Temporal Approach to Removal of a Large Orbital Foreign Body

Hécio Henrique Araújo de Moraes, PhD¹ Jimmy Charles Melo Barbalho, DDS²

Tasiana Guedes de Souza Dias, DDS¹ Rafael Grotta Gempel, PhD³

Ricardo José de Holanda Vasconcellos, PhD²

¹ Department of Oral and Maxillofacial Surgery, State University of Rio Grande do Norte, Caicó, Brazil

² Department of Oral and Maxillofacial Surgery, University of Pernambuco, Camaragibe, Brazil

³ Department of Oral and Maxillofacial Surgery, State University of Paraíba, Araruna, Brazil

Address for correspondence Jimmy Charles Melo Barbalho, DDS, Faculdade de Odontologia de Pernambuco/Universidade de Pernambuco, Av. General Newton Cavalcante, 1651 Tabatinga, CEP: 54753-220 Camaragibe, Pernambuco, Brazil (e-mail: jimmybarbalho@hotmail.com).

Cranio-maxillofac Trauma Reconstruction 2015;8:234–238

Abstract

Accidents with firearms can result in extensive orbital trauma. Moreover, gun parts can come loose and impale the maxillofacial region. These injuries can cause the loss of visual acuity and impair eye movements. Multidisciplinary treatment is required for injuries associated with this type of trauma. Computed tomography with three-dimensional reconstruction is useful for determining the precise location and size of the object lodged in the facial skeleton, thereby facilitating the planning of the correct surgical approach. The temporal approach is a fast, simple technique with few complications that is indicated for access to the infratemporal fossa. This article describes the use of the temporal approach on a firearm victim in whom the breech of a rifle had impaled orbital region, with the extremity lodged in the infratemporal fossa.

Keywords

- intraorbital foreign body
- orbit
- temporal

High-velocity injuries, such as those that stemming from a gunshot or industrial accident, can lead to the occurrence of an intraorbital foreign body,¹ often accompanied by penetrating ocular trauma.² In such cases, the ophthalmic examination should begin with the documentation of visual acuity, followed by a detailed examination of the orbit for periorbital and subconjunctival hemorrhage and proptosis. Extraocular movements and visual fields should be examined and a careful inspection of the globe should be performed to determine the presence or absence of perforation.³ With advances in radiological techniques, such as high-resolution reconstruction computed tomography, the assessment of such injuries has become easier and more accurate.⁴

The retrieval of an intraorbital foreign body can be difficult because of the proximity of critical structures, such as the contents of the superior orbital fissure, the optic nerve, ethmoidal vessels, and cranial structures.⁵ Among the differ-

ent approaches employed in the treatment of facial injuries, the coronal approach, which was popularized by Tessier, is one of the most versatile for midface surgeries.⁶ However, the large incision causes concern regarding the visible postoperative scar. Thus, several techniques have been described to minimize scar visibility, including a straight incision, coronal incisions, a gull-wing or W-shaped incision, and the use of six short linear incisions.⁷

This article describes the use of the temporal approach on a firearm victim in whom the breech of a rifle had impaled orbital region, with the extremity lodged in the infratemporal fossa.

Case Report

A 31-year-old male patient presented to the Regional Trauma Hospital in Campina Grande (state of Paraíba, Brazil) following an accident with the breech of a rifle, which had

received

November 30, 2013

accepted after revision

June 15, 2014

published online

December 8, 2014

Copyright © 2015 by Thieme Medical Publishers, Inc., 333 Seventh Avenue, New York, NY 10001, USA.
Tel: +1(212) 584-4662.

DOI <http://dx.doi.org/10.1055/s-0034-1396523>.
ISSN 1943-3875.

Fig. 1 Clinical aspect.

penetrated the right orbit 4 hours earlier. The clinical examination revealed a metallic object protruding from the right infraorbital region that was palpable in the temporal region (► **Fig. 1**). The patient reported the loss of visual acuity in the right eye because of trauma and reported having no visual impairment before the accident. The ophthalmologic examination using biomicroscopy demonstrated paralytic mydriasis, intact cornea, hyphema in the anterior chamber, lens in situ, and chemosis in the conjunctiva with hemorrhage. The fundoscopic examination revealed inferior vitreous hemorrhage, retinal hemorrhage, detachment of the choroid and vitreous and papillary detachment.

The ophthalmologist declared that the contusion in the right ocular globe triggered important internal bleeding with irreversible injuries in internal structures, leading to blindness. Computed tomography with three-dimensional (3D) reconstruction revealed fractures of the zygomatic bone and right lateral wall of the orbit in the region of greater wing of the sphenoid bone (► **Fig. 2**). The foreign body was a cylindrical metallic object that had passed through the right orbit, transfixated the greater wing of the sphenoid bone, and became lodged in the infratemporal fossa.

Surgical Technique for Temporal Access

The patient was prepared for removal of the foreign body under general anesthesia. After cleaning and antisepsis with 2% chlorhexidine, local anesthesia was performed with an injection of Xylocaine and epinephrine (1:200,000). A curved incision curve was initiated 10 mm in front of the tragus, continuing through half the posterior–anterior extension and ending in the upper portion of the temporalis muscle (► **Fig. 3**). The incision was made only

Fig. 2 Computed tomography with three-dimensional reconstruction (frontal view)

to the superior temporal lines laterally, preventing penetration of the temporalis fascia to the temporalis muscle, which bleeds readily on incision. The flap was elevated on the subgaleal plane with a scalpel and a temporal fascia was incised 6 cm above the zygomatic arch. Dissection proceeded immediately through the inner side of the deep layer of temporal fascia. With the exposure of the metallic object (► **Fig. 4a**), the surgical team cut the object into two pieces with cutter pliers for easy removal (► **Fig. 4b**). Suturing of the surgical wound was performed with nylon 3.0, followed by the placement of pressure dressing. Immediately following recovery from anesthesia, a new ophthalmologic examination confirmed the loss of visual acuity,

Fig. 3 Temporal approach (described by de Morais et al).

Fig. 4 (a) Exposure of foreign body in infratemporal fossa. (b) Large foreign body (breech of rifle) removed.

absence of pupillary reflexes and the maintenance of the movements of the extrinsic musculature of the eye. At the 1-year follow-up evaluation, the patient had an acceptable esthetic outcome and no complaints (►Fig. 5a, b).

Discussion

The removal of a foreign body from the maxillofacial complex should involve careful planning. Surgical explora-

tion without accurate preoperative localization is contraindicated due to the possibility of fragmentation, as incomplete removal of the material can lead to treatment failure. It is therefore essential to collect as much information as possible regarding the location of the object to determine the most appropriate surgical approach.⁸ Moreover, a multidisciplinary team is needed for orbital injuries caused by a foreign body, as accurate neurological and ophthalmic examinations are required before the surgical removal of the object. Computed tomography with 3D reconstruction allows the precise localization of the object and the determination of the proper surgical approach. In the case described herein, the ophthalmologist was essential to the diagnosis of the loss of visual acuity loss and 3D computed tomography allowed the determination of the most appropriate surgical approach.

The coronal approach is required for wider access to the orbital roof, frontorbital region or naso-orbital-ethmoid complex and facilitates circumferential exposure. The main drawbacks of the coronal approach are the size of the incision, the extensive dissection, and complications such as alopecia, forehead numbness and injury to the temporal branch of the facial nerve (►Fig. 6a).^{9,10} Luo et al, developed a novel coronal access, denominated the supratemporal access, and compared it with the traditional coronal access regarding the rate of complications, especially injuries to the temporal and zygomatic branches of the facial nerve (►Fig. 6b). The authors modified the coronal access through a subcutaneous incision 5 to 6 cm above the zygomatic arch in the temporal fascia and the dissection proceeded through the inner side of the deep layer of the temporal fascia. With the conventional access, the incision is 2 to 3 cm above the zygomatic arch in the superficial layer of temporal fascia and dissection proceeds within the superficial temporal fat pad. The supratemporal access exposes the zygomatic arch because of the dissection below the temporal fascia. During dissection, the facial nerve is protected by the entire superficial temporal fat pad, temporal fascia, and temporoparietal

Fig. 5 (a) Clinical aspect after 1 year. (b) The computed tomography with three-dimensional reconstruction after 1 year (frontal view).

Fig. 6 (a) The traditional coronal scalp approach. (b) Schematic depiction of the supratemporalis approach. The red line represents the anatomical levels involved in the supratemporalis approach: the deep layer of the temporal fascia, the superficial temporal fat pad, and the superficial surface of the temporalis.

fascia. With the traditional access, the division and separation of the superficial temporal fat pad occur when the superficial layer of temporal fascia is incised. Occasionally, the temporal branch of the facial nerve is located very close to this anatomic point, which increases the risk of nerve injury. The authors found a lesser rate of facial nerve injury with the supratemporal access.¹¹

It should be pointed out that two techniques were used to gain access to the foreign body in the present case:

- Skin incision (temporal access), which allowed the rapid, practical access to the infratemporal fossa.
- Subcutaneous incision (supratemporal access described by Luo et al) to minimize the risk of injury to the facial nerve.

The temporal approach was employed because the extremity of the object was palpable and lodged in the infratemporal fossa. In comparison to coronal access, the temporal approach combined with the supratemporal approach offers the advantages of fast execution, a lesser risk of nerve damage, and a less visible scar (→Table 1). This article demonstrates that the temporal approach is a viable alternative for the removal of a foreign body lodged in the infratemporal fossa that provides practicality and a favorable esthetic outcome.

Table 1 Characteristics of temporal and coronal approaches

	Temporal approach	Coronal approach
Cutaneous incision	<ul style="list-style-type: none"> • Localized access over temporal muscle • Fast access 	<ul style="list-style-type: none"> • Hidden, safe incision and clear exposure of operating field • Access requires longer operating time
Subcutaneous incision	<ul style="list-style-type: none"> • In temporal region near superficial temporal fat pad (STFP), temporal fascia is incised 5–6 cm to zygomatic arch. Flap is composed of skin, subcutaneous fat, temporal fascia and STFP on surface of temporal muscle (described by Luo et al)¹¹ • Minimizes risk of injury to temporal branch of the facial nerve 	<ul style="list-style-type: none"> • The superficial layer of temporal fascia is incised 2–3 cm superior to zygomatic arch, allowing entrance to STFP • Potential risk of injury to temporal branch of facial nerve
Indications	<ul style="list-style-type: none"> • Access to zygomatic arch, infratemporal fossa and temporomandibular joint for treatment of pathological and/or traumatic lesions 	<ul style="list-style-type: none"> • Access to frontal sinus, nasal root, nasoethmoid compartment, superior orbits and zygomatic arch for treatment of pathological and/or traumatic lesions
Contraindications	<ul style="list-style-type: none"> • Treatment of complex fractures in middle and upper thirds of face 	<ul style="list-style-type: none"> • Approach to infratemporal fossa, lateral orbital rim, and lateral skull base for treatment of pathological and/or traumatic lesions
Potential complications	<ul style="list-style-type: none"> • Infection • Hematoma requiring evacuation • Alopecia along incision line • Visible scar • Injury to frontal branch of facial nerve; numbness of flap tissue if supraorbital or supratrochlear nerves are injured • Injury to temporal and zygomatic branches of facial nerve • Anesthesia posterior to incision 	<ul style="list-style-type: none"> • Infection • Hematoma requiring evacuation • Anesthesia posterior to the incision • Minimal risk of injury to frontal, zygomatic and temporal branches of facial nerve

References

- 1 Fulcher TP, McNab AA, Sullivan TJ. Clinical features and management of intraorbital foreign bodies. *Ophthalmology* 2002;109(3):494–500
- 2 Ehlers JP, Kunimoto DY, Ittoop S, Maguire JI, Ho AC, Regillo CD. Metallic intraocular foreign bodies: characteristics, interventions, and prognostic factors for visual outcome and globe survival. *Am J Ophthalmol* 2008;146(3):427–433
- 3 Coogan P, Debehnke D. Occult penetrating orbital trauma. *Am J Emerg Med* 1993;11(4):396–399
- 4 Liu WH, Chiang YH, Hsieh CT, Sun JM, Hsia CC. Transorbital penetrating brain injury by branchlet: a rare case. *J Emerg Med* 2011;41(5):482–485
- 5 Shuker ST. Management of penetrating medial and retro-bulbar orbital shrapnel/bullet injuries. *J Craniomaxillofac Surg* 2012;40(8):e261–e267
- 6 Godhi SS, Kukreja P, Singh V, Goyal S. Versatility of the coronal approach in maxillofacial surgery. *J Oral Health Comm Dent* 2010;4:16–21
- 7 Netscher DT, Stal S, Peterson R. A critical analysis of coronal incisions. *Plast Reconstr Surg* 1990;86(1):167–169
- 8 Wesley RE, Wahl JW, Loden JP, Henderson RR. Management of wooden foreign bodies in the orbit. *South Med J* 1982;75(8):924–926, 932
- 9 Markiewicz MR, Bell RB. Traditional and contemporary surgical approaches to the orbit. *Oral Maxillofac Surg Clin North Am* 2012;24(4):573–607
- 10 Humphrey CD, Kriet JD. Surgical approaches to the orbit. *Operative Techniques in Otolaryngology* 2002;19(2):132–139
- 11 Luo W, Wang L, Jing W, et al. A new coronal scalp technique to treat craniofacial fracture: the supratemporalis approach. *Oral Surg Oral Med Oral Pathol Oral Radiol* 2012;113(2):177–182