CORRECTION OF SEQUELAE FOLLOWING ORBITO-ZYGOMATIC FRACTURES

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ABSTRACT

Aim: The purpose of this article is to share our experience regarding the late correction of orbito-zygomatic fracture sequelae. Material and Methods: We performed a review including 14 patients that underwent corrective surgery for functional or cosmetic impairment resulted from malunioned orbito-zygomatic fractures, between January 2013 and December 2017. Results: The posttraumatic sequelae were following two orbital blow-out fractures, four terapodal zygomatic bone fractures and eight comminuted orbito-zygomatic fractures. Most patients presented for diplopia and facial asymmetry. The procedures used for the correction of the various defects were titanium mesh reconstruction of the orbital floor, of the orbital contour and zygomatic bone, osteotomy and repositioning of the zygomatic bone, fat transfer and silicone implant placement for facial asymmetry correction, ectropion correction. The postoperative complications encountered were periorbital edema and ecchymoses. Overall, favourable outcomes were achieved postoperative with functional rehabilitation, including the disappearance of diplopia within one month in all involved cases, and the restoration of facial symmetry. Conclusion: Form and function can be accurately restored by performing procedures suitable to the individual defect, targeting the recontouring of the bone frame and the rearrangement of the overlying soft tissues, considering the degree of involvement.

Key words: orbit, zygomatic, fracture, diplopia, asymmetry

INTRODUCTION

The anatomical features specific to the zygomatic bone and orbital cavity are responsible for the high incidence of fractures with this location. The prominence of the zygoma as part of the facial architecture, makes it a frequent impact point in various traumatisms. The surrounding pneumatizations represented by the paranasal sinuses act as airbags protecting the adjacent intracranial structures (1, 2, 3). The frailty of the neighbouring bone walls forming the orbital cavity and the maxillary sinus justifies the frequent association of fractures involving these structures.

In the absence of treatment or with improper treatment, displaced fractures in this well-vascularized region of the face are quick to heal in an abnormal position. Delayed surgery in the presence of coexisting neurosurgical lesions or other life-threatening posttraumatic lesions, the absence of initial presentation, misdiagnosis, mistreatment, or complex fractures with residual postoperative deformity, are some of the causes for sequelae associated with lateral face fractures (4, 5).

Posttraumatic changes in the arrangement of the bone frame and of the surrounding soft tissue components result in cosmetic and functional impairment of various degrees considering the amount of lateral face deformity. The factors influencing the onset and type of sequelae are related to the initial
traumatism, regarding the displacement direction, the number of bone fragments, coexistence of other facial fractures and the presence of lacerations, but also to the presence or absence of an initial surgical procedure. The usual indication for correction surgery involves the presence of diplopia due to orbital dystopia, limited amplitude of mouth opening and facial asymmetry.

We aim to present our experience regarding the late correction of sequelae following orbito-zygomatic fractures, using an association of techniques aimed at soft tissue and bone reconstruction in the affected area.

MATERIAL AND METHODS

We retrospectively analysed the medical files of 14 patients with sequelae following orbito-zygomatic fractures, operated between January 2013 and December 2017. We included patients who underwent elective corrective surgery for residual functional or aesthetic impairment caused by previous fractures of the orbit and zygomatic bone, either isolated, or in association with other facial fractures. Information was collected regarding the initial fracture pattern, the existence of an antecedent treatment, the complaints upon presentation, the type of corrective surgery performed and the postoperative complications and outcomes.

RESULTS

From the total 14 patients, there were 11 (78.6%) men and 3 (21.4%) women, aged between 17 and 61. The initial fracture pattern consisted of pure orbital blow-out fractures in two patients (14.3%), tetrapodal zygomatic bone fractures in four cases (28.6%) and comminuted orbito-zygomatic fractures in eight cases (57.1%). Eight (57.1%) patients had associated soft tissue lacerations in the periorbital and zygomatic regions. The aetiology of the traumatisms was human aggression in six (42.9%) cases, road traffic accidents in four (28.6%) cases, accidental fall in two (14.3%) patients, horseshoe injury in two (14.3%) cases. Six (42.9%) patients presented first for the sequelae of the initial trauma, while the other eight (57.1%) had a previous initial surgery in the acute trauma setting. From the untreated patients, three (21.4%) did not seek medical consultation at the time of the traumatism and in three (21.4%) cases the fracture treatment was delayed due to the coexistence of serious neurosurgical posttraumatic lesions or life-threatening lesions elsewhere in the body. In six (42.9%) cases there were associated fractures of the facial skeleton, consisting of three middle occlusal-facial fractures (21.4%), two nasal fractures (14.3%), and four naso-orbito-ethmoidal fractures (28.6%). Upon presentation for corrective surgery eight patients complained of diplopia (57.1%), three of a limited amplitude of mouth opening (21.4%), twelve of facial asymmetry (85.7%), six had ophthalmologic ectropion-related complications (42.9%) and six presented with posttraumatic infraorbital nerve hypoesthesia (42.9%). Facial asymmetry was due to the lack of zygomatic bone projection in seven patients (50%), orbital contour changes in six cases (42.9%), enophthalmos in seven patients (50%) and soft tissue scarring in eight cases (57.1%).

The time interval from the initial trauma to the corrective surgery was minimum 6 months. In nine cases a CT scan (64.2%) and in seven cases a CBCT examination (50%) was used for the preoperative evaluation of the posttraumatic changes. A preoperative and postoperative ophthalmologic evaluation were performed in all patients. The surgical procedures employed were the reconstruction of the orbital floor using
titanium mesh in two patients (14.3%), reconstruction of the orbital contour and zygomatic bone using titanium mesh in seven patients (50%), zygomatic bone osteotomy and repositioning in four cases (28.6%), correction of facial asymmetry using fat transfer in four patients (28.6%), correction of asymmetry using silicone implant placement in one case (7.14%) and ectropion correction in five patients (35.7%). Three (21.4%) patients underwent multiple correction procedures. In four (28.6%) cases a stereolitographic model obtained by a mirroring technique and three-dimensional printing, was used for modelling of the titanium mesh.

The postoperative complications were peri orbital edema and ecchymoses in eight cases (57.1%). From the already existing preoperative complaints, the inferior eyelid ectropion improved but persisted postoperatively in four patients (28.6%) and diplopia persisted in two cases (14.3%) with gradual resolution within one month. Six (42.9%) patients had previous posttraumatic infraorbital nerve hypoesthesia that was maintained postoperative. Periorbital edema was more prominent in the morning and gradually decreased until complete resolution in the initial three weeks after surgery. The residual diplopia disappeared one month after the corrective surgery. In one case of initial cicatricial posttraumatic ectropion, the position of the inferior eyelid improved after orbito-zygomatic reconstruction, but soft tissue suspension was necessary for further improvement.

The overall functional results were favourable with the disappearance of diplopia in all cases at one month postoperative. The amplitude of mouth opening returned to normal after surgery in the three (21.4%) involved patients. There were good aesthetic results regarding facial symmetry restoration with re-establishing of the zygomatic bone projection, reshaping of the orbital contour, resolution of enophthalmos and equalling the level of the globes.

The positive outcomes are exemplified by images of a clinical case (Fig. 1-9).
Fig. 4. Three-dimensional CT reconstruction-frontal view showing the displaced malunioned left tetrapodal zygomatic bone fracture leading to orbital volume and contour modification with asymmetry of the midface

Fig. 5. Three-dimensional CT reconstruction-inferior view demonstrating the amount of zygomatic bone displacement and asymmetry of the malar projection

Fig. 6. Three-dimensional CT reconstruction-lateral view showing the malunioned zygomatic bone fracture trajectory, as well as the temporal bone fracture that constituted the reason for delaying the initial zygomatic bone reduction
DISCUSSIONS

Six patients included in this review had initially untreated fractures. The time factor plays an important role in orbito-zygomatic fracture repair, since the interfragmentary callus forms quickly in this well vascularized region. The coexistence of neurosurgical lesions or life-threatening injury in other body parts leads to the postponing of lateral facial fracture repair. This was the reason for surgery delay in three of the patients included in our study. In other circumstances, patients present late after the causing traumatism when the functional and cosmetic impairments become apparent as a result of edema resolution. A delay longer than two weeks favours the malunion of the fractured fragments and dictates the necessity for late corrective surgery. If such a procedure is decided, it is advisable to schedule the intervention after maturation of the formed scar tissue, six months following the initial injury. This is consistent with the opinions of most authors (4, 6, 7).

The small number of patients found in this retrospective study is evocative for the low incidence of untreated, mistreated, or complex orbito-zygomatic fractures resulting in important functional and aesthetic impairment. Other authors also describe their experience on relatively small groups of patients, with more occurrences in war regions (8). Like the findings in other papers (4, 6), most of the patients in our study presented for diplopia and facial asymmetry. Diplopia may disrupt every-day activities such as driving or the practice of skilful jobs leading to a decrease in the quality of life and social inadaptability (9, 10).

The main posttraumatic changes that determine the onset of diplopia is the unequal level of the globes due to the ptosis of the orbital contents in fractures of the orbital floor, or changes in the volume of the orbital cavity resulting in enophthalmos, in displaced orbito-zygomatic fractures. Inadequate initial evaluation of the involved segments, of the degree and type of displacement contribute to an incomplete treatment and resulting
sequelae. Orbital blow-out fractures can easily go unrecognized in the absence of computer tomography examination. The initial posttraumatic edema of the orbital contents may mask the posttraumatic changes in orbital volume and diplopia may manifest only after the retrocession of edema. The importance of the orbital component of a zygomatic fracture is sometimes underestimated either due to diplopia masking from existing edema, or as a result of an orbital volume compensation caused by the important posterior displacement of the fractured zygoma. In the latter case, reduction of the zygomatic bone without orbital floor reconstruction will unmask the inferior orbital wall fracture with orbital content ptosis and the apparition of diplopia postoperative. Evaluation by the help of three-dimensional CT image reconstruction is useful for a better understanding of the posttraumatic changes (11, 12).

The principle of reconstruction is to restore the previous orbital volume by reshaping the lost contours of the orbital walls and by proper lifting of the collapsed orbital soft tissues (5). In orbital blow-out fractures we achieved good outcomes by restoring the continuity of the orbital floor using titanium mesh. The residual diplopia in two patients resolved before one month postoperative and it was likely the result of orbital soft tissue edema, as mentioned also by other authors (6, 13). In patients presenting with important facial asymmetry, depressed malar projection and limited amplitude of mouth opening, the rearrangement of the fractured zygomatic bone is imperative for obtaining good function and cosmesis (14). In our case series, the osteotomy of the zygomatic bone was necessary due to the important displacement with rotation of the body of the zygoma leading to modifications of the orbital volume due to changes in the inferior and lateral aspect of the orbital cavity. Determining the accurate position of the refractured zygoma intraoperatively was challenging, but good results were obtained with restoration of the malar projection and symmetric globe level with resolution of enophthalmos.

The association with other facial fractures is a reconstructive challenge due to the absence of landmarks, the scarcity of stable fixation points, resulting in an increased difficulty of establishing the correct facial diameters and projection with residual deformity necessitating secondary procedures. High impact trauma often results in comminuted fractures, with missing bone substance and lack of soft tissue support. For the reconstruction of missing bone structure, many authors advocate the use of autologous bone grafts (15, 16). However, this procedure involves further morbidity at the level of graft harvest (14). It may associate a high risk of failure to integrate the graft and infection occurrence. In our experience, titanium mesh can provide an optimal method of restoring the lost bone surface and contours. The difficult intraoperative modelling of the mesh may be avoided by the preoperative shaping using a stereolithic model (17, 18).

Soft tissue sequelae are related to the presence of initial lacerations in the orbitozygomatic regions, the presence of foreign bodies (19), the existence of missing substance, the presence of soft tissue entrapment and compression involving regional muscles and nerves, as well as the choice of initial surgical approach. Ectropion is a frequent encounter in the context of midface traumatisms, either due to the initial trauma, associated lacerations, or following surgical incisions. We consider that restoration of the zygomatic bone projection allows good support for the inferior eyelid, less traction from the heavy genian soft tissues, and thus improves the position of the eyelid. Many studies underline the
importance of soft tissue resuspension following surgery for midface trauma in reducing the occurrence of ectropion and obtaining a natural arrangement of the soft tissues on the underlying bone frame (4, 20). This can be achieved by open procedures, or by using minimally invasive techniques such as barbed thread suspension (21, 22). We performed the suspension of the genian soft tissues in one patient with important posttraumatic ectropion and orbito-zygomatic reconstruction. We noticed the same positive effect of soft tissue resuspension on the position of the inferior eyelid.

Small defects in the positioning of the zygomatic bone resulting in facial asymmetry without any functional impairment, can be managed by filling the soft tissues using autogenous or alloplastic materials. Fat transfer in the depressed malar region will help achieve facial symmetry (23). The quality of the soft tissues is also improved using this method, when subcutaneous fat atrophy is a contributing factor to the existing facial asymmetry (24, 25). Increased support of the inferior eyelid is also obtained by augmenting the volume of the genian region with amelioration of ectropion (26, 27). We performed lipotransfer for filling of posttraumatic defects with good results regarding facial symmetry restoration, like the outcomes presented in the literature (25, 26, 28).

Differences in facial contours without function alteration can also be managed using silicone implants. Although there is a wide range of preformed implants available, selection of the most appropriate form and size for each individual defect is not always easy. We used stereolitographic models for a more accurate selection of the implant, with good outcomes regarding facial symmetry. Other authors also report good results with silicone implant placement for amelioration of facial asymmetry (14, 29).

CONCLUSION

We conclude that sequelae following malunited orbito-zygomatic fractures can be accurately corrected by a wide range of procedures targeting the bone frame and the overlying soft tissues, considering the degree of involvement and the existing functional and cosmetic impairment. Re-establishing of the orbital volume by lifting of the orbital soft tissues and reconstructing the contour and continuity of the orbital walls is key in resolving enophthalmos and for the disappearance of diplopia. The zygomatic bone projection is one of the main reference points in restoring facial symmetry. Soft tissue suspension is an important step in re-establishing the fullness of the zygomatic and genian regions. Inferior eyelid ectropion generally necessitates several corrective procedures for good outcomes. The posttraumatic infraorbital nerve hypoesthesia may persist despite fracture realignment.

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