Lateral orbital wall: an excellent guide for zygomatico-maxillary complex fracture reduction.

Original Article

Mohamed Koraitim , Aly mohamed Atteya

Maxillofacial and Plastic Surgery Department, Faculty of Dentistry, Alexandria University, Egypt.

ABSTRACT

Background: Zygomatico-maxillary complex (ZMC) fracture usually occur in the setting of severe facial trauma. Proper reduction of such fracture is important for achieving good aesthetic and functional result. The patient usually presents with facial swelling and the fracture could be isolated or associated with other facial fractures, ocular or intracranial injury.
Methods: a prospective study was conducted on 32 patients with ZMC fracture without concomitant maxillofacial fractures. The lateral orbital wall was used as the main reference for proper reduction. The results were evaluated subjectively by the degree of regain of malar prominence, and facial symmetry.
Results: proper reduction with excellent and good results was achieved in 25 and 7 patients, respectively. None of our patients had fair or poor results.
Conclusion: We found that the lateral orbital wall is a useful index for assessment of proper reduction in term of degree of displacement and rotation of the zygomatic bone.

Key Words: zygomatic fractures, malar projection, zygomatic arch fracture, lateral orbital wall

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Corresponding Author: Mohamed Koraitim, MD, PHD. Lecturer Maxillofacial and Plastic Surgery Department, Faculty of Dentistry, Alexandria University, Egypt.**Tel :** 034846062, **Mobile:** +20 100 520 3669 , **E-mail:**mohamed_koretam@hotmail.com

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INTRODUCTION

The zygomaticomaxillary complex (ZMC) is responsible for the malar prominence of the face and is vulnerable for to injury due to its convexity. The zygomatic bone is connected to the maxillary, frontal, temporal, and sphenoid bones. ZMC fracture occur mostly as a result of road traffic accidents followed by assault and sports injury. [1] Many functional and aesthetic consequences could be associated with these fractures, namely: binocular diplopia, hypoesthesia at the infraorbital nerve distribution, limited mouth opening, enophthalmos, and loss of facial width and projection. [2]

The lateral orbital wall is formed by the zygomatic bone anteriorly and the greater wing of sphenoid posteriorly. The junction between both bones is broad and is the most common site of fracture in the lateral wall associated with ZMC fractures. Open reduction and internal fixation of ZMC fractures could be performed through different approaches to the zygomatico-frontal suture (ZF), infraorbital rim, Zygomatico-maxillary buttress (ZM), and zygomatic arch. As these fractures are associated with rotation of the zygoma, proper alignment at these 4 points should be achieved to ensure proper reduction. Displaced fractures usually require two or 3 points fixations for proper and stable reduction and fixation. [3 - 4]

New approaches for proper reduction of ZMC fractures have been published including, 3D navigation surgery, [5]intraoperative CT, [6] and C-arm Guided reduction. [7] However, there is no consensus on the optimum method for assessment of proper reduction intraoperatively. Furthermore, these common fractures require a reliable, simple assessment not depending on tools that could not be found in every hospital or operating room, specially in lower income countries. In the current study we evaluated the use of lateral orbital wall as a reference for proper reduction of zygomatic fractures.

PATIENTS AND METHODS

This study included all patients with displaced ZMC fractures without concomitant craniofacial fractures admitted to the Maxillofacial and Plastic surgery department, Faculty of Dentistry, Alexandria University, Egypt, from September 2018 to July 2020. Computed tomography (CT) scan with 3D reconstruction was requested for all patients. Exclusion criteria were fracture without displacement, comminuted lateral orbital wall, and the presence of another fracture/s in the maxillofacial

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skeleton.Patients' demographic data, cause of trauma, and radiographic findings were recorded. When edema is severe, surgical intervention was delayed 6- 8 days until it subsides.

Under general anesthesia, the fracture lines were exposed via lateral eyebrow, upper gingivobuccal sulcus, and midtarsal incision. Some patients required exposure only of two fracture lines but the zygomaticofrontal suture was exposed in all patients. The zygomatic bone was reduced using with a transcutaneously inserted bone hook. The lateral orbital wall was dissected from inside the orbit and exposed in all patients (Figure 1). Adequate reduction was confirmed by proper alignment of the zygomaticofrontal suture, and the flat lateral orbital wall followed by fixation with mini plates and screws. Proper reduction was also confirmed by alignment of other fracture sites exposed through other incision/s.

Clinical assessment and follow-up were done at 1, 2 weeks, 1 month, and 3 months postoperatively. Adequate reduction was classified as excellent, good, fair, and poor according to recovery of malar width, projection, and facial symmetry (table 1) [8].

RESULTS

This study included 32 patients with ZMC fractures without concomitant craniofacial fractures. 24 of the patients were male and 8 were female and their age ranged from 17 to 56 years (mean= 32 years). The commonest cause of trauma was road traffic accidents (n=24), followed by Falling from height (n=4), assault (n=3), and sports injury in one patient. All patients had displaced fractures and 9 had associated blow out fractures that were reconstructed with titanium mesh. Operative time ranged from 60 to 90 minutes (mean= 75 minutes).

The lateral orbital wall was successfully exposed in all patients and using it as the main tool for assessment for proper reduction of ZMC fractures, the reduction was classified as excellent in 25 patients and good in 7 patients (Figure 2). No complications were recorded in any of our patients with minimal skin scaring which was almost invisible in majority of patients.

Figure 1. Intraoperative dissection and exposure of lateral orbital wall from inside the orbit and used as a reference for adequate reduction of the zygomatic bone.

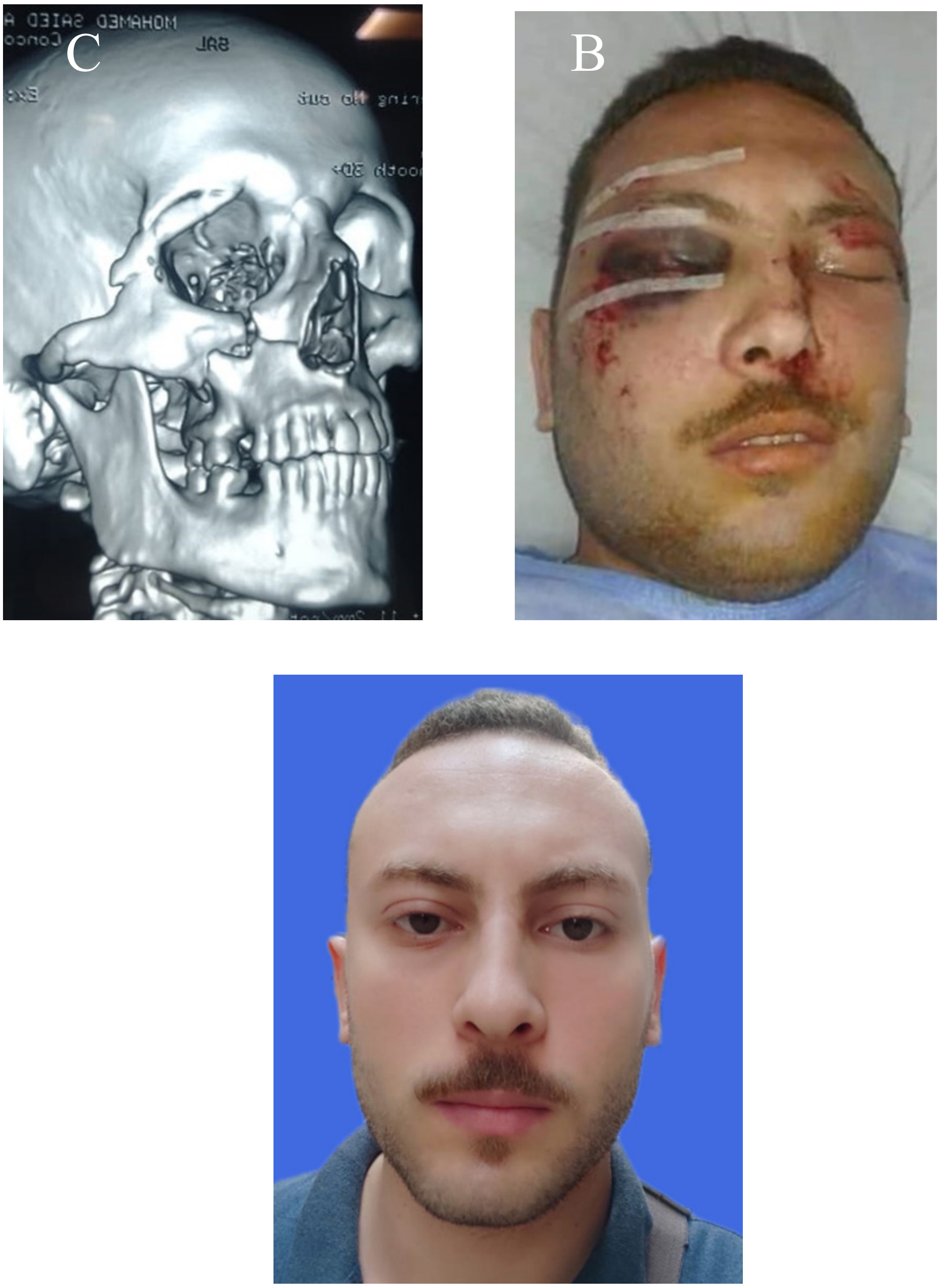

Figure 2. A 37 years old male with a ZMC fracture on right side. (A) 3D-CT shows a displaced zygomatic bone (B) preoperative and (C) 3 months postoperative picture showing excellent outcome.

Table 1. Evaluation of reduction status (Modified from J Oral Maxillofac Surg. 2007;65:457– 461.)

Evaluation	Reduction Status
Excellent	Complete recovery of facial symmetry, malar width, and projection
Good	Nearly Complete recovery of facial symmetry, malar width, and projection
Fair	Improved facial symmetry, malar width, and projection
Poor	No or little improvement of facial symmetry, malar width, and projection

DISCUSSION

ZMC fractures can be minimally displaced or without displacement and hence requires no reduction. Other are severely comminuted or posteriorly displaced and benefit from the coronal approach to expose the zygomatic arch. However, the majority of ZMC fractures are reduced using the anterior approach through zygomaticofrontal suture, inferior orbital rim, and zygomaticomaxillary buttress. [9] Some reports in the literature recommend the use of intra-operative ultrasound for assessment of proper reduction of ZMC fracture being easy to use, portable, and free from radiation exposure. [10,11] However, this modality did not gain popularity as clear imaging of bony surface is not always possible using ultrasound specially in the presence of soft tissue edema and emphysema. Furthermore, the ultrasound can only visualize only a localized area around the fracture, and not the whole zygomatic bone. [12]

The use of CT scan for assessment of proper reduction of ZMC fracture has been published but because of the radiation exposure, being expensive and time consuming, it is considered not practical specially in low-income countries. The cone beam CT C-arm system has lower radiation exposure than conventional CT and the emergence of 3D navigation guided reduction can provide a perfect reduction and fixation. However, these tools are expensive, time consuming and not readily available. [6, 13, 14] The

C-arm guided reduction was reported with satisfactory outcomes. This technique is simple, and available in most trauma centers as it is widely used by orthopedics but there is also low radiation exposure which can be avoided whenever possible. Also, in most reports the C-arm was used in isolated arch fractures. The use of C-arm fluoroscopy was reported for assessment of intraoperative reduction of ZMC fracture. Here, the assessment of malar projection and arch contour is possible but a three dimensional and assessment of the orbital floor is not possible. [15- 17]

In this study, none of our patients had fair or poor outcomes. As most of displaced ZMC fractures are depressed and laterally rotated, the lateral orbital wall can be used as a reference for adequate reduction. This wall is strong and not frequently comminuted, broad, and flat. With its exposure from inside the orbit adequate reduction can be achieved in term of displacement and rotation when it is properly aligned. This reference is easy to apply and does not require additional machine, cost, and not time consuming. We believe that using the lateral orbital wall as the main reference for ZMC fracture reduction result in adequate reduction with satisfactory results when it is well exposed and not comminuted.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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