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Orbital Floor Reconstruction Using Calvarial Bone Graft – A Case Report

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Abstract

In today's fast paced world, high velocity road traffic accidents have become very common and so have maxillofacial injuries. Orbital fractures, though relatively common, are a challenge to the maxillofacial surgeon aiming for a flawless repair. In cases presenting with orbital defects, a myriad of graft materials, both autogenous and alloplastic have been used for reconstruction. The autogenous calvarial bone graft is now widely accepted as a suitable bone graft for defects of the facial skeleton, especially the orbit. Here, we present the case of an 18 year old mini van driver , who reported to our hospital with a zygomaticomaxillary complex fracture on the left side, along with a defect in the floor of the orbit. All the fracture sites were surgically managed and reconstruction of the defect in the orbital floor was done with a split thickness calvarial bone graft.

Keywords: Orbital fractures, blow out fractures, calvaria, bone graft, orbit, reconstruction

Introduction

The orbit is an irregular conical-shaped cavity formed by seven bones including the frontal, sphenoid, zygomatic, maxillary, ethmoid, lacrimal and palatine bones. The orbital margin is quadrangular in shape with a rounded edge.The average orbital volume is 30 ml with a bony orbital volume to globe volume ratio of 4.5:1 (Doxanas & Anderson, 1984).[1] Orbital floor fractures may occur in isolation ("blowout" fractures) or as part of a zygomaticomaxillary complex fracture. The terms pure and impure have been used to describe isolated orbital fractures (pure) versus orbital fractures that occur in conjunction with other fractures (impure).[2] Both "buckling" theory and "hydraulic" theory explain the force transmission to the relatively weak orbital floor, resulting in fractures.[3] Various types of materials are used in orbital fracture reconstruction including synthetic, allogenic, or autogenous. The commonly used autogenous materials are bone and cartilage. The use of dura mater to reconstruct the orbital floor has also been reported. Autogenous bone grafts may be taken from the iliac crest, rib or calvarium. The advantages of using calvarial bone as a graft material are the presence of an inconspicuous scar hidden in the hair-bearing area, little or no postoperative pain and no obvious donor site deformity. It is possible to harvest abundant amounts of graft material of varying size and contour.The site is readily accessible and is in the same operating field as the orbit. Here, we have described a case of an 18 year old male patient, who presented with binocular diplopia and enophthalmos after suffering from a road traffic accident before 15 days. He had sustained an orbital floor fracture in conjunction with zygomaticomaxillary complex fracture of the left side. The floor was successfully reconstructed with autogenous calvarial bone graft, harvested from the non-dominant side with resolution of all his presenting symptoms. The patient was followed up for a year and the post-operative course was uneventful without any untoward complications.

Case Report

An 18 year old male patient presented to the department of Oral and Maxillofacial Surgery of our institution with the chief complaint of double vision, especially in the downward gaze, following a road traffic accident 15 days back. The diplopia was troublesome for him as it affected his job as a mini van driver significantly. There were no reports of any episodes of loss of consciousness, vomiting, seizure, amnesia or bleeding/ watery discharge from nose or ears. He was treated primarily at a local hospital before being referred to our institution for definitive management. On examination, mild periorbital ecchymosis and oedema was present on the left side. (Fig. 1) Subconjunctival haemorrhage was not apparent. On palpation, there was a distinctive step deformity on the left infra-orbital rim and fronto-zygomatic suture. On intra-oral palpation, step deformity and crepitations were apparent on the left zygomaticomaxillary buttress area. Tenderness was present in all the above mentioned sites. Diplopia and gaze restrictions were observed on frontal and downward gaze. With a Hertel'sExophthalmometer, we measured an enophthalmos of 2mm in his left eye. Computed Tomography (CT) scan revealed fracture of the left orbital floor with herniation of orbital contents in the maxillary antrum, fracture of the left fronto-zygomatic suture and left zygomaticomaxillary complex. (Fig. 2) We planned for reconstruction of the orbital floor with autogenous calvarial bone graft and reduction and fixation of the other fracture sites with Titanium plates and screws under General Anaesthesia. Access to the orbital floor was gained via transconjunctival incision with lateral canthotomy (Fig. 3), hence negating the aesthetic concerns of a transcutaneous incision. The defect in the orbital floor was exposed along with retrieval of the herniated orbital contents (Fig 4). The fronto-zygomatic suture was approached via a lateral eyebrow incision, parallel to the lateral third of the eyebrow, taking care not to resect any of the hair shafts. The zygomaticomaxillary buttress area was approached via an intra oral vestibular incision.(Fig. 5) A hemi-coronal flap was elevated to gain access to the cranium. A split thickness square block of calvarial bone graft measuring around 2cm X 2cm was harvested with a round bur and osteotome from the parietal bone of the right side, taking care not to injure the underlying vital structures.(Fig.6) The graft (Fig. 7) was contoured according to the shape of the orbital floor defect with special emphasis given on the postero-medial aspect of the orbit to correct the enophthalmos. The orbital contents were retrieved from the antrum and the graft was fixed with a 1.5mm 6 holed Titanium C plate. (Fig. 8). The fronto-zygomatic suture and the zygomatico-maxillary buttress were also fixed with 1.5mm and 2mm titanium mini plates respectively. (Fig. 7 and Fig. 9) A drain was inserted to prevent haematoma formation of the scalp and all the incisions were closed in layers. (Fig. 10 and Fig. 11)Postoperatively, the patient's visual function and extraocular motility were checked on the following morning after surgery. He received intravenous Ceftriaxone 1 g in conjunction with dexamethasone 8 mg twice daily for 3 days, followed by oral antibiotics to complete 7 days of treatment and ophthalmic antibiotic ointment for 2 weeks. There was resolution of the diplopia and enophthalmos after 14 days when the initial surgical oedema subsided. The patient was followed up for a year at regular intervals.There were no significant complications. Additionally he was back in his job as a driver.

Discussion

Several approaches have been used for reconstruction of orbital floor fractures. The transcutaneous incisions like the subtarsal and subciliary approaches allow easy access to the orbit but have several disadvantages such as causing eyelid malpositionssuch as ectropion and are also associated with an external visible skin scar if the incision is not designed properly . The transconjunctival approach, in contrast, is minimally invasive and is aesthetically superior to that of the transcutaneous incisions as is not associated with any visible scarring. Transconjunctival incisions when combined with a lateral canthotomy usually allows adequate exposure of the surgical field. This technique enables quick exposure and usually requires minimum wound closure, shortening the operative time.[4,5]In experienced hands, the transconjunctival approach has been shown to have a lower rate of postoperative complications, such as ectropion, eyelid retraction, scleral show, and pyogenic granuloma formation.[4,6-8] An alternate option is the endoscopic approach. This involves minimal globe manipulation, and sometimes, may be applicable in patients for whom a surgical intervention is contraindicated via traditional access.[9]

Although orbital floor fractures repaired with alloplastic implants usually have a satisfactory outcome, several complications have been well documented. These include fistula formation, implant migration or extrusion, ocular motility restriction, infection, globe elevation, cyst formation, sudden proptosis and optic nerve trauma.[10]

When the orbital floor defects are larger or there is a significant exposure to a sinus by herniation of the orbital contents, autogenous material should be considered. Autogenous bone grafts are considered the reference standard for facial and orbital reconstruction, mainly because of their high biocompatibility and low rate of infection, graft exposure, or displacement.[11,12] Although bone grafts have osteogenic, osteoconductive, and osteo-inductive capacity, they are susceptible to resorption. Nevertheless, it is believed to be balanced by new bone growth, enabling a good final outcome.[12] Iliac crest and rib bone grafts have both been used in orbital reconstructions but both tend to show unpredictable resorption (iliac crest more rapidly than rib) resulting in contour irregularities.[13] In addition to this,donor site morbidity can be troublesome, iliac crest and rib grafts producing mobilisation, gait and breathing difficulties respectively, leading to a prolonged period of hospitalisation and rehabilitation for the patient.[14]

The use of calvarial bone as a graft material has a number of advantages.[15] Firstly, the site is readily accessible and is in the same operating field as the orbit. An invisible scar beneath the hair is produced and there is no deformity and little post-operative pain at the donor site. There is an abundance of donor material as compared with other sources. There is greater graft volume survival with membranous bone from the skull as compared to endochondral bone of either the iliac crest or ribs. It has also been demonstrated that membranous grafts are revascularized earlier than endochondral grafts.[16]The main disadvantage of calvarial bone is its lack of malleability. This can be overcome by selecting the correctly contoured donor site and in young children preparing the graft as describe by Tessier in 1982. The graft may also be contoured by differential shaping with a bur. If the pericranium is left in situ the grafts will automatically curl and will adapt more accurately to the contours of the orbit. The limitations ofskull graft-harvesting techniques are few. It is advisable not to harvest bone crossing the midline as the sagittal sinus may be traumatised and severe bleeding might occur. Also, it is preferable to raise the bone from nondominant side; in this way, any cerebral complications may be less significant. To prevent haematoma formation, insertion of a drain and a suitably applied pressure dressing is essential. Lateral skull radiographs and CT scans may help to identify the thickness of the skull but are not always accurate. Tapping the skull with the same instrument in each case may allow one to gain experience in relating the tone to the thickness of the skull.[14]

Nevertheless, calvarial bone grafting has potential complications, including dural perforation with brain injury or intracranial bleeding, and chronic donor site pain and cosmetic disturbances. Our patient, however had no significant perioperative or long term donor site complication.

Conclusion

In conclusion, reconstruction of orbital floor fractures with autologous bone grafts through a transconjunctival or transcutaneous approach enables adequate orbital support and long-lasting volume restoration with minimal intraoperative and postoperative complications. The transconjunctival approach is preferable to avoid skin scarring and post- operative eyelid ectropion. The calvarial bone graft appears to be a successful, relatively straightforward technique, especially for the late repair of orbital floor fractures. However, because calvarial bone graft resorption rate is low, a longer follow-up period is probably appropriate. Nonetheless we recommend consideration of this procedure as one of the suitable options in the surgical management of orbital floor fractures.

Clinical Figures

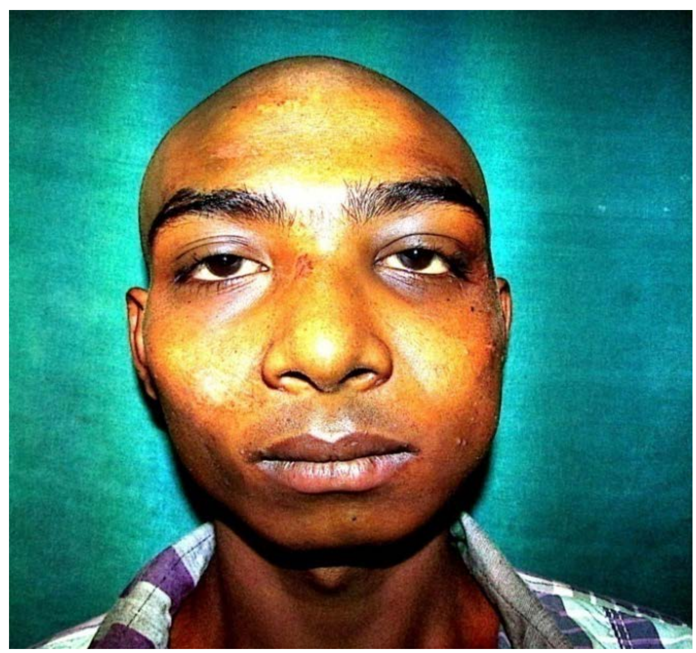

Fig. 1: Pre-operative picture of the patient

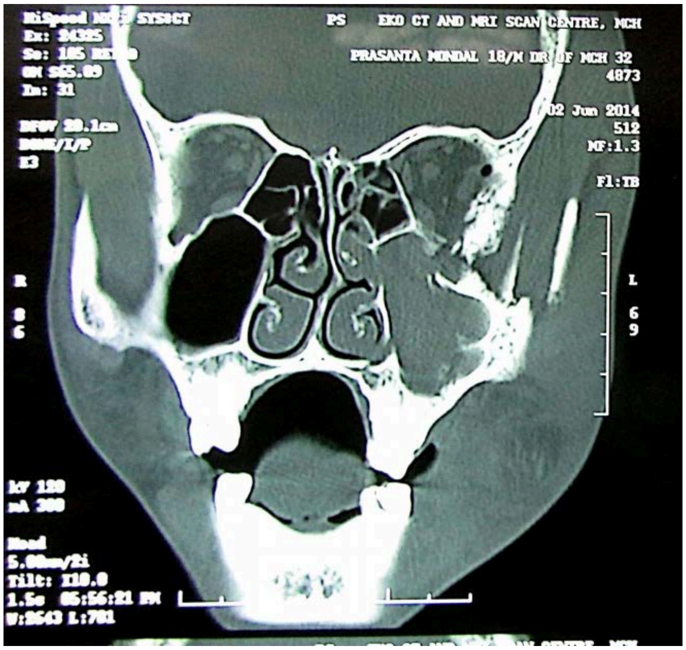

Fig. 2: CT Scan of the patient

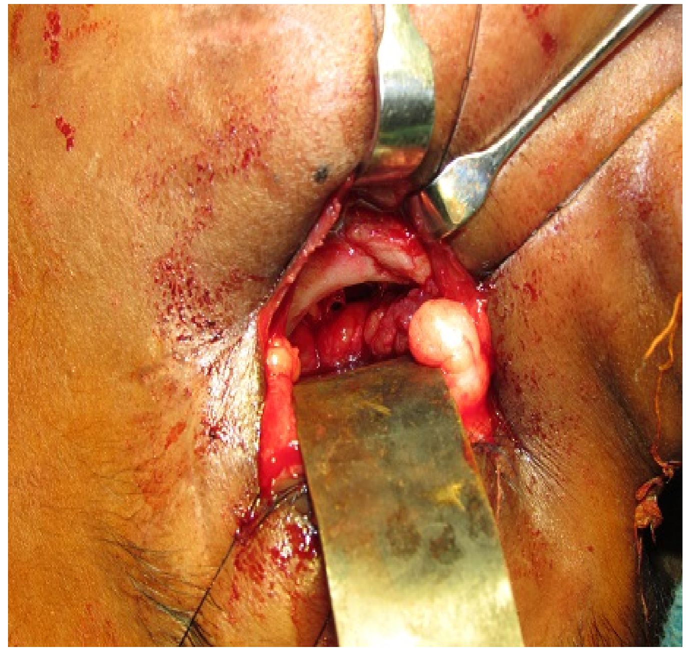

Fig. 4: Exposure of the defect in the orbital floor

Fig. 3: Transconjunctival incision with lateral canthotomy

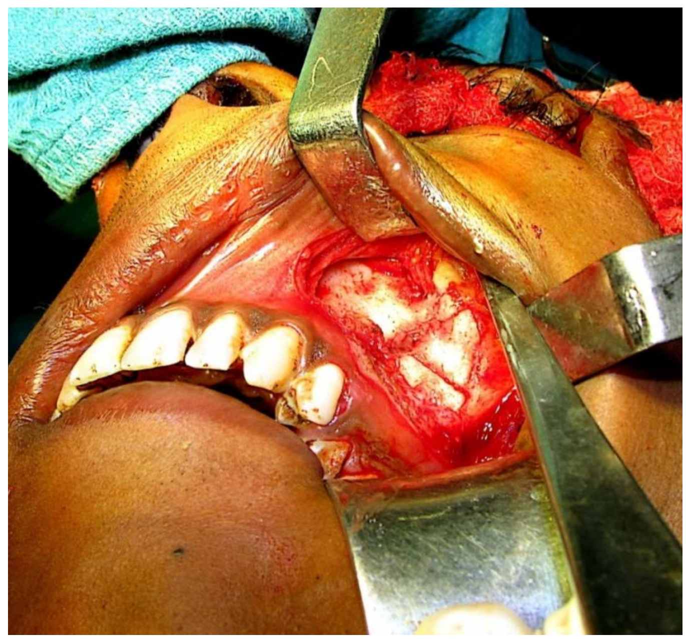

Fig. 5: Intra oral exposure of the Zygomaticomaxillary buttress area

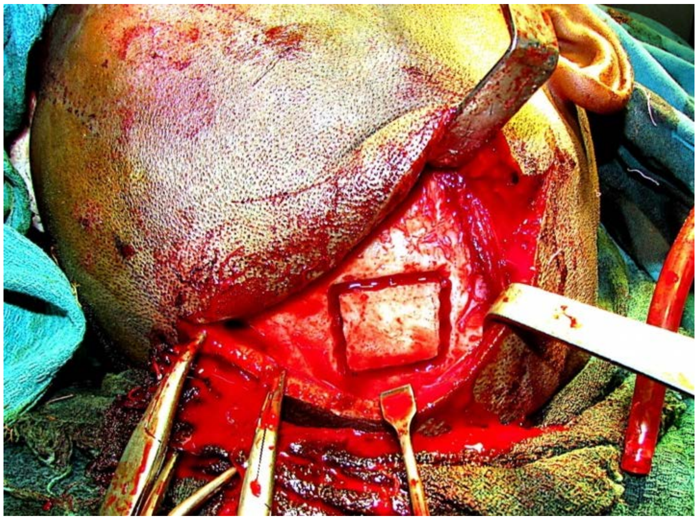

Fig. 6: Hemi-coronal flap elevated and outlining the design of the calvarial graft

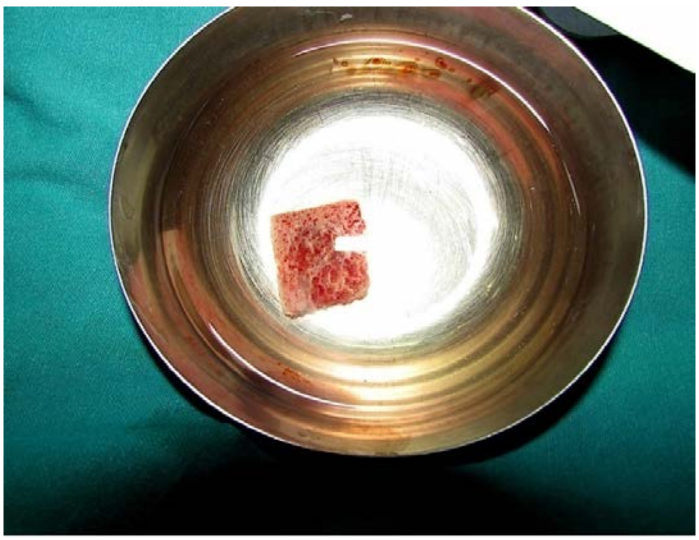

Fig. 7: The harvested split thickness calvarial bone graft

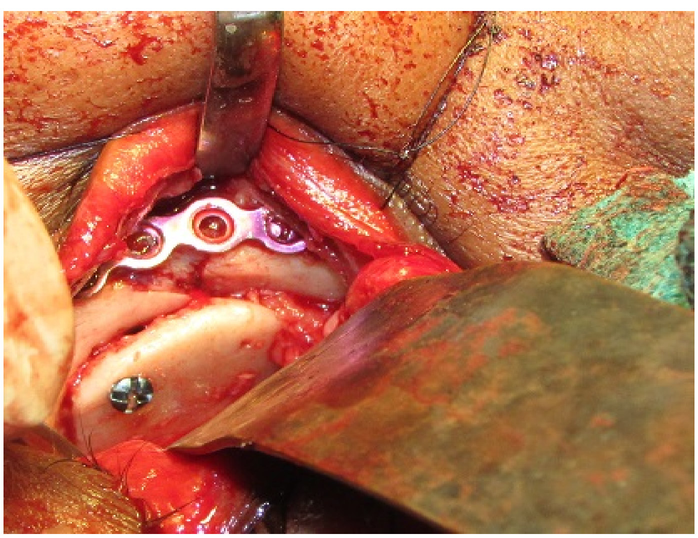

Fig. 8: Fixation of the graft

Fig. 9 : Reduction and fixation of the zygomatico-maxillary buttress area

Fig. 10: Closure of the hemicoronal flap and insertion of drain

Fig. 11: Closure of the lateral canthotomy and lateral eyebrow incisions

References

1. Doxanas M.T. & Anderson R.L.(1984). Clinical Orbital Anatomy. 1st Ed. Pp. 22-23
2. Ellis E 3rd, el-Attar A, Moos KF. An analysis of 2,067 cases of zygomatico-orbital fracture. J Oral MaxillofacSurg 1985;43:417-28.
3. Smith B, Regan WF Jr. Blow-out fracture of the orbit; mechanism and correction ofinternal orbital fracture. Am J Ophthalmol 1957;44:733-9.
4. Lane KA, Bilyk JR, Taub D, et al: "Sutureless" repair of orbital floor and rim fractures. Ophthalmology 116:e2, 2009
5. Ho VH, Rowland JP Jr, Linder JS, et al: Transconjunctival repair of orbital blowout fractures. OphthalPlastReconstrSurg 20: 458, 2004
6. Goldberg RA, Lessner AM, Shorr N, et al: The transconjunctival approach to the orbital floor and orbital fat. A prospective study. OphthalPlastReconstrSurg 6:241, 1990
7. Jacono AA, Moskowitz B: Transconjunctival versus transcuta- neous approach in upper and lower blepharoplasty. Facial PlastSurg 17:21, 2001
8. Patel PC, Sobota BT, Patel NM, et al: Comparison of transconjunctival versus subciliary approaches for orbital fractures: A review of 60 cases. J CranioMaxillofac Trauma 4:17, 1998
9. Kim HS, Jeong EC. Orbital floor fracture. Archives of craniofacial surgery. 2016 Sep;17(3):111.
10. Jordan DR, St Onge P, Anderson RL ***et** al.* Complications associated with alloplasticimplants used in orbital fractures repair. Ophthalmology 1 992; 99:1600-1608.
11. Ellis E III, Tan Y: Assessment of internal orbital reconstructions for pure blowout fractures: Cranial bone grafts versus titanium mesh. J Oral MaxillofacSurg 61:442, 2003
12. Kontio R: Treatment of orbital fractures: The case for recon- struction with autogenous bone. J Oral MaxillofacSurg 62:863, 2004
13. PermanKI,PriceGW.Autogenous bone in orbital reconstruction. Ophthalmic PlastReconstrSurg 1988; 7:93-98.
14. Ilankovan V, Jackson IT. Experience in the use of calvarial bone grafts in orbital reconstruction. Br J MaxillofacSurg 1992;30:92-96.
15. Jackson IT, Helden G, Marx **R.** Skull bone grafts in maxillofacial and craniofacial surgery. J Oral MaxillofacSurg 1986;44:949-955.
16. Kusiak JF, Zins JE, Whitaker **LA.** The early revascularization of mem- branous bone. Plast Reconstr Surg 1985;76:s**10-5**I 4.

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