



# Minimally invasive approaches in severe panfacial fractures

## Ciddi panfasial kırıklarda minimal invazif yaklaşımlar

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### BACKGROUND

Minimally invasive approaches to severe panfacial fractures are being used increasingly to reduce surgical trauma and the related complications. In this study, it was aimed to determine the ideal surgical approaches in severe panfacial fractures.

### METHODS

Sixteen patients with severe panfacial fractures were included in this study. Minimally invasive approaches were used for *Le Fort* III fracture in six patients, for *Le Fort* II fracture in four patients, and for bilateral maxillary and orbital floor fractures in six patients. We used subciliary, intraoral vestibular, lateral eyebrow, and open skin incisions to reach orbital, maxillary, zygomaticomaxillary buttress, and nasoethmoidal fractures, respectively.

### RESULTS

All fractures were repaired with miniplates and screws. No hematoma, wound infections or other complications were observed.

### CONCLUSION

Minimally invasive approaches in severe panfacial fractures are considered suitable and effective in terms of aesthetic results.

**Key Words:** Minimally invasive; panfacial fracture; surgical approach.

### AMAÇ

Cerrahi travma ve ilgili komplikasyonları azaltmak için, ciddi panfasial kırıklarda minimal invazif yaklaşımların kullanımı gittikçe artmaktadır. Bu çalışmada, ciddi panfasial kırıklarda ideal cerrahi yaklaşımlar amaçlanmıştır.

### GEREÇ VE YÖNTEM

On altı panfasial kırıklı hasta çalışmaya dahil edildi. *Le Fort* III kırıklı altı, *Le Fort* II kırıklı dört ve iki taraflı maksilla ve orbital taban kırıklı altı hastada minimal invazif yaklaşımlar kullanıldı. Orbital, maksiller, zigomatikomaksiller bileşke ve nazoetmoidal kırıklara yaklaşmak için sırası ile subsilier, ağız içi vestibular, lateral kaş ve açık cilt insizyonları kullanıldı.

### BULGULAR

Tüm kırıklar miniplak ve vidalar ile onarıldı. Hematom, yara enfeksiyonu ya da diğer komplikasyonlar gözlenmedi.

### SONUÇ

Ciddi panfasial kırıklarda, minimal invazif yaklaşımların estetik sonuçlar açısından uygun ve etkin olduğu göz önünde bulundurulmalıdır.

**Anahtar Sözcükler:** Minimal invazif; panfasial kırık; cerrahi yaklaşım.

The facial region has both functional and aesthetic units. Trauma to the facial region may corrupt any of these units, causing aesthetic deformities and functional difficulties. The periorbital region, including the zygomatic arch, and nasoethmoidal areas are the key-

stone aesthetic units of the face. The facial region also has an important role in the upper airway tract, and it must also be evaluated after facial injuries. Deformities after facial trauma must be evaluated and treated as soon as possible.<sup>[1-3]</sup>

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Violent assaults, motor vehicle accidents and sports injuries may cause panfacial fractures that affect the lower, middle and upper part of the face.<sup>[1]</sup> Misdiagnosis, inadequate operation planning, lack of exposure, and insufficient bone grafting during the operation may cause secondary deformities such as flattening of the midface, ectropion, soft tissue dystopia, skeletonization of the frontal process of the zygoma, and temporal wasting.<sup>[2]</sup> Generally, trauma centers prefer the coronal approach for the surgical exposure<sup>[3]</sup> because it provides the greatest potential surface exposure to the upper and middle facial regions. The coronal approach begins with incision from ear to ear and dissection continues to the orbital region in an avascular plane of subperiosteal or supraperiosteal layer.<sup>[4]</sup> Dissections of neurovascular bundles and the frontal branch of the facial nerve are the main difficulties of this procedure. Widened scars, peri-incisional hair loss, sensory deficits, frontalis nerve injury, temporal fossa depression, and corneal abrasion can be seen as complications of the coronal approach. To obtain an adequately wide exposure in the case of lower face fracture, an additional incision,

like transoral or infraorbital incision, may be required.

The author used subciliary incision to reach the orbital floor and the orbital rim, intraoral vestibular incision to reach the anterior maxilla and mandibula and open sky approach to reach the nasoethmoidal region. If there is a laceration zone above the fracture, it is used to reach the fracture zone. The authors investigated the efficacy of a minimally invasive approach in fractures that have a gap formation in bone.

## MATERIALS AND METHODS

Sixteen patients were operated because of panfacial fractures. Only patients who had a gap formation between the fractures in different facial bones were included. Eleven patients were male and five were female. The age of the patients ranged from 3 to 41, with an average age of 23 years.

Six patients had *Le Fort* III fracture, four patients had *Le Fort* II fracture and six patients had bilateral maxillary and orbital floor fractures. Nine patients also had mandibular fractures with midfacial fracture. Nasoethmoidal fractures were treated in 10 patients.

Medial canthal ligament repair was done in 11 patients with Kirschner wire. Six patients had gap formation at the orbital floor. Iliac crest bone grafts, titanium meshes and septal grafts were used to reconstruct the orbital floor. All fractures were repaired with miniplates and screw systems whereby the incisions and dissections. We used intermaxillary fixation for six mandibular fractures and rigid fixation for three mandibular fractures.

### Types of Surgical Approaches

We used subciliary incision to reach the orbital floor and the orbital rim. Skin incision starts 2 mm below the lower-lid margin and courses in lateral to medial fashion. The pretarsal orbicularis oculi muscle is preserved. Dissection proceeds in the inferior and posterior direction, and at the level of the inferior border of the tarsus, the orbicularis oculi is transected horizontally. After the muscle is transected, the orbital septum is encountered. The periosteum over the orbital rim is incised and adequate exposure of the orbital rim and floor is obtained.<sup>[5]</sup>

Intraoral vestibular incision is made in the upper vestibular region



**Fig. 1.** Preoperative anterior (a), right oblique (b), left oblique (c), and lateral (d) views in a 23-year-old male patient with panfacial fractures (Figures were provided with patient's consent).

from the second molar to first canine. With the mucoperiosteal flap elevation, exposure of the anterior maxilla and superior dento-alveolar arch is obtained. Intraoral approach also permits the exposure of mandibular fractures if necessary.

Exposure of zygomaticomaxillary buttress fractures is achieved by an incision that is made at the lower border of the lateral part of the eyebrow. The dissection is very simple and carries no risk of damaging the frontal branch of the facial nerve.

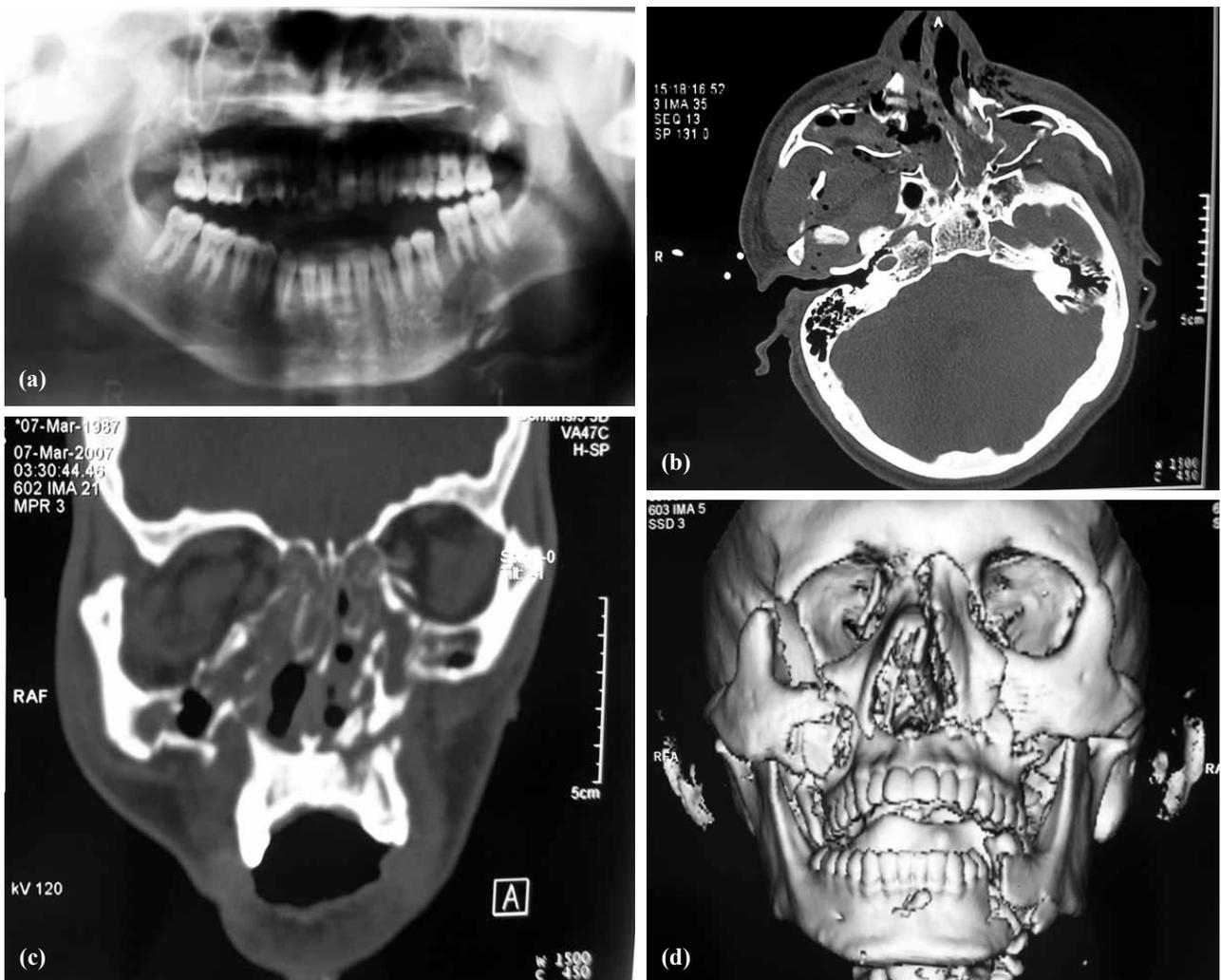
Converse described the open sky technique for the exposure of nasoethmoidal fractures.<sup>[6]</sup> The author used modified open sky technique, in which a vertical incision is made between the medial cantus and nasal dorsum, and the incision can be extended to the medial eyebrow. If there are bilateral nasoethmoidal fractures, a contralateral incision can be done so that exposure of the nasal root, frontal process of the maxilla and medial canthus is obtained.

## RESULTS

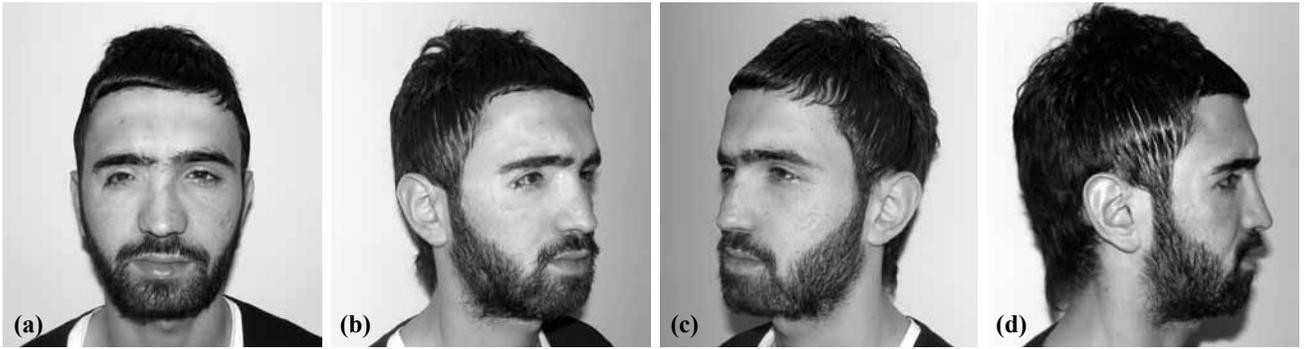
Nine patients were also operated for accompanying mandibular fractures. No local complications, like infection or hematoma, were observed.

Gap formation at the orbital floor was reconstructed with iliac crest bone graft in six patients, titanium mesh in three patients and nasal septum in one patient. The author used bone grafts for larger defects. After the operation, orbital bulging to the fracture site was prevented and enophthalmos of the patients was corrected. Two patients had moderate vision loss prior to surgery due to optic nerve entrapment but one of the patients regained his normal vision after the surgery.

Medial canthal ligament repair was performed in six patients by attaching the canthal ligament to nasal bones. The oval shape of the eye and the symmetry between the eyes was preserved and flattening of the nose was also corrected. There was no incidence of cerebrospinal fluid leakage. One patient had lacrimal canal stenosis after the operation, which required a minor operation.



**Fig. 2.** Preoperative panoramic (a), computerized tomography (b, c, d) images in the same patient (notice *Le Fort III* and complex mandibular fractures).



**Fig. 3.** Postoperative anterior (a), right oblique (b), left oblique (c), and lateral (d) views in the same patient (Figures were provided with patient's consent).

At first, fractures of buttresses were reduced and fixated with miniplates and screw (Figs. 1-4). When the main framework was obtained, the other fracture sites were exposed and treated. The author used iliac bone graft to establish normal height of the zygomaticomaxillary buttress in three patients and a normal facial projection was achieved.

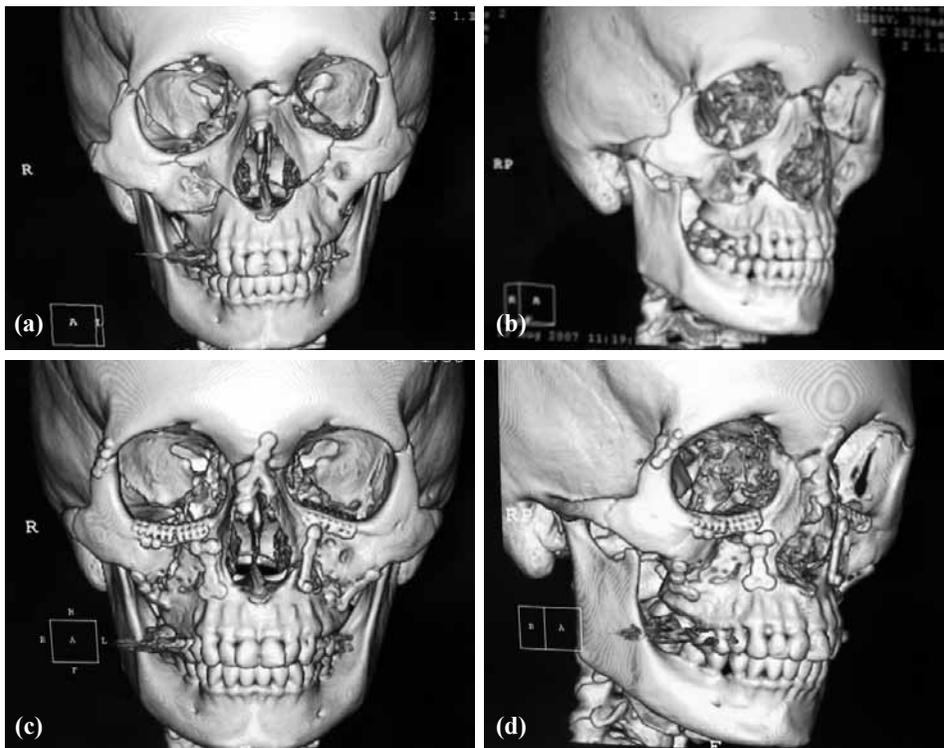
**DISCUSSION**

A systematic approach must be planned and used for the treatment of panfacial fractures. Recent articles have reported varied means of skin incision and osteosynthesis, and there is no consensus among the authors for the treatment of facial fractures. Reconstruction of

buttresses, frontal bar, and ramus and corpus of the mandibula is very important to provide facial width, length and projection.<sup>[7]</sup> Bone fractures also affect the skin envelope and lead to soft tissue shrinkage, stiffness and undesirable scarring.<sup>[8]</sup>

Different approaches to the facial skeleton are used by various surgeons. In trauma and orthognathic surgery, coronal incisions are mostly preferred to reach the frontal bone, upper orbita and zygoma.<sup>[9]</sup> British maxillofacial surgeons have reported that local incisions are preferred by 71% of surgeons for zygomaticomaxillary fractures.<sup>[10]</sup>

A coronal approach provides the widest exposure,



**Fig. 4.** Preoperative anterior (a), right oblique (b) and postoperative anterior (c), right oblique (d) three-dimensional computerized tomography images in a 35-year-old female patient (notice *Le Fort III* fracture).

but larger scars, peri-incisional hair loss, sensory deficits, frontalis nerve injury, temporal fossa depression, and corneal abrasion can be seen as complications of the coronal approach. Complex dissection of the neurovascular bundle also complicates the procedure. Some authors reported that local incisions have inadequate surgical exposure,<sup>[11]</sup> but local incisions are gaining in popularity recently because the dissection is simple and the scar may be hidden in the natural crease.

Especially in fractures of the buttress, facial height and width are changed and cause great deformity, and bone grafting may be used to provide proper height. Immediate bone grafting may facilitate the reconstruction and achieve optimal and desirable results.<sup>[12]</sup> Early exposure of the fracture and replacement of the missing parts are the best treatment options to prevent bone collapse.

Subciliary, subtarsal and transconjunctival incisions are all used for exposure of the orbital rim and orbital floor. In the literature, low complication rates are reported.<sup>[13]</sup> Ectropion, entropion, lid edema, and risk of noticeable scar are all potential complications. There is no significant difference in complications between the three methods. We used subciliary incision, which provides adequate exposure and also permits titanium mesh or bone grafting with no need for additional incisions. If there is a gap formation in the orbital floor or if the orbital bulging is excessive, the subciliary incision can be used for the reconstruction.

Occlusion is the touchstone of mandibula-maxillary fracture treatment. Intermaxillary fixation or rigid fixation with miniplates and screws is used for osteosynthesis. If the mandibula has multiple fractures, the author begins from the condylar fracture and osteosynthesis proceeds outer to inner, in a lateral to medial fashion.

Closed and open approaches are both used for mandibular fractures. The two approaches have acceptable and good long-term results.<sup>[14]</sup> Intermaxillary fixation provides better occlusion and has a lower infection rate,<sup>[15]</sup> so it should be the first choice if possible. If open approach is used for treatment in comminuted or multiple mandibular fractures, the osteosynthesis proceeds outer to inner, in a lateral to medial fashion. The condylar fractures are reduced and the other fracture sites are managed according to the condyle.

In conclusion, a minimally invasive approach to the fracture site is a good alternative method. It is simple and effective, with a lower complication rate,

and also provides the opportunity for immediate bone grafting, if necessary.

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