A Modified Temporal Incision: An Alternative Approach to the Zygomatic Arch

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Abstract Zygomatic arch fractures occur due to a direct injury to the lateral aspect of the head. When there are multiple fractures of the arch, open reduction and internal fixation is indicated. Conventionally hemi-coronal and pre-auricular incisions are placed to approach the arch. A modified temporal incision has been described. Open reduction and internal fixation of zygomatic arch fractures has been done.

Keywords Zygomatic arch · Temporal incision · Facial nerve · Pre-auricular incision

Introduction

The zygomatic arch is a horizontal bone on the side of the head in front of the ear, a little above the tragus. It is formed by the temporal process of the zygomatic bone (anterior two-third) and the zygomatic process of the temporal bone (posterior one-third) [6]. The zygomatico-temporal suture crosses the arch obliquely downwards and backwards. The lateral surface of the zygomatic arch is subcutaneous. The posterior end of the zygomatic arch is attached to the squamous temporal bone by anterior and posterior roots. Fractures of zygomatic arch most frequently occurs as a result of fracture of entire zygomatic complex. However the isolated fracture of the zygomatic arch without other injuries do occur when a force is applied directly onto the lateral aspect of the head [5]. Isolated

zygomatic arch fractures comprise about 10% of total the zygomatic fractures and result in noticeable depression at the fracture site [8]. They are classified accordingly [9]. Occasionally zygomatic arch requires open reduction and internal fixation when the fractures are in several segments or grossly displaced and cannot be reduced with closed methods. Semi-coronal and pre-auricular incisions are usually used to approach the zygomatic arch. However complications do occur due to facial nerve damage, we have used a modified temporal incision which is safe and reduces the operative time and complications.

Case Report

A 34-year-old male patient reported to the department of Oral and Maxillofacial surgery with the chief complaint of pain and reduced mouth opening since 3 days. The history revealed that he had met with a road traffic accident 3 days back. He was unconscious for half an hour when he was admitted in the general hospital immediately. He was referred to the department when he regained consciousness fully and was well oriented.

On local examination, there was depression on the left side in the zygomatic region and reduced mouth opening of 20 cm (Figs. 1, 2). On palpation, confirmation of the depression and tenderness on the zygomatic arch area was appreciated. Submentovertex radiograph and computed tomography were advised. Multiple segments of fracture of the zygomatic arch was confirmed (Figs. 3, 4, 5, 6). Open reduction and internal fixation was decided as the treatment modality. After all the preliminary blood investigation and anesthetic evaluation, the case was posted under general anesthesia.

Under aseptic conditions, the superficial temporal artery was identified and marked. A modified temporal incision

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Fig. 1 Depression in zygomatic arch region

Fig. 2 Reduced mouth opening

below the anterior branch of superficial temporal artery and 1 cm above the zygomatic arch was made (Fig. 7). Through the blunt dissection, the temporal fascia and the temporalis muscle was identified (Fig. 8). The branches of the facial nerve run within the temporal fascia. In order to protect the nerves, the flap was elevated with the fascia inferiorly and the zygomatic arch was approached and the fragments exposed (Fig. 9). With the help of Rowe zygomatic elevator, reduction of the arch was done. With the help of periosteal elevator, accurate reduction of the fragments was carried out so as to restore the smooth curvature of the arch and fixation was done with six holes titanium plate (Fig. 10). Three layered closure was done (Fig. 11)

Fig. 3 SMV showing arch fracture

Fig. 4 CT shows overlap of fragments

and the patient was advised not to sleep on that side for 7 days. Post operative period was uneventful. He was prescribed with antibiotics, and analgesics postoperatively. Function as well as aesthetics was restored with satisfaction.

Discussion

Zygomatic arch is formed by the temporal process of zygoma and the zygomatic process of temporal bone. The masseter muscle consisting of three superimposed layers which blend anteriorly gains attachment from zygoma and the zygomatic arch. The superficial layer arises from the maxillary process of zygomatic bone and from the anterior two-third of the lower border of the zygomatic arch. The

Fig. 5 3D CT showing arch fracture

Fig. 7 Incision

Fig. 6 3D CT showing arch fracture

Fig. 8 Showing fascia, and nerve

middle layer arises from the deep surface of the anterior two-third of the zygomatic arch. The deep layer arises from the deep surface of the arch. Contraction of this muscle is often implicated as the primary cause of post reduction displacement of the zygoma. Due to the attachment of the temporalis fascia along the superior aspect of the arch, internal fixation is unnecessary even in mildly displaced fractures as the fascia will immobilize the fragments effectively [1]. However multiple and depressed fractures need stabilization. The temporal fascia covers the temporalis muscle whose fibers pass through the gap between zygomatic arch and the side of the skull to get inserted into the coronoid process. About 2 cm above the zygomatic

Fig. 9 Fracture site exposed

Fig. 10 Titanium plate in place

Fig. 11 Wound closure

arch the fascia splits into two layers one of which is attached to the upper border and the other to the lateral border. This division of the fascia is taken advantage of when approaching the arch through the temporal incision in order to protect the branches of the facial nerve which are superficial to it. While approaching the zygomatic arch, the branches of the facial nerve have to be protected. The temporal branches emerge from the upper part of the parotid gland, cross the zygomatic arch obliquely and pass to supply the frontal belly of the occipitofrontalis, the orbicularis oculi and the anterior and the superior auricular muscles. The small zygomatic branches run across the zygomatic arch to supply the orbicularis oculi and the

larger branches run below the arch to supply the muscles of the nose and those between the eye and mouth [3, 12, 13].

Isolated zygomatic arch fractures occur as a result of direct trauma to the temporal region. This results in noticeable depression at the fracture site [8]. There may be impingement of the fractured arch with the coronoid process resulting in limited mouth opening as seen in the case reported. The treatment for isolated zygomatic arch fractures depends on the degree of displacement. Usually fractures with significant displacement need reduction. Simple reduction of the arch can be accomplished by either by a percutaneous hook, Gillies temporal approach [11], or through intraoral approach. The need for stabilizing zygomatic arch varies with the location of injury, number of fragments and displacement of segments. Ellis et al. found that ten out of 126 cases required fixation. Various materials like metal eye shield, plastic oral airways, short pieces of endotracheal tubing and orthopedic finger splints have been used as the external device for fixation [4, 7]. The unstable fractured zygomatic arch can be stabilized by kirschner wire [2]. However when there is a comminuted fracture of the arch, there is a need for open reduction and internal fixation.

Zygomatic arch can be approached directly either by bicoronal, pre-auricular, percutaneous or lateral eyebrow incision [15]. The coronal incision is extremely useful for surgery of zygomatic complex including the arch. It appears as a radical approach to the zygomatic complex and it provides an excellent access to all the associated structures with virtually no complications. This is useful when there is comminution of supra-orbital and lateral orbital rims and zygomatic body and arch. The scar produced is hidden within the hair and is therefore invisible. Zhang et al. while describing coronal incision for the open reduction and internal fixation for the zygomatic complex mentioned various complications associated with it. Hemorrhage, hematoma infection, swelling and temporary nerve injury are the early complications while alopecia, obvious scarring, permanent paralysis of facial nerve and depression of temporal fascia are the long term complications. Although coronal incision will facilitate accurate reduction and fixation of fragments, indication for the coronal incision should be strictly controlled and this incision should not be overused [16].

Mizuno et al. reported 16 cases where pre-auricular incision was used to expose the malar arch. The advantages include the ability to attain excellent stability of the broken arch, mobilization of the fracture fragments precisely and avoidance of excessive stretching of the nerve fibers [10]. However the operative time and the possibility of injury to the nerve are of greater concern in this approach.

Thangavelu et al. [14] suggested the use of fronto-temporal approach to the management of zygomatic complex

Fig. 12 Modified temporal incision

fractures. A fronto-temporal incision was placed up to the depth of temporalis fascia. Dissection towards the arch and orbital rim should be in a plane deep to the superficial layer of the deep temporal fascia so that frontal and orbital branches of the facial nerve are elevated with the flap. The periosteum is then incised along the orbital rim along the arch fragments deep to the attachment of the superficial layer of the fascia. The fracture fragments are directly visualized reduced and stabilized using semi-rigid internal fixation. This approach gives excellent visualization and allows fixation at three points of articulation and the incision is concealed within the hair bearing area. The disadvantages of this approach are prolonged operative time and possible damage to the branches of facial nerve [14].

When there is an isolated comminuted fracture of zygomatic arch and needs the open reduction and internal fixation, an alternative incision is suggested as mentioned in the above case. A modified curved incision is placed just approximately 1 cm above the zygomatic arch. This incision is safe as it is placed just posterior to the temporal branch of the facial nerve and below the anterior branch of the superficial temporal artery. The temporal branch of the facial nerve crosses the zygomatic arch more anteriorly (Fig. 12). Through blunt dissection, deep fascia is reached and the flap with the superficial fascia is elevated so that the branches of facial nerve are preserved as it goes along the flap. Dissection is continued inferiorly until the periosteum of the zygomatic arch is encountered. The periosteum is incised and the fragments exposed. The fragments were reduced and semi-rigid fixation was done with the help of six hole titanium plate. We did not come across any complications either early or late. Following the reduction of the zygomatic arch fracture, one must protect the side of the head from further injury. The force of the weight of the head resting on a pillow is sufficient to displace even a properly reduced fracture.

Conclusion

Although the isolated fracture of the zygomatic arch is rare and even rarer is the need for the open reduction and internal fixation, this alternative approach to the arch is useful. The operative time is reduced and the complications are minimized through this approach. However many more cases have to be carried out in order to establish the efficiency and the efficacy of this particular approach.

References

1. Banks P (1992) Killey's Fracture of the middle third of the facial skeleton, 5th edn. Varghese Publishing House, Bombay
2. Cammiller AC, Gilhooly M, Cooke ME (2005) Stabilization of the unstable fractured zygomatic arch with a Kirschner wire. *Br J Oral Maxillofac Surg* 43(2):183–184
3. Drake LR, Vogl W, Mitchell AWM (2005) Gray's anatomy for students. Elsevier Churchill Livingstone, Philadelphia
4. Ellis E 3rd, el-Attar A, Moos KF (1985) An analysis of 2067 cases of zygomatico-orbital fractures. *J Oral Maxillofac Surg* 43(6):417–428
5. Fonseca JR (2005) Oral and maxillofacial trauma, 3rd edn., vol 1. Elsevier, Philadelphia, pp 569–642
6. Indirbir Singh (ed) (1996) BD Chaurasia's human anatomy regional and applied, 3rd edn., vol 3. CBS Publisher, New Delhi
7. Jones GM, Speculand B (1985) A splint for the unstable zygomatic arch fixation. *Br J Oral Maxillofac Surg* 24(4):269–271
8. Kazuhiko Y, Yamamoto K, Murakami K, Sugiura T, Fujimoto M, Inoue M, Kawakami M, Ohgi K, Kirita T (2007) Clinical analysis of isolated zygomatic arch fractures. *J Oral Maxillofac Surg* 65(3):457–461
9. Marcus Z (1992) Classification and treatment of zygomatic fractures: a review of 1025 cases. *J Oral Maxillofac Surg* 50(8):778–790
10. Mizuno A, Torri S, Akiyama Y, Motegi K (1987) Pre-auricular (tragus) skin incision in fracture of malar arch. *Int J Oral Maxillofac Surg* 16(4):391–396
11. Ogden GR (1991) The Gillies method for fractured zygoma: an analysis of 105 cases. *J Oral Maxillofac Surg* 49(1):23–25

12. Ozyazgan I (2007) A new Proposal of classification of zygomatic arch fractures. *J Oral Maxillofac Surg* 65(3):462–469
13. Ramanes GJ (1996) Cunningham's manual of practical anatomy: head, neck and brain, 15th edn., vol 3. Oxford University press, New York
14. Thangavelu A, Ramesh C, Yoganandha (2007) Fronto-temporal approach for the management of zygomatic complex fracture—a changing paradigm. *J Maxillofac Oral Surg* 6(2):11–13
15. Williams JL (1994) Rowe and Williams' maxillofacial injuries, vol 1. Churchill livingstone, New York, pp 475–590
16. Zhang QB, Dong YJ, Li ZB, Zhao JH (2006) Coronal incision for treating zygomatic complex fractures. *J Craniomaxillofac Surg* 34(3):182–185