

## ***Surgical correction of sequels involving orbitozygomatic fractures: a case report***

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### ***Abstract***

***The treatment of the sequels involving the orbitozygomatic complex is a challenging inside oral and maxillofacial surgery. The surgical correction involves the reestablishment of the zygomatic contour with adjacent bones and the anatomy-functional restoration of ocular globe. With this purpose several techniques and materials can be used, among them it can be cited bone graft and biomaterials. The aim of the present paper is to present a surgical treatment of zygomatic-orbital fracture sequel using autogenous graft of iliac crest and titanium mesh, to improve the repositioning of ocular globe and bone edges. Moreover, discussions on the handling of fractures sequels involving zygomatic-orbital complex will be argued under the form of literature revision.***

***Keywords: Zygomatic-orbital fractures- Surgical correction- Biomaterials- Autogenous Graft***

### ***INTRODUCTION***

***The fractures involving the orbitozygomatic complex are sufficiently common and the literature reports a high occurrence of it<sup>1</sup>. Significant complications can occur as consequence of an absence or inadequate therapy, including facial asymmetry, enophthalmos, persistent diplopia, vertical dystopia, restriction of ocular movements and sensorial deficit involving infra-orbital nerve<sup>2</sup>. The main causes of these complications happen due to an inadequate reduction of fracture segments and to a loss of ocular globe support, which cause alterations in the relation content-container of the ocular globe and its bone compartment.***

***The treatment of zygomatic-maxillary complex sequels aims to repair the bone continuity in orbital floor; the contour of zygomaticofrontal suture and the zygomatic arch, the alignment of the zygomatico-maxillary pillar and the internal portion of orbital bone walls***

***The present paper aims to report a surgical treatment of zygomatic-orbital fracture sequel using autogenous bone graft and titanium mesh, to obtain a correct repositioning of ocular globe and infra orbital margin in addition to proportion an adequate bone contour in the region of frontozygomatic and zygomaticmaxillary suture,***

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*resetting the morpho-functional integrity of involved facial structures*

### **CASE REPORT**

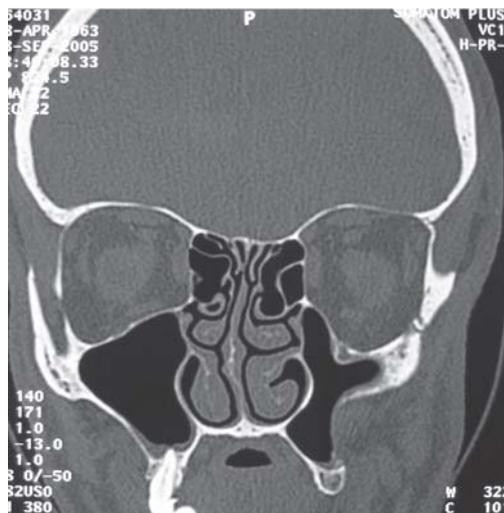
*Having suffered a car accident three years before, a forty-two-year-old male patient came to us with a history of trauma in the zygomatic-orbital area. Immediately after the accident, the patient received first-aid treatment only.*

*Through the clinical exam, we identified facial asymmetry and mild enophthalmos on the left side, as well as vertical dystopia and injuries both in the frontal zygomatic suture and in the infraorbital opening. The outcome of the palpation was an irregularity in the front zygomatic suture and in the left infraorbital margin. In addition, the intraoral exam confirmed the unevenness in the zygomatic-maxillary area. Although the patient reported feeling paresthesia in the left infraorbital margin, he did not complain about diplopia or limitation of eye movement.*

*The computed tomography showed the presence of osseous consolidation in the zygomatic bone, with medial rotation in the left frontal zygomatic, zygomatic-maxillary and zygomatic-temporal sutures. Furthermore, a dislocation of the lateral wall in relation to the medial wall was found in the maxillary area, with volume decrease. As for the eyeball, its diameter had increased vertically. Finally, by means of axial sections the medial dislocation in the speno-zygomatic suture was observed (PICTURE 1; PICTURE 2).*

*Based upon these findings, we reached a diagnosis of complete dislocation of the zygomatic bone (medial direction) associated with increase in the eyeball volume. The suggested surgical technique consisted of autogenous juxtaposed bone graft as well as titanium ribs in the orbital margin and floor. As for the frontal zygomatic suture, we decided to use the juxtaposed graft only.*

*The orbital floor was reconstructed by using cortical, iliac crest bone mainly, which was covered with titanium ribs as well as autogenous particulate bone, obtained from the same iliac crest. The new contour of the infraorbital margin was reestablished by adjusting the titanium rods to the zygomatic-maxillary body, in order to simulate the infraorbital border. The titanium rod was affixed with three 5*



Picture 1 - The computed tomography shows medial rotation in the left frontal zygomatic, zygomatic-maxilla and zygomatic-temporal sutures.



Picture 2 - The computed tomography with tridimensional reconstruction shows medial rotation in the zygomatic-orbital area.

*mm long screws, as well as covered with autogenous particulate bone (PICTURE 3). Aiming at fixing the other bone defect, located in the frontal zygomatic suture, we inserted another iliac segment by means of two screws, juxtaposed to the site where the bone had been fractured, in order to reestablish the orbital lateral projection (PICTURE 4).*

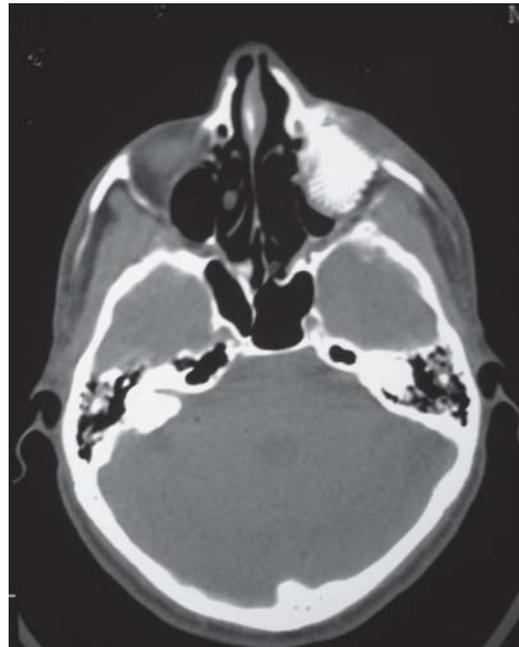
*The patient is undergoing follow-up sessions which consist of clinical and imaging exams, in which we can clearly see the improvement in the projection of the eye ball, the decrease of the*



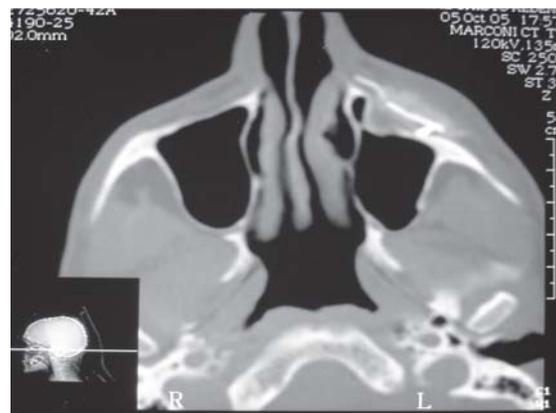
Picture 3 - Autogenous particled bone graft associated with titanium rods.



Picture 4 - Bone graft in the frontal zygomatic suture.



Picture 5 - The patient is undergoing follow-up sessions which consist of imaging exams.



Picture 6 - Postoperative follow-up showing reconstruction of the infra-orbital margin.

*enophthalmos, the better infraorbital projection as well as the excellent recontour of the frontal zygomatic suture (PICTURE 5; PICTURE 6).*

**DISCUSSION**

*Zygomatic-orbital fracture sequels may derive directly from the absence or inadequate reduction of the fractures, as well as from bone*

*instability due to the inappropriate choice of the site and number of screws for stabilizing the bone.*

*In order to deal with the traumatic sequels of the zygomatic-orbital complex, it is mandatory that a complete assessment of the patient be made. For establishing an objective plan of treatment, various factors must be determined and analyzed, such as the level of bone dislocation, the integrity of the orbital walls, the position of the eyeball, the volume of the orbital content, the changes in the insertions of the canthal ligament, the periorbital*

soft tissues, the radiographic and tomographic exams, and the ophthalmologic evaluation.<sup>3</sup> In the present case, the combination of all these data has provided the precise information about the level and extension of the dislocation of the zygomatic bone, the volume of the orbital cavity and the conditions of the orbital floor:

The treatment of the zygomatic orbital sequels involves two surgical modalities, i.e., osteotomy and refracture with repositioning of the bone and employment of juxtaposed grafts. The time period between the injury and the treatment plays an essential role in the selection of the best surgical procedure to be adopted. From 21 days to 4 months, Carr and Mathog<sup>4</sup> recommend performing osteotomies on the lines of the fracture in order to reposition the zygomatic bone. Cohen and Kawamoto Jr.<sup>5</sup> describe a technique for correcting late enophthalmos and facial asymmetry by using an oscillating saw to recreate fracture lines, and then reposition the zygomatic bone in an overcorrected way, through interposed bone grafts.

The use of bone grafts is frequently required in late traumatic reconstructions.<sup>6</sup> Due to the long time period between fracture and surgery, a process of remodeling and reabsorption of the juxtaposed, fractured bone margins and of the smashed fragments takes place. As a result, the identification of the exact site of the fracture lines, the anatomic repositioning of the segments and the bone stabilization may be difficult to be achieved.<sup>3</sup> After 4 months of untreated fracture, the most adequate therapeutic conduct for surgical correction, according to Carr and Mathog<sup>4</sup>, is to juxtapose autogenous bone grafts, excluding the processes of osteotomy and bone repositioning, aiming at reestablishing adequate bone contours and eyeball leveling.

In the present case, due to the rather long time period, we chose to use autogenous bone graft to reestablish the contour in the frontal-zygomatic and maxilla-zygomatic areas. For a better stabilization and support of the eyeball in the orbital floor area, the association of autogenous cortical bone graft to titanium rods was employed. In the infraorbital margin area, due to the absence of projection, the plaque was modeled in such a way to simulate that anatomic area.

Craniofacial bone defects may be repaired by using different techniques and implant materials

The choice of the implant material will depend upon the size and shape of the defect to be repaired, in addition to the conditions of the area that will receive it. According to Potter and Ellis III<sup>2</sup>, the osteogenic, osteoinducing and osteoconductive capacities, combined to a possibly greater bone availability, to the presence of cortical and spongy bone and to its easy handling, make the anterior crest of the iliac bone the most adequate area for reconstructions in the zygomatic-orbital complex. However, one disadvantage of such procedure, mentioned in the literature, is the unpredictability of the reabsorption level of the graft.<sup>7</sup> Therefore, one important aspect to diminish the reabsorption level of the bone graft is its binding to the receptive area, since micromovements made by the ocular muscles conduct to a greater resorption of the graft. Furthermore, Ozaki and Buchmar<sup>8</sup> have shown that grafts which are especially cortical keep a better volume when compared to the spongy ones. For these reasons, the cortical portion of the iliac crest was used on the orbital floor, together with the titanium ribs for its binding.

Studying the long term outcomes of craniofacial reconstruction using titanium ribs, Kuttenger and Hardt<sup>9</sup> have demonstrated that the tridimensional reconstruction capacity produced by such procedure guarantees long term, functional and aesthetic stability, making it an alternative to bone and cartilaginous graft. Besides, particulate bone was juxtaposed to titanium ribs, due to the osteogenic capacity of the graft.

The excellent biocompatibility and easy handling of the titanium ribs have allowed us to reestablish, in a rather faithful way, the infraorbital and orbital floor areas of the patient whose case is described here, which matched perfectly with the organic properties of the iliac crest bone. Moreover, the titanium ribs worked as a support structure for the particulate bone, which takes us back to what Hammer and Prein<sup>10</sup>, Kuttenger and Hardt<sup>9</sup>, and Oliveira<sup>6</sup> have stated.

## CONCLUSION

By carefully analyzing the treatment of the sequels produced by fractures in the zygomatic-orbital complex, we may conclude that:

- *Detailed clinical and imaging exams must be carried out in order to establish the level of dislocation of the fracture and the extension of the orbital floor fragmentation, aiming at determining the necessary correction for the reestablishment of an adequate bone recontour and at the enophthalmos correction.*

- *The fractures up to four months old must be treated through osteotomy and bone repositioning techniques*

- *Older fractures are better corrected through juxtaposed bone grafts in the front-zygomatic suture and zygomatic-maxilla areas, as well as in the infraorbital margin and orbital floor.*

- *The association of autogenous bone graft to titanium ribs adds the organic properties of the bone to the adaptation and support capacities of the titanium ribs*

## **Tratamento cirúrgico de seqüelas de traumatismo zigomático-orbitário: relato de caso**

### **Resumo**

O tratamento de seqüelas que envolvem o complexo zigomático-orbitário é um grande desafio em Cirurgia e Traumatologia Bucomaxilofacial. Sua correção cirúrgica inclui o reestabelecimento do contorno ósseo orbitário e a reabilitação anátomo-funcional ocular. Para obter esses resultados, uma série de técnicas e materiais podem ser utilizados, entre os quais o enxerto ósseo autógeno e o implante de biomateriais. O objetivo deste relato é apresentar um caso de tratamento cirúrgico de seqüela de traumatismo zigomático-orbitário, com utilização de enxerto ósseo autógeno retirado de crista ilíaca, associado à tela de titânio, para obter-se o reposicionamento ósseo e do globo ocular. O manejo terapêutico de seqüelas que envolvem o complexo zigomático-orbitário é discutido à luz da revisão de literatura.

**Palavras-chave:** fraturas zigomático-orbitárias - tratamento cirúrgico, biomateriais, enxerto, ósseo autógeno.

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