Original Article

Choice of operative method for management of Isolated Zygomatic Bone Fractures; evidence based study

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Abstract

Objective: To evaluate the treatment outcome of different methods for reduction and fixation of isolated zygomatic bone fractures using degree of displacement as a guide to classify patients into closed and open reduction groups.

Methods: This Clinical Trial was conducted at de' Montmorency College of Dentistry/ Punjab Dental Hospital, Lahore between 21st July 2000 and 30th June 2003.

Sixty patients with isolated zygomatic bone fractures were assigned to open and closed reduction groups of treatment depending on the degree of fracture displacement.

Adequacy of reduction was evaluated by comparing pre and post operative radiographs. Aesthetic outcome was assessed by biometric evaluation.

Results: Reduction was adequate in all patients except four. In two of four no facial deformity was apparent. No patient showed post surgical change in position of reduced zygomatic bone. Biometric evaluation revealed acceptable aesthetics and adequate mouth opening in all except two patients.

Conclusion: Our study indicates that displacement of 2mm at any of the fractured site on occipitomental radiographs can be successfully used as a criterion to assign patients into open and closed reduction groups, for treatment of isolated zygomatic bone fractures (JPMA 59:615; 2009).

Introduction

The zygoma or malar complex forms the central support of cheek and is a strong buttress of lateral portion of middle third of facial skeleton.[1] Because of its prominent position it is frequently subjected to fracture[2] and dislocation either alone or in combination with other structures of midface such as maxilla, nasoethmodial and orbital area.[3]

Zygomatic fractures are the second most common fractures of the face after nasal fractures.[4] Zygomatic bone is frequently displaced after fracture which can lead to malar depression, ocular dystopia and enophthalmos.[5] Thus, for both cosmetic and functional reasons, it is mandatory that zygomatic bone injuries be properly diagnosed and treated.

Patterns of zygomatic bone factures range from simple fracture to comminute and from minimally displaced to severely displaced.[6] Treatment options for reduction of isolated zygomatic bone fractures range from closed reduction without fixation to open reduction with multiple points of exposure and fixation.[7] There is a general consensus that open reduction is the treatment of choice for comminuted fractures but the reduction method for management of less severe fractures is still controversial.[8] We evaluated the treatment outcome of different methods for reduction and fixation of isolated zygomatic bone fractures using degree of displacement as a guide to classify patients into closed and open reduction groups.

Patients and Methods

This study was conducted on sixty patients reporting with isolated zygomatic bone fractures at de' Montmorency College of Dentistry/Punjab Dental Hospital, Lahore between 21st July 2000 and 30th June 2003.

Patients of any age or sex, having isolated unilateral zygomatic bone fractures were included in the study. Patients having multiple facial fractures, bilateral zygomatic bone fractures and comminuted fracture of zygomatic bone were excluded.

Ethical approval was obtained from the ethics committee of the hospital and informed consent was obtained from each participant. Demographic data like age, sex and etiology of fracture were obtained. Detailed history and physical examination was carried out for all patients. Neurosensory disturbance, periorbital ecchymosis, malar depression, subconjunctival haemorrhage, trismus and diplopia were recorded.

Occipitomental view (paranasal sinus) was the standard radiograph used for pre and post operative radiographic evaluation. Patients presenting with isolated zygomatic bone fractures were divided into two treatment groups based on degree of displacement of fracture on the

radiograph at any of the fracture site. A gap of 2mm between bony segments on occipitomental radiographs was taken as a guide to classify patients into open and closed reduction treatment groups.

In group 1; open reduction and fixation was done when there was a gap of more than 2mm between bony segments on the radiograph. The patients in this group were randomly assigned to two treatment groups:

Group 1a; Open reduction and rigid fixation with miniplates.

Group 1b; Open reduction and fixation with wire osteosynthesis.

In group 2; patients were treated with closed reduction (displacement < 2mm) and were randomly assigned to two treatment groups based on two of standard techniques

Group 2a; Temporal approach (Gillies technique)[9]

Group 2b; Intraoral approach with or without sinus packing (Keen's technique)[10]

Operative Management:

All patients were operated under general anaesthesia by one of the following approaches:

Group 1a and 1b: Open reduction and fixation with miniplate/wire osteosynthesis: Exposure of zygomatic bone was obtained by lateral brow incision, infraorbital incision and upper gingivo buccal sulcus incision. After ensuring reduction and satisfactory alignment miniplate/wire were applied at two points i.e., frontozygomatic suture (FZ), and inferior orbital rim (IOR) or three points FZ, IOR and zygomatico maxillary buttress (ZMB), depending upon severity of fracture and degree of displacement. Wounds were closed in two layers after irrigation.

Group 2a: Temporal Approach: This was done as described by Gillie.[9] Briefly, zygomatic arch was approached with temporal hairline incision. Temporal fascia was incised 2.5cm above the arch and temporalis muscle exposed. Elevator was slid over the muscle underneath the arch and displaced zygomatic bone was reduced by levering the elevator.

Group 2b: Buccal Sulcus Approach: It was done as described by Keen.[10] 1cm long incision was made in the mucobuccal fold just beneath the zygomatic buttress of maxilla. Mucosa, submucosa and buccinator muscle fibers were incised. Soft tissue was dissected supra periosteally by periosteal elevator. Zygoma was reduced by a superior, lateral and anterior force. Maxillary sinus was packed with white head varnish in two patients.

Adequacy of Reduction:

Adequacy of reduction was determined by two methods:

a. Radiographic evaluation.

b. Biometric evaluation.

Radiographic evaluation: Adequacy of reduction was determined by pre and post occipitomental radiographs taken after 24 hours of surgery. Fracture stability was assessed by comparing the immediate postoperative radiograph with those obtained five weeks later. Comparisons were made with the opposite side regarding orbital size, alignment of the infraorbital rim, contour of zygomatico maxillary buttress and approximation of frontozygomatic suture. Any asymmetry on images less than 0.5mm in magnitude was considered acceptable reduction.

Biometric evaluation: Aesthetic outcomes of reduction were analyzed by biometric evaluation. For this purpose, pre and post operative bizygomatic widths were measured and compared. The width was measured by "beam compass" by placing its horizontal scale below the columella and pointers touching the soft tissue gently over the zygomatic bone on both sides of face. Pre and post operative evaluation of widest mouth opening was carried out to assess the functional outcome. It was measured by pair of dividers by placing its tips on incisal edges of upper and lower incisors. Pain analysis was done by asking the patient to indicate pain on scale of 0-10.

Results

The sample included 48 males and 12 females with a mean age of 30 ± 10.01 years. Range varied from15 to 54 years. Motor vehicle accidents accounted for 62.5% of fractures, followed by altercations (20%), falls (10%) and sports (7.5%). The left/right ratio of the zygomatic bone fracture was 25:15.

The preoperative symptoms of patients in the order of frequency were neurosensory disturbance (94.2%), periorbital ecchymosis (91.2%), malar depression (86.5%), subconjunctival haemorrhage (67.3%), trismus (21.1%), and diplopia (9.6%).

Patients were usually treated 15 days on an average after trauma (range 1-30 days). Thirty seven patients were treated by open reduction and fixation. Out of these 22 were given rigid fixation by miniplates and 15 were treated with wire osteosynthesis. Two point fixations were done on sixteen patients with most frequent being IOR and FZ suture. In twenty one patients three point fixations were done at IOR, FZ suture and ZMB.

Closed reduction was done in 23 patients. Twelve patients were treated with Gillies temporal approach while 11 by intraoral approach, 9 without sinus packing and two with sinus packing. Sinus was packed with white head

varnish in both the cases.

Radiographic evaluation: Post operative radiographs showed adequate reduction in all except four patients when 2mm displacement was taken as a guide to classify patients into open and closed reduction treatment groups. Two of these were treated by closed reduction one with Gillies approach and other with Keen's approach. In two of the cases open reduction and fixation was done by wire osteosynthesis. The complications were malpositioning of zygomatic bone in all four cases.

Clinical assessment: No ocular motility disturbance was noted, and none of the patients had enophthalmos postoperatively. After 5 weeks, only 8 of the 60 patients showed small areas of numbness in the region of nasal ala and lip commissure. After 6 months, only three patients had hypoesthetic areas in these regions.

Biometric evaluation: Aesthetic evaluation revealed adequate results in all but two patients as measured by beam compass. At every follow up visit, all patients and their attendants felt that they had facial symmetry. Clinically, this subjective assessment was verified visually and by palpation to rule out presence of bony steps especially at ZMB.

Mouth opening as a measure of functional outcome was measured by a pair of dividers. Six patients had mouth opening less than 30mm. In four instances it improved within 5 weeks. Pain analysis on pain analogue scale (0-10) was between 2-4 during opening and closing of mouth which was satisfactory.

Discussion

Zygomatic fracture is the second most common type of facial fracture after nasal bone fracture. Zygomatic bone has frontal, maxillary, temporal and orbital processes which articulate with their corresponding bones. Displaced fractures of zygoma if not properly stabilized remain vulnerable to further malpositioning as a result of masticatory forces.[11]

In our study, males to female ratio was 4:1, similar to other reports.[12,13] Ninety percent of fractures in our study were due to over speeding, fights and sports related injuries. Most common symptom that we encountered was sensory disturbance of infraorbital nerve (94.2%) at the time of presentation which was reduced to 12% at follow up.

The most important consideration in treating zygomatic bone fractures is proper reduction and adequate stabilization to achieve normal function and aesthetics.[7] Proper treatment planning is the key to obtain adequate results in treating isolated zygomatic bone fractures. We successfully used the cutoff value of 2mm to divide patients into open and closed reduction groups as only four of the sixty zygomatic fractures in our study were inadequately reduced as assessed by radiographs taken immediately postoperatively. Of the maltreated cases two were treated by closed reduction while two by open reduction and fixation by wire osteosynthesis. Aesthetic evaluation of first two cases revealed that no further treatment was required which indicates that some imprecision in reduction may be clinically insignificant on long term follow, depending on magnitude, location and soft tissue masking of the fracture.

Zingg et al[14] in reviewing 946 zygomatic bone fractures treated by a variety of means including 164 treated by 'closed reduction,' found a 13% incidence of malar asymmetry. In our study out of 23, only in two cases results were not satisfactory after simple reduction without fixation. The two techniques used for closed reduction in this study showed equally good results for treatment of mildly displaced zygomatic bone fractures.

One of the most controversial topics in maxillofacial trauma is how much fixation is enough to prevent post reduction displacement of fractured zygomatic bone. Recommendations for fixation of fractures vary from none to three or four bone plates at different locations.[7] Since 1980s, miniplate fixation has gained favour over wire fixation. Exposure on deep surfaces of fracture, difficulty to apply in a comminuted fracture, and stability in only one plane of rotation are disadvantages of wire fixation. The plates on the other hand offer three-plane fixation and are easy to use; however, their disadvantage includes, need for broader exposure.[4] Davidson et al[5] in their study tested 25 combinations of wire and plates for treatment of zygomatico maxillary complex fractures, they found that three-point fixation with miniplates or wires offered equal stability while plate fixation was superior to wire fixation with two-point and one-point fixations. In our study there was inadequacy in two cases which were treated by open reduction and fixation, where two point fixation was done with wire osteosynthesis, but no displacement was seen after rigid fixation. Rigid fixation gave better results than wire fixation as shown by others[15,16] and three point fixations were found to be superior to two point fixation as proved earlier.[5,11]

Isolated zygomatic bone fractures can result in minimal to severe displacement of bone segments at the fracture site. The treatment should be based on degree of displacement of fracture as evident by radiographic evaluation. This study shows that 2mm displacement can be successfully used as criteria to divide patients with isolated zygomatic bone fractures in closed and open reduction groups, as fifty six out of sixty patients were successfully treated using the above mentioned criteria.

Conclusion

In treating isolated zygomatic bone fractures most

important consideration is proper treatment planning. Oral surgeons need to decide whether patients with isolated zygomatic bone fractures should be treated by closed reduction or open reduction technique. The choice varies with the severity of fracture and degree of displacement. This study shows that 2mm displacement at any of the fractured site on occipitomental radiographs can be successfully used as a criterion to assign patients to open and closed reduction groups. Patients having displacement of fracture less than 2mm on radiographs should be treated with closed reduction and those having displacement of more than 2mm with open reduction technique. Closed reduction by temporal or intraoral approach is equally good when applied properly for treatment of mildly displaced fractures. In cases where open reduction is required, fixation by miniplates is superior to fixation by wires and three point fixations is superior to two point fixation especially when wires are the fixation devices used.

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