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Treatment and Complications of Patients with Zygomatic Fractures

Saeed Nezafati [1], Ali Mortazavi [1,*], Seyed Ahmad Arta [1], Javad Yazdani [1] and Milad Ghanizadeh [1]

[1] Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Tabriz University of Medical Sciences, Tabriz, IR Iran

[*] *Corresponding author*: Ali Mortazavi, Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Tabriz University of Medical Sciences, Azadi Street, Tabriz, IR Iran. Tel: +98-914 3175166, Fax: +98-4133355921, E-mail: aliweb001@gmail.com

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Abstract

Background: In recent years, there has been a significant increase in the incidence of injuries and the relevant morbidity and mortality in Iran. The present study was undertaken to determine the etiology, type, and treatment modalities applied to zygomatic fractures and investigate the correlation of postoperative complications with the treatment modality used in patients referring to Imam Reza hospital.

Methods: The target population consisted of all the patients with zygomatic bone fractures referring to the oral and maxillofacial surgery service of Imam Reza hospital (2011 - 2012). Demographic data, the reason for trauma, the trauma date, the location and the type of fracture, and the clinical symptoms of fracture were recorded in checklists. The surgery was undertaken and the surgical procedure, the type of the therapeutic intervention and its complications, the type of the plate used, and the place it was used for fixation also were recorded in the checklists. Data were analyzed with descriptive statistics and chi-squared test using SPSS 21.

Results: Of 165 patients with zygomatic fractures, 80% were male and 20% were female with a mean age of 32.81 years. Motor vehicle accidents were the most important cause of zygomatic fractures (64.8%), and the infraorbital nerve paresthesia was the most frequent symptom (62.4%). Paresthesia was the most frequent complication remaining after surgery in three follow-up visits (38%). The most commonly used open surgical procedures were eyebrow (53.9%), subciliary (46, 27.8%), and vestibular (46, 27.8%) surgeries, respectively.

Conclusions: Male patients, with a mean age of 32 years, exhibited the highest rate of zygomatic fractures. The most commonly used open surgical procedure was eyebrow surgery. Paresthesia of the infraorbital nerve was the most prevalent postoperative complication but these complications had no relationship with the surgical techniques used.

Keywords: Zygomatic Fracture, Complication, Treatment, Oral and Maxillofacial Surgery

1. Background

The zygomaticomaxillary complex (ZMC) is a component of the lateral wall and floor of the orbit and the walls of temporal and infratemporal fossa because it articulates with the frontal, temporal, and maxillary bones, and the greater wing of the sphenoid (1-3).

Zygomatic bone is separated from adjacent bones at or near the suture lines due to heavy forces. It might separate from its four articulations, resulting in the zygomaticomaxillary complex, zygomatic complex, or orbitozygomatic fractures (1-5). Disruption of the malar bone position is very important from psychological, esthetic, and functional viewpoints because it might disrupt ocular and mandibular functions (6, 7). Displacement of a fractured zygomatic arch might result in the limitations of mouth opening process due to mechanical problems in the coronoid process (1-3, 7, 8). Zygomatic fractures might also affect the bite force because the masseter muscle originates from the zygomatic arch (9). Therefore, it is necessary to properly diagnose and manage zygomatic bone injuries for cosmetic and functional reasons (5, 6).

Many surgical techniques can be applied in this context, each of which is associated with advantages and disadvantages. The amount of exposure and skin scars and the degree of technical difficulty must be considered.

The lower eyelid might exhibit functional and aesthetic deficiencies when the trans-conjunctival and subciliary approaches are employed (10). The bicoronal technique might also give rise to sensory and motor disturbances (11, 12). Paresthesia of the infraorbital nerve (ION) might occur due to the fracture itself or the surgical trauma (13-15).

In recent years, there has been a significant increase in the incidence of injuries and the relevant mortality in Iran, and injuries have become the second most common cause of death after cardiovascular diseases and the first cause of

years of life lost (YLL) in the country (16), necessitating periodic epidemiological reviews to re-evaluate established trends or identify new patterns of disease frequency. The present study was undertaken to determine the etiology, type, and treatment modalities applied to zygomatic fractures and correlate complications in patients referring to Imam Reza hospital (a level-one center for trauma in the north-west of Iran.

3. Methods

In the present descriptive cross-sectional study, the target population consisted of all patients with zygomatic bone fractures with and without other facial fractures and fractures in other body parts, referring to the oral and maxillofacial surgery service of Imam Reza hospital from March 2011 to February 2012. The exclusion criteria consisted of LeFort fracture, a history of trauma or surgery in the facial region, a history of congenital defects in the facial area, and patients not referring for follow-up visits. The clinical examinations of all the patients were carried out by two oral and maxillofacial surgeons. In this context, after recording the subjects' demographic data, consisting of age and gender, the following data were recorded in the patients' checklists: the reason for trauma, the trauma date, the location of the fracture, the type of fracture, and the clinical symptoms of the fracture. Then, each patient underwent spiral CT scan examinations at axial and coronal cross-sections and the clinical diagnosis was confirmed (Figure 1). For patients requiring surgical intervention, the best surgical approach was selected based on the type and location of the fracture, the patient's systemic condition, and esthetic and functional requirements of the patient. The surgery was undertaken after explaining the procedure to the patient and obtaining an informed consent form. Following the surgical procedure, the type of the therapeutic intervention and its complications, the type of the plate used, and the place it was applied for fixation were recorded in the checklist for each patient. The patients were discharged 3 - 4 days after the surgery and medications were prescribed in association with recommendations for the use of soft foods and for observation of oral hygiene. The patients were re-visited at one-, two-, and four-week intervals after the surgery and the symptoms and signs remaining after the surgery or appearing after the surgery and the healing process were accurately recorded in their checklists. Kappa coefficient was used to evaluate inter-observer agreement, which was estimated at 97%.

All the ethical considerations were followed according to the Helsinki humanity research declaration. The ethics committee of Tabriz University of Medical Sciences approved the protocol of this study.

Data were analyzed with descriptive statistics (frequencies, percentages, means, and standard deviations) and chi-squared test, using SPSS 21. Statistical significance was set at $P < 0.05$.

3. Results

Of 165 patients with zygomatic fractures evaluated during the two-year study period, 132 (80%) were male and 33 (20%) were female, with a male-to-female ratio of 4:1. The patients' age at presentation was 12 - 90 years, with a mean age of 32.81 years (SD = 12.85).

Motor vehicle accidents were the most important cause of zygomatic fractures, accounting for 64.8% of all the injuries (107 patients). In the accidents, there were 55 drivers or passengers of cars (51.04%), 40 motorcyclists (37.3%), and 12 pedestrians (11.2%). Other causes of ZMC fractures were falls with 30 (18.1%), assaults with 16 (9.6%), and sports accidents with seven (4.3%) patients. None of the patients reported infliction of traumas by their husbands, child abuse, and occupational accidents.

Of 165 cases of zygomatic fractures, there were zygomatic buttress fractures in 93 patients (56.3%) and isolated arch fractures in 12 patients (7.2%), with 60 patients (36.3%) exhibiting both buttress and arch fractures.

The following surgical techniques were used for the patients: open eyebrow in 89 (53.9%), subciliary in 46 (27.8%), vestibular in 46 (27.8%), sub-tarsal in 17 (10.3%), and transconjunctival in one (0.6) patient. In contrast, lateral canthotomy, lower eyelid, upper eyelid, and coronal techniques were not used for any patient.

The following plates were used for the patients: 4-hole plates in the zygomaticofrontal area for 77 patients (46.6%); 6-hole plates in the lower rim for 54 patients (32.7%); L-shaped 4-hole plates in the buttress for 53 patients (32.1%); a 10-hole periorbital plate for one patient (0.6%); and the central rim for one patient (0.6%).

Table 1 presents the frequencies of clinical signs and symptoms and remaining complications after surgery in the three follow-up visits. After surgery, new complications associated with the surgery were not observed. Infraorbital nerve paresthesia was the most frequent symptom (62.4%), followed by inferior orbital rim step (60%). In the first, second and third follow-up visits, paresthesia, visual blurring, and asymmetry were the most frequent complications remaining. Depression, malunion, infection, and non-union were not detected in any patient in any follow-up visit.

In addition, in the first follow-up visit, 23 patients (13.9%) exhibited a limitation in mouth opening, with a mean of 25.47 ± 5.08 degrees and a range of 12 - 35 degrees.

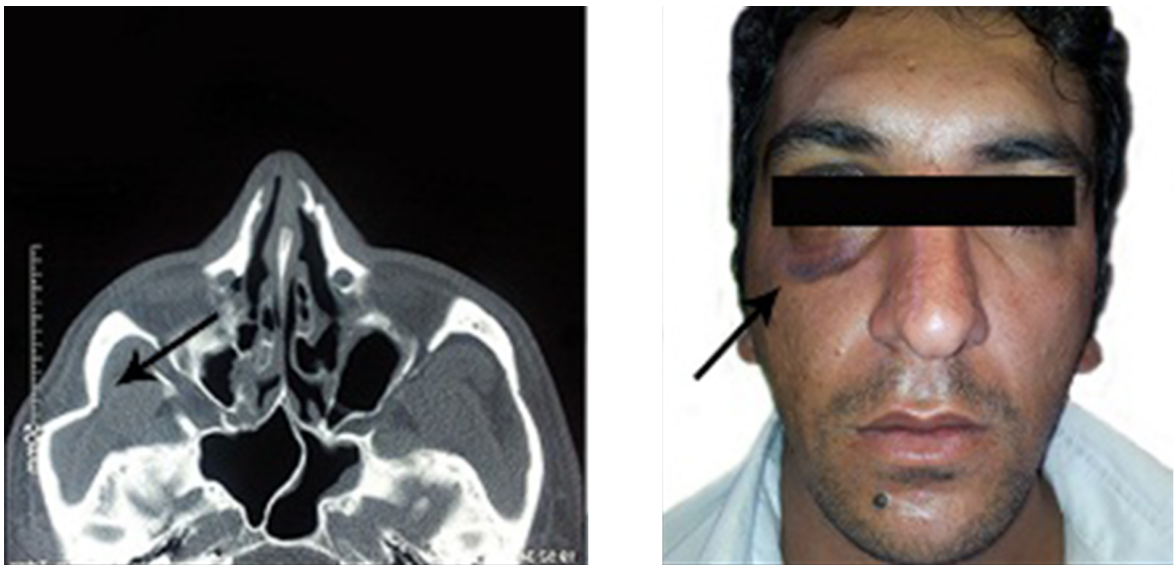

Figure 1. Photograph and CT scan of the patient with zygomatic fracture

Table 1. The Frequencies of Clinical Signs and Symptoms and Remaining Complications after Surgery in the Three Follow-Up Visits[a]

	Preoperative Signs and Symptoms	Remaining Complications After Surgery		
		First Follow-Up Visit	Second Follow-Up Visit	Third Follow-Up Visit
Infraorbital nerve paresthesia	103 (62.4)	64 (38.8)	63 (38.2)	63 (38.2)
Inferior orbital rim step	90 (60)	5 (3)	5 (3)	5 (3)
Facial asymmetry	83 (50.3)	14 (8.5)	14 (8.5)	14 (8.5)
Malar depression	82 (49.6)	2 (1.2)	2 (1.2)	2 (1.2)
Arch depression	21 (12.7)	1 (0.6)	1 (0.6)	1 (0.6)
Blurred vision	19 (11.5)	14 (8.5)	14 (8.5)	14 (8.5)
Binocular diplopia	14 (8.4)	8 (4.8)	8 (4.8)	8 (4.8)
Exophthalmus	14 (8.4)	6 (3.6)	5 (3)	5 (3)
Enophthalmous	14 (8.4)	5 (3)	5 (3)	5 (3)
Limitation of globe movements	8 (4.8)	2 (1.2)	2 (1.2)	2 (1.2)
Blindness	2 (1.2)	1 (0.6)	1 (0.6)	1 (0.6)

[a] Values are expressed as No. (%).

In the second follow-up visit, 18 patients (10.9%) exhibited a limitation in mouth opening, with a mean of 27.95 ± 8.3 degrees and a range of 6.28 - 35 degrees.

In the third follow-up visit, six patients (3.6%) exhibited a limitation in mouth opening, with a mean of 24.83 ± 12.67 degrees and a range of 1 - 38 degrees.

Table 2 presents the frequencies of residual complications separately in each surgical technique in the first, second and third follow-up visits. The chi-squared test showed no significant relationships between open surgical techniques and the residual complications in general in the three follow-up visits (Table 3).

4. Discussion

Zygomatic complex (ZC) fractures are one of the most common maxillofacial injuries, with a prevalence depending on different factors. The treatment of such fractures with adequate reduction is a surgical challenge (5).

Imam Reza hospital in Tabriz is the first-level center in the north-west of the country for referring trauma patients, and a large number of patients refer to this hospi-

Table 2. The Frequencies of Residual Complications Separately in Each Surgical Technique in the First, Second and Third Follow-Up Visits

Visits/Complication	Eyebrow	Subciliary	Vestibular	Subtarsal
First follow-up visit				
Enophthalmos	4	4	1	2
Limitation in mouth opening	17	5	11	4
Diplopia	5	7	4	0
Limitation in eye movements	2	2	0	0
Visual blurring	12	9	5	2
Infection	0	0	0	0
Asymmetry	13	8	7	3
Blindness	1	0	1	0
Paresthesia	52	24	28	11
Second follow-up visit				
Enophthalmos	4	3	1	2
Limitation in mouth opening	11	6	7	4
Diplopia	5	7	4	0
Limitation in eye movements	2	2	0	0
Visual blurring	12	9	5	2
Infection	0	0	0	0
Asymmetry	13	8	7	3
Blindness	1	0	1	0
Paresthesia	51	24	27	10
Third follow-up visit				
Enophthalmos	4	3	1	2
Limitation in mouth opening	2	1	2	2
Diplopia	5	7	4	0
Limitation in eye movements	2	2	0	0
Visual blurring	12	9	5	2
Infection	0	0	0	0
Asymmetry	13	8	7	3
Blindness	1	0	1	0
Paresthesia	51	24	27	10

tal each year after they sustain traumas to the maxillofacial areas. The results of the present study showed that motor vehicle accidents, falls, assaults, and sports accidents were the most important factors responsible for the fractures of the zygomatic complex. In addition, the majority of the patients were male, with a mean age of 32 years. The most frequent complication was a disturbance in the infraorbital sensory nerve (62.4%), consistent with the results of the majority of previous studies (1, 8, 17, 18). Men are more susceptible to traffic accidents during their life, resulting in facial fractures (3). The use of protective devices can decrease the incidence of facial traumas due to motor vehicle accidents, with airbags being considered the best protective tools available now (17).

Recent studies have reported different percentages for infraorbital nerve paresthesia, including 45.5% (18), 94.2% (19), and 24.6% (20). Many authors have reported that the majority of cases of sensory infraorbital nerve dysfunctions are resolved in 3 months (3).

The most frequent surgical procedures used in descending order were eyebrow, subciliary, and vestibular techniques. In contrast, no lateral canthotomy, lower eye-

Table 3. The Results of the Chi-Squared Test in Relation to the Residual Complications Separately in Each Open Surgical Procedure in the First, Second and Third Follow-Up Visits

Visits	Values
First follow-up visit	
χ^2	16.89
Sig	0.85
Second follow-up visit	
χ^2	16.81
Sig	0.88
Third follow-up visit	
χ^2	16.85
Sig	0.86

lid, upper eyelid, and coronal procedures were carried out for the patients.

Despite the surgical procedures on the patients in the first, second and third follow-up visits carried out one, two, and for weeks after surgeries, there were still some complications, the most frequent of which was paresthesia of the infraorbital nerve. However, new complications associated with surgery were not observed after the surgery.

Such paresthesia might occur during the elevation of the buccal maxillary flap, but it is predominantly attributed to the fracture line usually running through the infraorbital foramen or secondary to a blunt force and trauma. We did not consider paresthesia of the ION as a complication of the surgical procedure; rather, the trauma itself was considered due to its presence before surgery.

Visual blurring and asymmetry were other more frequent complications of the surgical procedure. However, complications such as depression, malunion, infection, and non-union were not observed in any of the follow-up visits. In addition, there was no relationship between the residual complications and the surgical technique used. In a study by Trindade et al. (2012), the most prevalent residual complication was the paresthesia of the infraorbital nerve (ION), too. In addition, in a study, of 32 procedures on the infraorbital rim, consisting of subciliary with/without lateral extension or transconjunctival with/without lateral canthotomy, four resulted in functional or aesthetic defects in the lower eyelid (ectropion or entropion). The authors were unable to correlate a complication rate for each approach to the infraorbital rim due to the small sample size (7).

In a study by Olate et al. in 2010, there was an infection in 3.1% of the samples, which was favorably resolved with a new surgery and administration of antibiotics (5).

Another study did not yield any results in relation to postoperative infection rates (18, 20, 21). Infections in most cases were attributed to the intraoral approach, mainly in patients with unsatisfactory oral hygiene (18).

In relation to the rate of postoperative complications in patients with orbitozygomatic fractures, a recent review showed that the majority of complications were related to ocular problems, such as ectropion, diplopia, enophthalmos, and uncommon loss of vision (22).

Studies on populations reflect the epidemiology of a specific disease or different traumas, and the local statistics and social behaviors vary in terms of the geographical location. Factors such as the geographical location, the socioeconomic status, and psychological status can affect the etiology and the type of the traumas to the face. An increase in facial traumas emphasizes the need for epidemiological evaluations in order to adopt proper prevention and management strategies for patients. Long-term collection and analysis of epidemiological data on zygomatic bone fractures are important steps for preventing and managing these traumas. In short, it is important to gain knowledge on the epidemiology of zygomatic bone fractures and the related traumas. This is important not only to more extensively adopt preventive measures but also to make decisions in relation to taking care of patients, developing proper treatment modalities, and allocating the necessary resources.

4.1. Conclusions

Motor vehicle accidents were the most important factor responsible for the fractures of the zygomatic complex. Male patients with a mean age of 32 years exhibited the highest rate of zygomatic fractures. The most commonly used open surgical procedures were eyebrow, subciliary, and vestibular procedures in a descending order. Paresthesia of the infraorbital nerve, blurring of the vision, and asymmetry were the most common residual complications after surgery. New complications associated with surgery were not observed. These complications had no relationship with the surgical techniques used.

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