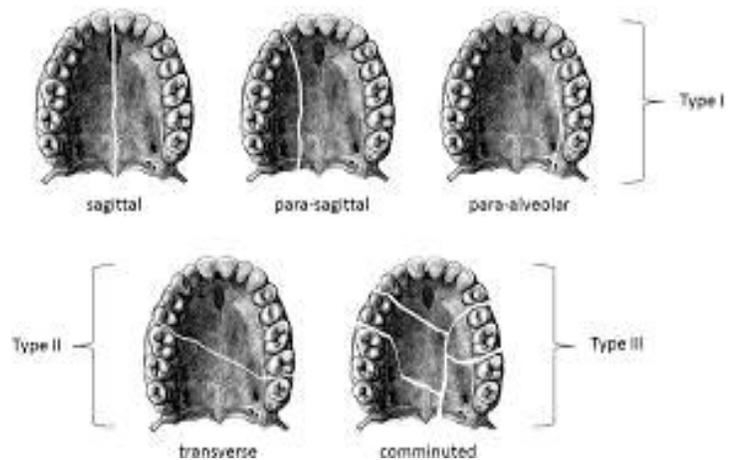
Other simpler approaches to only frontozygomatic suture are:

- Lateral eye brow -(A)
- Supratarsal (upper eyelid) -(B)



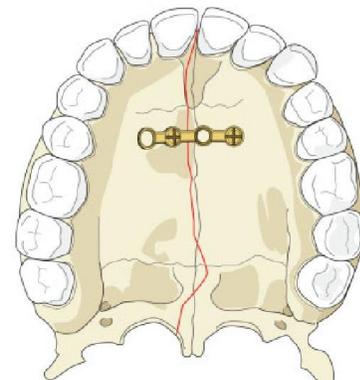
Palatal Fractures Classification

- ✓ Type I: Sagittal; if the fracture is located at the midline, it is considered the median type. The paramedian type describes a fracture that parallels the midpalatal suture
- ✓ Type II: Transverse
- ✓ Type III: Comminuted



Treatment

Treatment of the palatal fracture can be either IMF or ORIF or Occlusal splints (which are extremely helpful in the comminuted palatal fracture).



This is the end of the Lecture, Good Luck