Original Article

Evaluation of the lateral orbital approach in management of zygomatic bone fractures

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Abstract

Zygomatic maxillary fractures, also known as tripod fractures, are usually the result of a direct blow to the body of the zygoma. Tripod fracture consists of (a) zygomatic arch fracture, (b) fracture of the lateral orbital wall, and (c) fracture of the inferior orbital floor. The purpose of this study is to evaluate the functional and esthetic outcome following this lateral orbital approach in the management of zygoma fracture. This study was carried out in VMS Dental College, Salem, and in a private hospital. This study was based on the experience gained from a retrospective study of the 30 lateral orbital approaches that were used in 30 patients with fractures of the zygomatic complex, which were conducted for a period of 8 years between January 2003 and January 2011. In the retrospective study, all the 30 patients were able to open the mouth completely; eyeball movements were normal; esthetically, all patients appeared normal. There were no sinusitis or visual problems in any of the studied patients. We conclude that the lateral orbital approach is an ideal option in reduction and treatment of zygomatic bone and arch fractures.

Key words: Fracture, lateral orbital approach, reduction, zygoma

INTRODUCTION

The zygomatic complex is responsible for the mid-facial contour and for the protection of the orbital contents. Zygomatic maxillary fractures, also known as tripod fractures, are usually the result of a direct blow to the body of the zygoma. Tripod fracture consists of (a) zygomatic arch fracture, (b) fracture of the lateral orbital wall, and (c) fracture of the inferior orbital floor.[1] Fractures of the zygomatic complex are among the most frequent in maxillofacial trauma.[2]

Another view of zygomatic complex fractures involves at least four skeletal junctions, including the sphenozygomatic suture, inferior orbital rim and floor, ZF suture, and zygomaticomaxillary suture.[3] They are also called tetra pod fractures.

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The etiologies of zygomatic complex fractures include road traffic accidents, assaults, and falls, sports and missile injuries.[4] Common clinical features of zygomatic complex fractures include diplopia, enophthalmos, subconjunctival ecchymosis, flattening of the cheek, gagging of the occlusion, and sensory disturbances.[5]

The fractured zygomatic bone is usually displaced in an inferior medial and posterior direction, which results in a cosmetic deformity with a loss of ipsilateral malar prominence. Trismus is also a common finding, particularly after a fracture involving the zygomatic arch. It results from impingement upon the coronoid process of the mandible by a depressed zygomatic arch. This may indicate a need for elevation of the depressed arch, accurate reduction, and fixation. Diplopia may occur after zygoma fractures for a number of reasons. These include but are not limited to hematoma, muscle injury, motor nerve injury to the extra ocular muscles, entrapment of extra ocular muscles, or damage to the fine connective tissue system. Diagnosis of zygomatic complex fractures is usually clinical, with radiographic confirmation.[6]

The following approaches are available to reduce the displaced zygoma; namely temporal extra oral approach,

intraoral approach, transantral approach, supra frontal approach, and per cutaneous approach. Although various approaches are in use to reduce the fractured zygoma, here we describe a simple and effective method for the reduction of the zygoma fracture that has been used with great success. This study preferred the lateral orbital approach method to reduce the fractured zygoma, in all the 30 cases treated. This technique was preferred due to its direct access behind the body of zygoma; and its incision could be used for direct fixation at the fronto zygomatic suture line. The objective of this study is to evaluate the efficacy of this lateral orbital approach in reduction of zygoma fractures.

MATERIALS AND METHODS

Over a period 8 years from January 2003 to January 2011, 30 patients with fractures of the zygomatic complex were retrospectively studied at private hospitals situated in Namakkal and VMS Dental College, Salem.

Treatment strategies should be optimized toward not only evaluation with objective measures but also patients' subjective evaluation; To optimize treatment of zygomatic bone fractures, patients' subjective evaluations of symptoms are necessary.[7]

Therefore, in this retrospective study along with following parameters such as esthetic and functional results, patients' subjective evaluations of symptoms were observed to find the outcome of the lateral orbital approach reduction and fixation.

Data documented were age, sex, etiology, pattern of injury, method of reduction, and results of the treatment. Twenty-three patients were operated under general anesthesia and seven patients were operated under local anesthesia. The cases were either isolated zygoma fracture or combined with other fractures of face. All patients were male. The instrument used to elevate zygoma was Howarth's periosteal elevator or Ohm's periosteal elevator.

Surgical procedure

Under general anesthesia, the site near lateral wall of orbit is disinfected with betadine antiseptic solution. Subcutaneous infiltration of a local anesthetic/vasoconstrictor solution of the soft tissues over the lateral orbital rim is helpful for hemostasis. An approximately 2 cm long horizontal incision is marked within the bounds of the lateral eyebrow parallel to the hair follicles. The incision goes through the skin first and then through the subcutaneous fat and muscular tissue layers. The access area can be enlarged in two fashions: Medial extension of the incision toward the supraorbital foramen and nerve staying inside the eyebrow. Extending the incision inferiorly along the orbital rim by the way of a small angled skin-only turned into a crow's foot wrinkle laterally. After the skin and muscle incision the periosteum over lateral wall of the orbit was incised and the fracture site was identified. A small incision was made in the fascia immediately beneath the frontal process of zgomatic bone to facilitate insertion of the Howarth elevator behind the body of zygoma [Figures 1 and 2]. Lateral and outward force is given to elevate medially displaced zygoma. The reduction was completed on hearing a click sound. The step deformity correction near fronto zygomatic suture and infra orbital margin was verified. A mini plate was placed and fixed across the fracture site near fronto zygomatic suture. In the case of fracture zygomatic arch the periosteal elevator was inserted beneath the fractured zygomatic arch and the elevator was moved mediolaterally to elevate depressed zygomatic arch. The reduction was completed on hearing a click sound. The free movement of mandible was verified to check the function of mandible.

RESULTS

In this study, while reviewing, the following parameters were observed to judge the efficacy of lateral orbital approach: (1) function of mandible, (2) function of eyeball, (3) vision, (4) ptosis, (5) paresthesia, (6) sinusitis, and (7) appearance.

Function of the mandible was normal in all 30 patients; eyeball movement function normal in 30 cases and no patient reported ptosis; paresthesia was present in the initial postoperative period, but paresthesia disappeared after

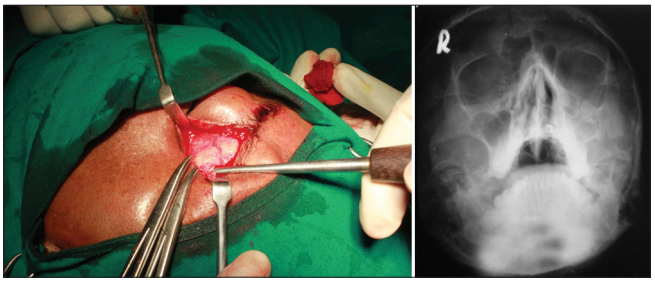

Figure 1: Prior to reduction of fracture; lateral wall orbit. X-ray sinus view

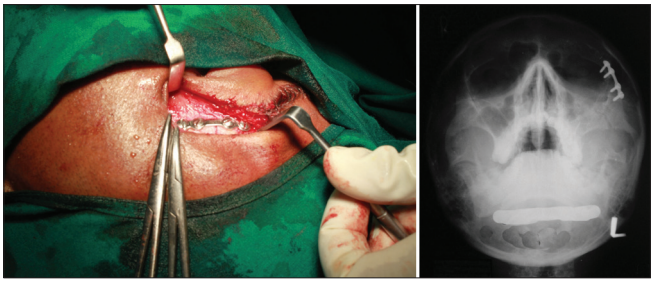

Figure 2: Postreduction of fracture; lateral wall orbit. X-ray sinus view

6 months time; no patient reported sinusitis symptoms. All operated patients were satisfied with the results they had following management of their zygoma fracture.

DISCUSSION

Various approaches to ZMC fractures have been well described in the literature. These include coronal, eyebrow, upper eyelid, transconjunctival and infraciliary lower eyelid, maxillary vestibular approach, temporal approach, and supra orbital approach. The pioneers in methods of reduction of zygoma fractures are Du Verney closed reduction (1751), Lothrop's trans antral approach (1906), Keen intra oral approach (1909), Gillies temporal approach (1927), and Dingman and Natvig's supra orbital approach.

Du Verney[8] in 1751 described the anatomy, type of fractures observed, and approach to reduction in two cases. Recognizing the importance of reduction for proper healing, Du Verney took advantage of the mechanical forces of the masseter and temporalis muscles on the zygoma in his approach to closed reduction techniques.

In 1906, Lothrop was the first to describe an antrostomy reaching the fractured zygoma through a Highmore antrum below the inferior turbinate.[8] Total complete reduction of zygoma may not be possible in this method.

In 1909, Keen categorized zygomatic fractures as those of the arch, the body, or the sutural disjunction. He was the first to describe an intraoral approach to the zygomatic arch *via* a gingivobuccal sulcus incision. Masseter muscle bleeding may occur along with ocular insult if the instrument is placed too high.[8]

These techniques offer the advantages of avoiding any skin incision, thereby avoiding any visible scaring. They allow minimal dissection and an excellent vector for reduction; however, they may result in increased rates of infection by introducing oral flora into the infra temporal fossa.[8] The practical difficulty in this approach is intra oral contamination of the fixation site at fronto zygomatic suture. Special care is required to prevent infection.

In 1927, Gillies was the first to create an incision made behind the hairline and over the temporal muscle to reach the malar bone.[9] In this technique, an extra incision is required to elevate zygoma compared to the lateral orbital approach. Other than this, the temporalis muscle may get injured which may result in postreduction trismus. Damage to superficial temporal artery can produce severe bleeding in this technique.

Studies by Kobienia *et al.* of intraoperative portable fluoroscopy have demonstrated improved results with the use of a temporal or supraorbital approach for arch fractures.[10]

Xie *et al.* introduced an endoscopic-assisted approach *via* a small preauricular incision to achieve reposition and osteosynthesis of isolated zygomatic arch fractures. They concluded, "All preauricular scar and facial lateral contour are esthetically satisfactory".[11]

However, the above-mentioned methods may not be economical for all patients. A study performed by Dingman and Natvig concluded that most displaced fractures of the zygoma should be treated by open reduction and direct wire fixation. He advocated the supra frontal approach to reduce fracture zygoma[12]

Apfelberg *et al.* (2008) treated zygoma and arch fracture by elevation and reduction with the use of a zygomatic elevator from an intraoral upper buccal sulcus approach. No patient suffered a recurrence of the fracture of deformity or required an open reduction. This little publicized procedure is easy, fast, and effective in carefully chosen cases of zygoma and zygomatic-arch fractures.[13] This method of reduction and fixation is more time consuming than the approach discussed in this study.

Krishnan and El Sheikh managed 25 patients with isolated zygomatic-arch fractures successfully under local anesthesia and sedation using dental forceps through the intraoral buccal sulcus approach.[14] This approach may be useful only in arch fractures; introduction of large handle may produce more injury to the tissues.

Mezitis *et al.* used curved mosquito forceps to treat isolated fractures of the arch successfully in 21 patients under local anesthesia.[15]

Hwang and Lee, in 1999, described their technique as follows, "the orbital rim and zygomatic arch are outlined with a marking pen. The exact fracture site is then marked by palpation. The depressed fracture site is held with a towel clip and pulled outward gently. A clicking noise may be heard. The clip is then released. The contour of the zygomatic arch is compared with the other side.[16] In the above two techniques, it is not possible to produce complete reduction in all type of fractures.

In 1993, Bergsma *et al.*[17] reported about foreign body reactions to resorbable poly(L-lactide) bone plates and screws used for the fixation of unstable zygoma fractures; however, we have used nonresorbable titanium or stainless steel plates to fix the unstable zygoma at fronto zygomatic

suture; according to the author, all the 10 cases they studied had reactions and required removal. However, in our study, three cases required removal of plates due to infection but not due to foreign body reaction.

Although various methods are available to treat to fracture zygoma, the most common techniques in use are Gilley's temporal approach and Intra oral approach; although they provide excellent access to reduce fractures of body and arch, the lateral orbital approach provides a simple and rapid access to the lateral orbital rim. The same incision could be used for mini plate fixation at fronto zygomatic suture. No functionally important neurovascular structures are at risk in this approach. Nevertheless, the treatment can be done under local anesthesia.

The supra orbital approach followed in this study is a modification of Dingman and Natvig's method. The technique followed, in this study, can be used to reduce all types of zygoma and arch fractures. The following advantages were found in the lateral orbital approach in reduction of zygoma fractures. A separate incision either in oral cavity or temporal region is not necessary when we reduce the zygoma through this approach. No special instrument is required in this technique to elevate zygoma or arch. The instrument used was simple Howarth's periosteal elevator. This surgical approach is easier and convenient for patients and operators. Elevation in this technique is less time consuming. During plate fixation, the fractured fragment can be supported under direct vision. This technique is useful in comminuted type of fracture. Through this approach, fracture in lateral wall of the orbit could be palpated for its reduction. This study found many advantages over other techniques of elevation of fractured zygoma and arch.

This technique differed in Ding man's technique, in spite of incision to insert the periosteal elevator. He advised to make incision in temporalis fascia near the supra orbital region whereas in this study incision made immediately beneath the frontal process of zygomatic bone near lateral wall of orbit.

While reduction in Ding man's technique when the elevator is inserted from the supra orbital region, it may be difficult to reach behind zygomatic buttress and body of zygoma. It is a good approach to reduce the fractured zygomatic arch but for reduction of zygomatic bone Ding man's approach has limitations.

Currently, Gilley's temporal approach is routinely used to reduce zygomatic arch and bone fractures but this technique requires extra incision in the temporal region and produces postoperative trismus when temporalis muscle is injured. This technique requires a special and large elevator which produces more injury to tissues.

Limitations of this study are: (1) This approach is not advisable in isolated arch fracture because the intra oral approach is a better option than the lateral orbital approach; (2) Gille's temporal approach is better option when the zygoma fracture does not require fixation after elevation; (3) In this technique, a visible scar is seen in the lateral orbital region; however, in all displaced fractures fixation at lateral wall of orbit is a must.

CONCLUSION

A retrospective study found excellent functional results and acceptable esthetic outcome. This study has revealed a new modified easier approach to treat zygoma fractures. Due to its several advantages, this technique could be a better option in reduction and treatment of zygoma fractures.

REFERENCES

1. Jansma J, Bos RR, Vissink A. Zygomatic fractures. Ned Tijdschr Tandheelkd 1997;104:436-9.
2. Hollier LH, Thornton J, Pazmino P, Stal S. The management of orbito zygomatic fracture. Plast Reconstr Surg 2003;111:2386-92.
3. Obuekwe O, Owotade F, Osaiyuwu O. Etiology and Pattern of Zygomatic Complex fractures, a Retrospective Study. J Natl Med Assoc 2005;97:992-6.
4. Afzelius LE, Rosen C. Facial fractures. A review of 368 cases. Int J Oral Surg 1980;9:25-32.
5. Adebayo ET, Ajike OS, Adekeye EO. Analysis of the pattern of maxillofacial fractures in Kaduna, Nigera. B rJ Oral Maxillofac Surg 2003;41:396-400.
6. Ait Benhamou C, Kadiri F, Laraqui N, Benghalem A, Touhami M, Chekkoury A, *et al*. Zygomatic-orbito-malar fractures. Apropos of 85 cases. Rev Larygol Otol Rhinol 1996;117:15-7.
7. Kurita M, Okazaki M, Ozaki M, Tanaka Y, Tsuji N, Takushima A, *et al*. Patient satisfaction after open reduction and internal fixation of zygomatic bone fractures. J Craniofac Surg 2010;21:45-9.
8. Cohen AJ, Narayan D. Zygomatic Complex Facial Fractures. Available from: http://emedicine.medscape.com/article/1284142-overview. [Last accessed on 2011 Aug 15].
9. Gillies HD, Kilner TP, Stone D. Fractures of the malar-zygomatic compound: With a description of a new X-ray position. Br J Surg 1927;14:651-6.
10. Gosain AK, Song L, Corrao MA, Pintar FA. Biomechanical evaluation of titanium, biodegradable plate and screw, and cyanoacrylate glue fixation systems in craniofacial surgery. Plast Reconstr Surg 1998;101:582-91.
11. Xie L, Shao Y, Hu Y, Li H, Gao L, Hu H. Modification of surgical technique in isolated zygomatic arch fracture repair: Seven case studies. Int J Oral Maxillofac Surg 2009;38:1096-100.
12. Dingman RO, Natvig P. Surgery of Facial Fractures. Philadelphia: WB Saunders Co; 1964. p. 212-3.
13. Apfelberg DB, Lavey E, Maser MR, Lash H. Upper buccal sulcus approach to reduction of zygomatic fractures. J Trauma 1977;17:847-9.
14. Krishnan B, El Sheikh MH. Dental forceps reduction of depressed

zygomatic arch fractures. J Craniofac Surg 2008;19:782-4.
15. Mezitis M, Stathopoulos P, Rallis G. Use of a curved mosquito for reducing isolated zygomatic arch fractures. J Craniofac Surg 2010;21:1281-3.
16. Hwang K, Lee SI. Reduction of zygomatic arch fracture using a towel clip. J Craniofac Surg 1999;10:439-41.
17. Bergsma EJ, Rozema FR, Bos RR, de Bruijn WC. Foreign body reactions to resorbable poly(L-lactide) bone plates and screws used for the fixation of unstable zygomatic fractures. J Oral Maxillofac Surg 1993;51:666-70.

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