



## Reference point and confirming points two important guides in treatment of panfacial fractures of panfacial Fx: A case report

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### ABSTRACT

A therapeutic challenge to maxillofacial surgeons is management of panfacial fractures, especially when treating multiple comminuted bone fractures. One of the most important goals in these fractures is achieve and stablish a correct occlusal relationship of the mandibular-maxillary unit in parallel with the proper positioning of the jaws with the skull base and other facial units. Also, it is important to prevent long-term sequelae such as facial asymmetry, enophthalmos, and malocclusion that could be caused by inadequate correction. To achieve all these goals some usual guides of management are proposed as follow: "Bottom to up", "Top to down", "outside to inside", or "inside to outside". We present 3 cases of Panfacial fracture and the proposed methods were based on different sequences of management with introducing "reference point" as the most intact area to determine the management concept & "confirming point" as the areas that should be reduced and fixed completely. These points act as an orientation aid during surgery and aid to successfully restore the entire face contour and maxillomandibular occlusion and also to improves surgical procedure.

**Keywords:** Panfacial fracture; Internal fixation; Open reduction; Reference point; Confirming point.

### Introduction

Panfacial fractures are defined as multiple facial bone fractures including the upper, middle, and lower thirds of the facial skeleton [1], which in most cases are associated with loss of soft- and hard tissue and some sequela such as blindness [2]. Even at early management, the exact reduction and repositioning of fracture segments to their pre-traumatic position will be very complicated and challenging especially in comminuted ones [3]. In

this matter, various sequences of reduction are offered: "Bottom-to-top", "Top-to-bottom", "Inside-out", and "Outside-inside" are the most common concepts of sequence regarding the management of panfacial fractures in which the selection of the sequence is based on some factors such as the pattern of fracture and the experience and priority of surgeon [4].

The most widely used concepts are “Bottom-to-top & Outside-to-inside”; i.e. After mandibular reconstruction as a strong buttress, and establishing the maxilla over the mandible with the aim of rehabilitation of the occlusion, other facial compartments including zygomatico-orbital complex (ZMC) and naso-orbito-ethmoidal complex (NOE) will be reconstructed [4]. In this article, we presented 3 patients with emphasis on two concepts including “Reference point” and “Confirming points” which act as a guide to reduce the fracture segments, return the facial contour and improves the result of surgical procedure. Reference point is defined as the intact point around the fractured area from which the reduction will start and ascertain the sequence of the reduction and fixation. For example, if in a total orbital reconstruction, the only intact area is medial part of the infraorbital rim, this point could be the reference point and reconstruction will obey the sequence of Inside-outside. The other concept is confirming points which indicate the areas that should be checked out—and of course should be reduced and fixed- in order to become sure that the tridimensional orientation of the facial complex is precise. We have three confirming points for the midface: ZS suture (zygomatico-sphenoid suture), Root of zygomatic arch and zygomatic buttress.

In some centers with the lack of high-technology surgical modalities (navigation assisted surgery) and especially in some cases in which the patient is not able to afford the expenses of such modalities or better to say in some countries which are confronted with the SANCTION, it is still remarkable to rely on the intraoperative direct visual assessment of the surgical field by the surgeon. On the other hand, in this article we try to mention and emphasize that the selection of the sequence of treatment should have a logical background and concept rather than the taste and priority of the surgeon.

### Case Report I

A 19-years-old patient has been referred to Maxillofacial Surgery ward of Sina Hospital with diagnosis of panfacial fracture due to motor vehicle accident (MVA) 1.5 months before the referral time.

The clinical findings were as follows:

1. Loss of right mandibular premolars,
2. Right comminuted ZMC fracture,
3. Right comminuted mandibular body fracture,
4. Right hemi Lefort I fracture,
5. Right Coronoid fracture,
6. Right ectropion due to severe multiple facial scars,
7. Severe malocclusion,
8. Paresis

of right facial nerve. 9. Malnutrition as the sequela of the trauma (Fig-1 & 2). Treatment plan was planned in two phases so that treatment of ZMC fracture was postponed to the second phase. At the first phase, via the vestibular approaches in maxilla and mandible and also through old facial scar, we had an access to the fractures in Maxilla and Mandible. The arch bars were placed and fixed to the teeth at both jaws and also two IMF screws were placed in right molar area of mandible (non edentulous area). After osteotomy and refracturing of the fracture segments and removal of callus in mandible and maxilla, intermaxillary fixation was performed. For fixation we started with the simplest fracture area; i.e. Hemi Le fort I fracture which has been done with the aid of a miniplate placed at pyriform rim. Thereafter ORIF (open reduction and internal fixation) at the body of the mandible was performed by a mandibular plate at compression zone and a miniplate at tension zone. The gap at the fracture site of mandibular body was filled with the previously removed callus and also the coronoid process, which had been osteotomized, At the end scar revision was done.

At the following photos, you can see the Pre- and Post-operative CT scans and clinical views (4 months thereafter) of the patient (Fig-3 & 4). The second surgical phase was scheduled 4 months after the first phase (5.5 month after trauma) with the sequence of “top to bottom” and “outside to in inside”: In this phase, the approaches were Hemicoronal, Transconjunctival (Retrosseptal) and maxillary Vestibular. In this patient the intact area was upper face so the most suitable area to start fixation or the Reference point was frontozygomatic suture (ZFS). On the other hand, ZFS has to be reduced and fixed based on the Confirming point adjacent to it, which was Zygomatico-sphenoid Suture (ZS). In other words, the position of ZS suture would confirm the accuracy of reduction at ZFS and its tridimensional orientation. In this case, due to defect at ZS suture, we didn't have this confirming point and not only we had to rely on other confirming points for exact orientation of ZMC, but also, we had to reconstruct the Lateral Orbital wall with titanium mesh to prevent postoperative enophthalmos (Fig-5). After fixation of zygomaticofrontal suture, horizontal pillars should be reconstructed. The first horizontal pillar to be reduced and fixed would be zygomatic arch which was fixed with a microplate in order to prevent postoperative pseudo-zygomatic arch bowing. Root of zygomatic arch in these cases, in which fracture line is located at posterior part of arch, has to be checked out as the second confirming point (Fig-6). The second horizon-

tal pillar to be reduced should be Inferior Orbital rim. In this case, medial orbital wall was intact so internal orbital reconstruction was done only to reconstruct the defect at Orbital floor with titanium mesh covered by temporal fascia in order to provide a smooth surface for the globe. In internal orbital reconstruction paying attention to Orbital axis and the edge of defect is mandatory (Fig-7).

Next the large defect from infraorbital rim up to maxillary alveolar process at anterior wall of maxillary sinus was covered with another Titanium mesh. The third confirming point is Zygomatic buttress which was fixed by a mini plate. Furthermore, ORIF at pyriform rim was repeated. Finally, Zygomaticus Major muscle was suspended with 2-0 Nylon suture. The following photos show the comparative CT scan (Pre- and Post-operative) (Fig-8). Nine months after the second surgery, the third surgery was scheduled. The problem list was: 1. Right Zygomatic arch bowing (was diagnosed 2 months post-op), 2. Depression at right Temporal fossa and 3. Mild right enophthalmos (Fig-9).

The approaches were Hemicoronal and Transconjunctival (Retro-septal) approaches. Intraoperatively we noticed that the fracture of microplate over the zygomatic arch was the cause of delayed postoperative bowing of zygomatic arch. The treatment plan in this phase was designed as follow: at first the plates at zygomatic arch and zygomaticofrontal suture were removed and the segments of Zygomatic arch was re-fixed with two short miniplates. Internal Orbital reconstruction was adjusted by releasing of soft tissue from titanium mesh and adding a double-layered Medpore. Finally, temporal depression was augmented with two sheets of Medpore (Fig-10). You can see the final results in the following photo (Fig-11).

## Case Report II

A 25-years-old patient was referred to Maxillofacial surgery ward of Sina hospital with the diagnosis of Panfacial fracture due to motor vehicle accident (MVA) one month before referral. The clinical findings were as follows: 1. No light perception at right eye, 2. Scar over the dorsum of the nose, 3. Telecanthus with 40 mm intercanthal distance, 4. Saddle nose and 5. Mild enophthalmus (Fig-12). In summery we had: right Lefort II fracture, left Lefort I fracture and Lefort III fractures, undisplaced palatal fracture, naso-orbito-ethmoidal (NOE) type II fracture, frontal bone (glabella) fracture and comminuted nasal bone fracture (Fig-13). For this patient (just like the 1<sup>st</sup>. case) we preferred to use

submental intubation and the approaches were Bicoronal approach, vestibular approach at maxilla, bilateral Transconjunctival approach (Retroseptal+Lat. Canthotomy) and H- type approach over the nose including old scar on the nose. The concept of “Top to bottom” and “Inside to outside” was selected so initially upper midface including glabella & dorsum of the nose were reconstructed. For this aim two nasal bones and frontal processes of maxillary bone were fixed to frontal bone using microplates then ORIF for other segments of nasal bones were completed with other microplates. Then with the aid of a 0.4mm SS wire and bur holes at the Med. orbital walls (and passing the wire like a mattress suture), we constricted and elevated the NOE complex in order to decrease the intercanthal distance to 35mm. Then we grasped the Med. canthal tendon at each side with the 2-0 Nylon suture and fixed it to the contralateral plate in order to have a support for the ligaments. You can see all these procedures in the following photos with indicating the wire and the sutures with purple pointing marks. As the next step, Frontozygomatic suture and Lateral Orbital wall were fixed, paying attention to Zygomatico-sphenoid sutures as a confirming point and after that right and left inferior orbital rims were fixed (Fig-14).

Since bilateral zygomatic arches were relatively not displaced, the next step was fixation of left Zygomatic buttress and right Pyriform rim (Fig-15). Consequently, a monocortical calvarial graft was harvested in order to augment the nasal dorsum. This graft was then covered with temporal fascia and was fixed with the suture grasping the upper lateral cartilage and passing over the graft (Fig-16). In the following photos you can compare the Pre- and Post-operative CT scans (Fig-17).

## Case Report III

A 37-years-old patient was referred to Maxillofacial surgery ward of Sina hospital with the diagnosis of Panfacial Fx. due to motor vehicle accident (MVA) 5 days before referral time. According to clinic-radiographic findings, the pattern of the fracture was as follows: Symphyseal Fx., Lefort I Fx., Right Lefort II Fx., Left Lefort III Fx., Maxillary and Mandibular dentoalveolar Fx., s, and Frontal bone Fx. Some degree of pure blow out fracture was seen at sagittal cuts of CT scan which also revealed a spur-shaped bone fragment resulting restriction of movement of ocular muscle (Inferior Rectus M.) (Fig-18). At the beginning we followed the sequence of “bottom to top”: At first mandible has been reduced and fixed as a reference point. In oth-

er words, after reduction of dentoalveolar fractures in both jaws with the aid of Arch bar and IMF, the fracture line at symphysis was exposed via Vestibular approach and was reduced and fixed with 2 miniplates. But at upper-face and midface we preferred to obey the concept “Up to bottom”. Via Bicoronal approach, frontal bone, nasofrontal suture and left ZFS were exposed, reduced and fixed. Then with a wire we established a bone fragment at sup. Orbital rim. As the next step ORIF over pyriform rim and zygomatic buttress have been performed via vestibular approach.

Finally, internal orbital reconstruction of left eye was done through Transconjunctival approach and a sheet of Porex was inserted at orbital floor to cover the defect. The postoperative photos were obtained 2 months after operation. At the following photos you can see the intraoperative and postoperative photos of the patient and compare the Pre- and Post-operative CT scans (Fig-19 to 21).



Fig 1. Preoperative photograph. Case 1.

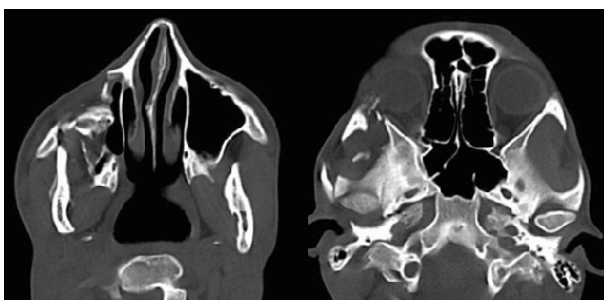


Fig 2. Preoperative CT scan. Case 1.

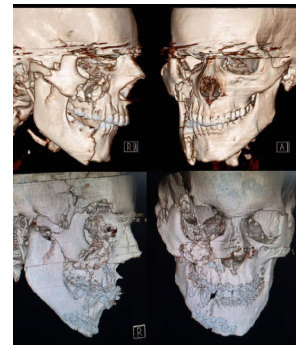


Fig 3. Pre- and Post-operative CT scans. Case 1.



Fig 4. Post first surgery photographs. Case 1.

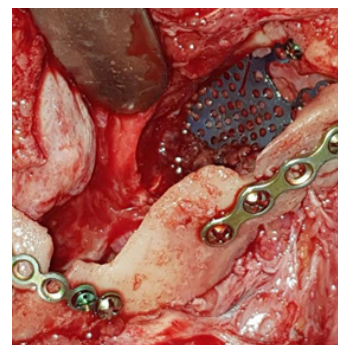


Fig 5. Lateral Orbital wall reconstruction with titanium mesh.

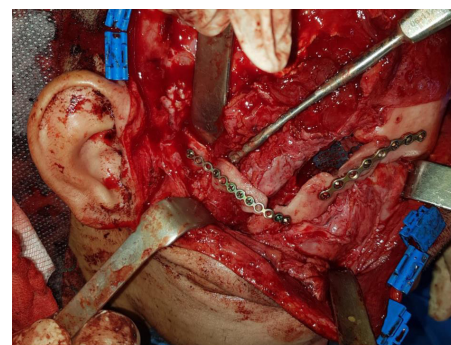


Fig 6. Zygomatic arch fixation.

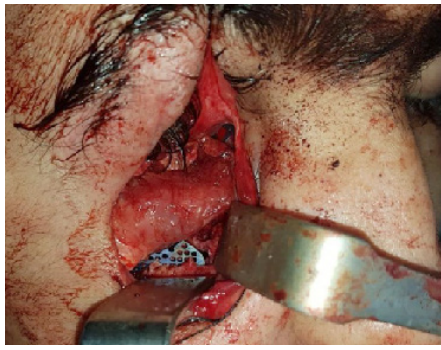


Fig 7. Temporal fascia placed over the orbital floor.



Fig 11. Pre- and Post-operative comparison. Case 1.

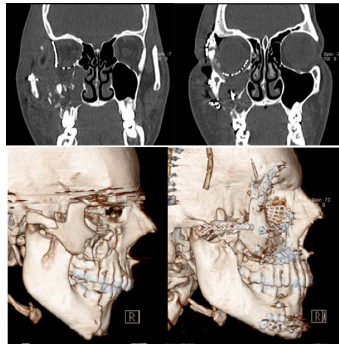


Fig 8. Pre- and Post-operative comparative CT scan.

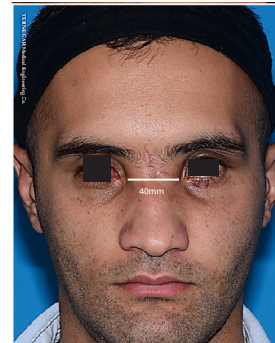


Fig 12. Preoperative photograph. Case 2.



Fig 9. Post second phase surgery photographs.

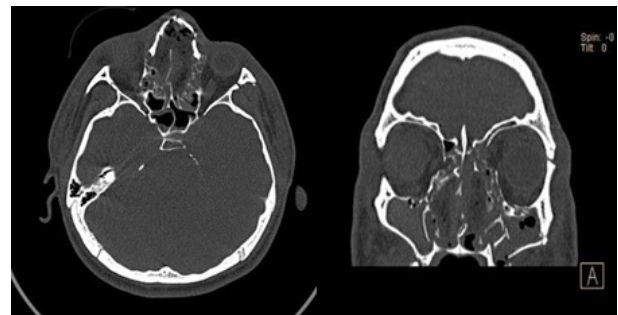


Fig 13. Preoperative CT scan. Case 2.

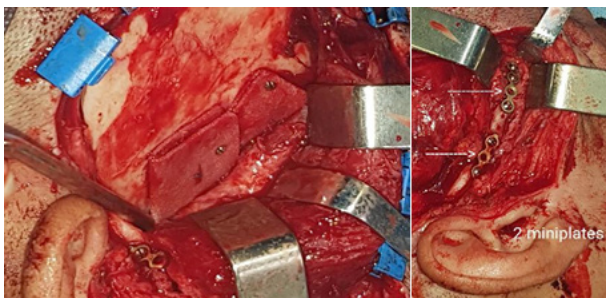


Fig 10. Temporal depression augmentation with two sheets of medpore.

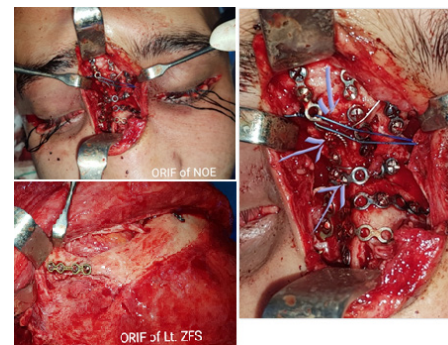


Fig 14. Intraoperative photography. Case 2.

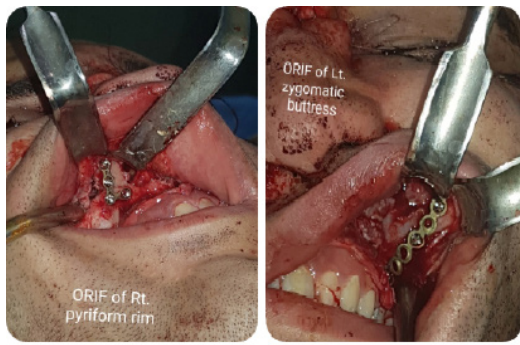


Fig 15. Zygomatic buttress and right Pyriform rim. Case 2.



Fig 19. Intraoperative photographs. Case 3.

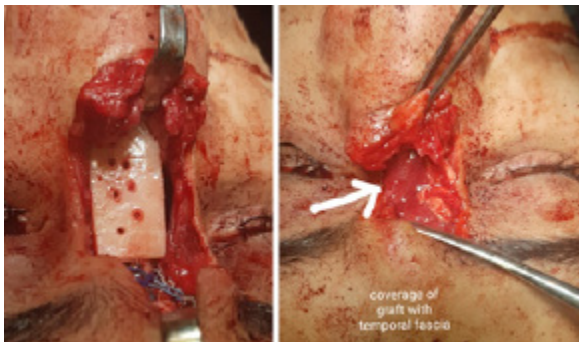


Fig 16. Temporal fascia & graft placing using suture passing through upper lateral.



Fig 20. Case 3 final clinical results.

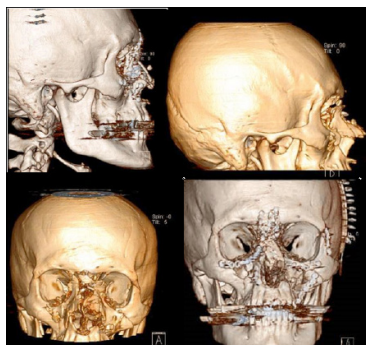


Fig 17. Pre- and Post-operative CT scans. Case 2.

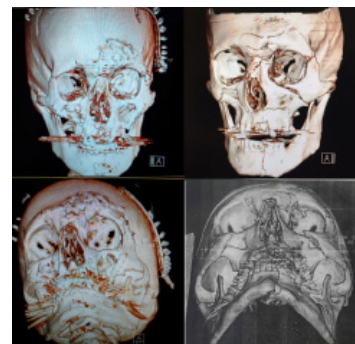


Fig 21. Final CT scan results of case 3.

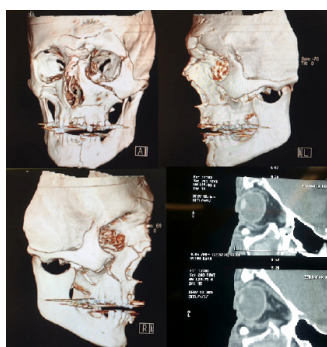


Fig 18. Preoperative CT scan. Case 3.

## Discussion

There are different etiological factors for Panfacial fractures according to geographical, socioeconomical and cultural characteristics of the society [5,6]. In our society motor vehicle accidents & motor cycle accidents are the most common causes. The main goal in treatment of Panfacial fractures is repositioning of fracture segments, reconstruction of facial contour and more importantly rehabilitation of occlusion [7]. There are various concepts regarding sequence of reduction and fixation of fracture segments in management of Panfacial Fx [1]. Furthermore there are different approaches for exposure and fixation based on experience of the surgeon [8]. Some surgeons considered reconstruction of occlusion as the first step in treatment and begin with mandible. Therefore they pay attention to facial

vertical height by repositioning of maxillomandibular unit and then the rest of the face. In fact they follow the sequence of “Bottom to top” [9]. On the other hand some surgeons addresses establishing facial width to reconstruct facial projection and consequently establishing the facial height, following the concept of “Inside to outside” [2]. An important point in reduction and fixation of maxillofacial skeleton is paying attention to the horizontal and vertical pillars of the face which make a strong framework for face and a good pathway to transmit the mastication forces [10]. These pillars should be reduced properly and stabilized firmly [1]. No matter which concept has been chosen, the exact three-dimensional orientation of face has to be checked out by confirming points.

### Conclusion

In this study, we have tried to emphasize the importance of “Reference point and Confirming points” in term of reduction and fixation of fracture segments besides the “concepts of sequencing” through 3 cases. Although choosing the most conservative approaches to expose the fracture segments has always been the priority of surgeons, management of Panfacial fracture needs more aggressive approaches.

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### Conflict of Interest

There is no conflict of interest to declare.

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