

# Naso-orbitoethmoid fractures: 37-year experience of the Craniofacial Surgery Service of the Hospital de Cajuru and Hospital do Trabalhador

*Fraturas nasoetmoideorbitais: experiência de 37 anos do Serviço de Cirurgia Craniofacial do Hospital de Cajuru e Hospital do Trabalhador*

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## ABSTRACT

Fractures of the naso-orbitoethmoid complex (NOE) remain one of the most challenging tasks in facial reconstruction and account for 2.1% of facial trauma cases. Clinical analyses of NOE fractures showed that they usually affect the telecanthus and cause deformities that would then require repositioning of the nasal pyramid. Therefore, computed tomography is an essential technique for further assessment and to identify bone dislocations and fistulas. Treatment involves reconstruction of the intercanthal distance, nasal projection, and internal orbital structures.

**Keywords:** Ethmoid bone/injuries. Nasal bone/injuries. Orbital fractures/surgery. Reconstructive surgical procedures.

## RESUMO

A fratura do complexo nasoetmoideorbital (NEO) permanece como uma das tarefas mais desafiadoras no trauma facial. Corresponde a 2,1% dos casos de trauma de face. Achados clínicos clássicos das fraturas NEOs são telecanto e deformidade com retroposicionamento da pirâmide nasal. O estudo com tomografia computadorizada é imprescindível para determinar detalhes e procurar localizar deslocamentos ósseos e fístulas. O tratamento é direcionado à reconstrução da relação intercantal, da projeção nasal e das estruturas internas da órbita.

**Descritores:** Osso etmoide/lesões. Osso nasal/lesões. Fraturas orbitárias/cirurgia. Procedimentos cirúrgicos reconstrutivos.

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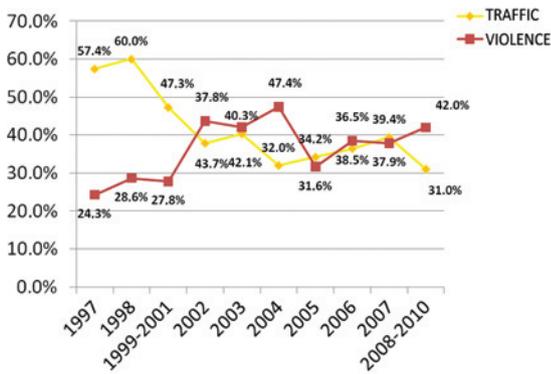
**INTRODUCTION**

The diagnosis and treatment of fractures that affect the naso-orbitoethmoid complex (NOE) are challenging tasks in facial reconstruction and may lead to visible sequelae on the patient's face if they are not appropriately performed<sup>1-7</sup>.

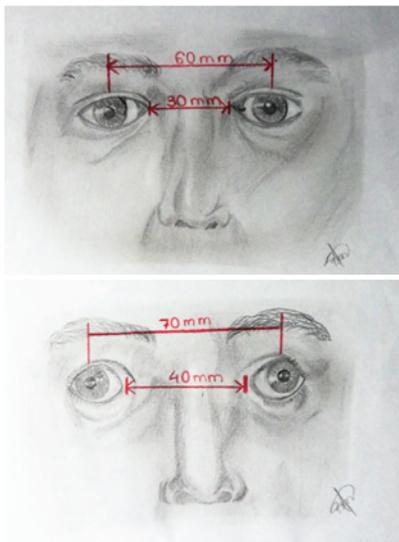
Figure 1 illustrates the experience of our institution based on 8,240 patients with facial fractures submitted to reconstruction surgery between January 1974 and December 2010 carried out by the first author. Of these patients, 416 (5%) presented with NOE fractures; however, only 170 (2.1%) had pure NOE. A total of 117 (1.4%) patients presented with frontobasal and naso-orbitoethmoid fractures, whereas 129 (1.6%) had complex facial fractures in which all the bones of the face were simultaneously fractured. Of the 170 patients with NOE fractures, 14.6% were women and 85.4% were

men with an average age of 27.9 years (range, 16-85 years). No deaths due to the reconstruction of facial fractures were observed during the study.

Clinical analyses of the NOE fractures showed that they usually affected the telecanthus and caused deformities that required repositioning of the nasal pyramid<sup>8</sup>. In adults, the intercanthal distance is normally 30 mm (Figure 2). Due to displacement of the medial canthal ligament, the upper and lower eyelids in the telecanthus are laterally diverted - an effect that is then reflected in an increased intercanthal distance. NOE fractures include lesions of the nasal dorsum and may affect one or both jaws at the insertion site of the medial canthal ligament. A pseudohypertelorism appearance of the orbits is accentuated by flattening and widening of



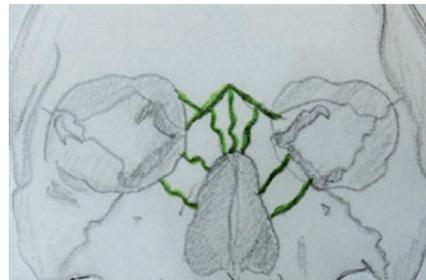
**Figure 1** – Graphic showing inversion of prevalence among traffic accidents and interpersonal violence, as a result of social changes.



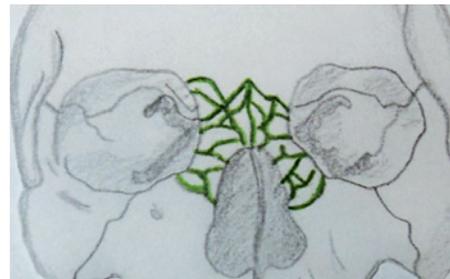
**Figure 2** – Normal intercanthal distance and telecanthus.



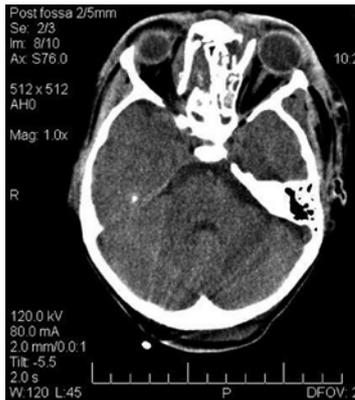
**Figure 3** – Type 1 nasoethmoidal fracture, according to Markowitz classification.



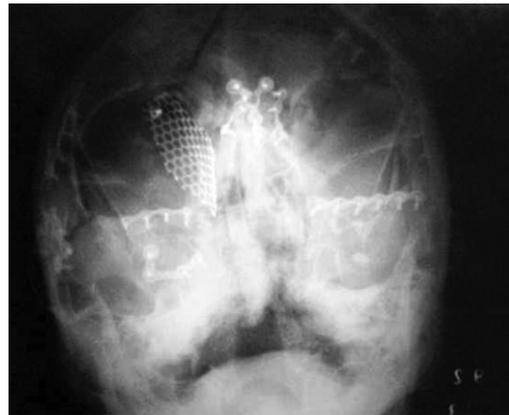
**Figure 4** – Type 2 nasoethmoidal fracture, according to Markowitz classification.



**Figure 5** – Type 3 nasoethmoidal fracture, according to Markowitz classification.



**Figure 6** – Pre-operative image of anteroposterior impaction with ethmoidal dislocation toward the optic nerve.



**Figure 8** – Post-operative conventional x-ray showing nasoethmoidal fracture correction, associated to additional middle third fractures: reconstruction with bone grafts, titanium mesh, microplates and screws.



**Figure 7** – Post-operative image of surgical correction without grafts and optic nerve decompression.



**Figure 9** – K-wires supported on frontal process of the maxilla, stabilizing septal cartilage.

the bony dorsum of the nose. As a result, the eyes appear far apart (Figures 3 to 5)<sup>1,9</sup>.

### SURGICAL PROCEDURE

The treatment of NOE fractures consists of the reconstruction of the displaced anatomical structures and may involve the use of bone grafts, cartilage, and/or alloplastic implants to fill the ethmoid bone displacements that cannot be properly reduced due to technical issues. Transnasal canthopexy facilitates the achievement of a balance between the canthal medial ligaments and an appropriate intercanthal distance. The bone attached to the medial canthal tendon or the tendon itself needs to be immobilized in its anatomical position using a transnasal wire according to the procedure described by Raveh, or with small titanium anchors if the bone is able to support it. The use of bone grafts obtained from the iliac crest, external skull, or rib is a routine procedure that is used to replace the orbital contents and recover the ocular projection and nasal pyramid (Figures 6 to 8)<sup>10,11</sup>.

Direct approaches (coronal, transpalpebral, superomedial, and transconjunctival) are preferred for ethmoid wall reconstruction, although the approach involving access through the wound is also used. The transnasal-orbital approach, wherein nasal endoscopy facilitates the extension of the access to the medial orbital wall, is difficult to perform due to the high incidence of iatrogenic injuries. Such injuries result from the difficult nature of accessing the lateral nasal wall to reach the compromised orbital region. Therefore, these surgical procedures may be used only in special cases. Cerebrospinal fluid fistulae at the cribriform plate are preferably treated with an endonasal technique, which has shown good results thus far.

Nasal pyramid fractures are normally reduced by digital manipulation with the occasional use of Asch forceps. It may be necessary to use microplates and screws to immobilize this type of fracture. Disjunction of the ethmoid and nasal septal cartilage is repaired using transnasal Kirschner wires

supported by the anterior edge of the frontal process of the maxilla<sup>1,2,12,13</sup> (Figure 9).

When inefficiently operated, nasal fractures may present with a higher incidence of late post-surgical deformities, which may be approximately 50%. According to the literature, this may be primarily due to deformities as well as septal fractures that were not identified before the reduction<sup>3</sup>.

The sequelae are difficult to resolve. Orbital dystopias, nasal deformities, and sinusopathy are frequently observed<sup>1,2</sup>.

## REFERENCES

1. Rohrich RJ. Advances in craniomaxillofacial fracture management. Philadelphia: W.B. Saunders; 1992. p. 167-93.
2. Cruz GAO. Fraturas do terço superior da face. In: Barros JJ, Manganello-Souza LC, eds. Traumatismo buco-maxilo-facial. 2ª ed. São Paulo: Roca; 2000. p. 319-31.
3. Violani GP. Comparação com a literatura dos resultados imediatos e tardios de manutenção e recidiva da redução de fraturas nasais recentes em adultos utilizando atendimento e tratamento cirúrgico padronizado [monografia]. Curitiba: Curso de Especialização de Cirurgia Plástica e Reparadora, Universidade Federal do Paraná; 2011.
4. Molina F, Ortiz-Monasterio F. Rinoplastia. Buenos Aires: Médica Panamericana; 1997. p. 10.
5. Manson PN, Clifford CM, Su CT, Iliff NT, Morgan R. Mechanisms of global support and posttraumatic enophthalmos: I. the anatomy of the ligament sling and its relation to intramuscular cone orbital fat. *Plast Reconstr Surg.* 1986;77(2):193-202.
6. Sturla F, Abnsi D, Buquet J. Anatomical and mechanical considerations of craniofacial fractures: an experimental study. *Plast Reconstr Surg.* 1980;66(6):815-20.
7. Testu L, Jacob D. Aparato de la vision. In: Tratado de Anatomia Topográfica. Barcelona: Salvat Editores; 1956. p. 395-495.
8. Hwang K, You SH. Analysis of facial bone fractures: an 11-year study of 2,094 patients. *Indian J Plast Surg.* 2010;43(1):42-8.
9. Janis JE. Essentials of plastic surgery: a UT Southwestern Medical Center handbook. St. Louis: Quality Medical; 2007. p. 228-9.
10. Marão HF, Gulinelli JL, Pereira CC, Carvalho AC, Faria PE, Magro Filho O. Use of titanium mesh for reconstruction of extensive defects in fronto-orbito-ethmoidal fracture. *J Craniofac Surg.* 2010;21(3):748-50.
11. Leão Júnior H, Orgaes FAFS, Fozati DJM, Gonella HA. Reconstruções orbitárias pós-traumáticas com utilização de retalhos osteofasciais de fâscia temporoparietal e enxerto ósseo. *Rev Bras Cir Plást.* 2008; 23(3):229-33.
12. Papadopoulos H, Salib NK. Management of naso-orbital-ethmoidal fractures. *Oral Maxillofac Surg Clin North Am.* 2009;21(2):221-5.
13. Motta MM. Análise epidemiológica das fraturas faciais em um hospital secundário. *Rev Bras Cir Plást.* 2009;24(2):162-9.

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