Comparison of various approaches for exposure of infraorbital rim fractures of zygoma

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Abstract

Objective The aim of this study was to randomly compare four incisions—subciliary, subtarsal, infraorbital and transconjunctival with lateral canthotomy for treatment of orbital rim or floor fractures.

Methods 40 patients with zygomatic complex fractures either isolated or in association with pan facial fractures, were selected for the study. They were divided into four groups of 10 patients each, Group I—Transconjunctival with lateral canthotomy, Group II—Subciliary [single eyelid incision], Group III—Subtarsal incision, and Group IV—Infraorbital incision. The following parameters were compared a) The average time from incision to fracture exposure b) The amount of exposure of the site provided c) The aesthetic appearance of the ‘scar’ d) Complications e) Factor of ‘time’ – its effect on scar and complications.

Results The study revealed that all four incisions provided adequate exposure of fracture site and transconjunctival (22 minutes) required the maximum time for exposure. The complications included ectropion in group I and prolonged edema in group IV. Group II and III patients had relatively lesser number of complications. Group IV patients had visible scar as compared to no scar in group I patients.

Conclusion We conclude by saying that transconjunctival approach provides an excellent aesthetic result when done meticulously. However the subciliary and the subtarsal incisions provide a more rapid, direct approach to the orbital floor and infraorbital rim with minimal morbidity and an aesthetically acceptable scar. The infraorbital incision is the least acceptable aesthetically.

Keywords Transconjunctival · Superciliary · Infraorbital · Subtarsal approach

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Introduction

Orbital fractures represent one of the more common conditions encountered today in our modern mechanized life which produces multiple injuries that involve the maxillofacial region, be it the blowout variety or as a part of more complex zygomatic fractures. Conventional approach to the infraorbital rim/orbital floor has been by cutaneous infraciliary incisions namely the subciliary, mid lower eyelid or subtarsal and infraorbital incisions. These approaches leave behind a scar which may be cosmetically disfiguring at times. An alternate method that avoids the cutaneous scar with adequate exposure is, the use of a concealed transconjunctival incision

placed through the conjunctiva. Bourquet described this approach, however it was Tessier [1] who popularized it. The enthusiasts of this approach used it primarily for correction of congenital anomalies of the orbit.

McCord and Moses [2] popularized the use of transconjunctival incision for traumatic deformities of the orbit coupled with lateral canthotomy. This allowed the lower eyelid to swing downwards widely, providing adequate exposure of the orbital floor. The subciliary incision is made 2mm caudal to the cilial line. The subtarsal incision is placed parallel to the ciliary margin just caudal to the tarsus. The infraorbital incision is designed to lie in a skin crease at the level of the bony orbital

margin. Although it may seem that the difference lies only at the level of the incision from the ciliary margin, the anatomy of the region and the plane of dissection also influence the final esthetic result. Complications have also been cited as related to a particular incision used. Eventhough the transconjunctival approach leaves no visible scar; it has its own list of complications ranging from a minor granuloma or cyst to avulsion of lower eyelid with lacrimal system injury. The aim of this study was to randomly compare four incisions - subciliary, subtarsal, infraorbital and transconjunctival with lateral canthotomy for treatment of orbital rim or floor fractures.

Materials and methods

40 patients with zygomatic complex fractures with or without other fractures of the facial skeleton were selected for the study and randomly divided into four groups, each group having ten patients. The exclusion criteria included patients with comminuted fracture of the rim and orbital floor, more than 5mm of displacement of fractured segments and patients with extensive soft tissue injury in the zygoma region. A detailed history of the patients was recorded; both clinical and radiographic examinations were done. The next patient who presented to the emergency medical services and satisfied our criteria was selected. A cyclic order was followed with the selection of the type of incision. The following order was practiced - transconjunctival, subciliary, subtarsal and infraorbital.

Group I - Transconjunctival with lateral canthotomy

Group II - Subciliary [single eyelid incision]

Group III - Subtarsal incision

Group IV - Infraorbital incision

The parameters for comparison included:

1. The average time from incision to fracture exposure
2. The exposure of the site provided
3. The aesthetic appearance of the scar
4. Complications – Analysis of the intraoperative and postoperative complication
5. Factor of 'time' – its effect on scar and complications

Results

All the patients selected for the study were followed up for a minimum period of 6 months. Postoperative assessment for the above mentioned parameters were done on the first, third and sixth month respectively. Results showed that the average time from skin incision to exposure of fracture was 8 minutes for infraorbital, 10 minutes for subtarsal, 14 minutes for single eyelid incision and 22 minutes for transconjunctival with lateral canthotomy approach (Table 1). All the incisions provided adequate exposure of the infraorbital rim and orbital floor (Table 2). All the photographs were evaluated by the surgeon and by three independent observers. Average score for each patient and then for each type of incision was calculated. The scores for scar were given

Table 1 Comparison of time from incision to fracture exposure

Table 2 Comparison of aesthetic appearance of scar

Table 3 Comparison of time on scar

as follows. 1 point for invisible scar, 2 points for barely visible scar and 3 points for visible scar. The mean grade was calculated as

Group I	→	1.00
Group II	→	1.55
Group III	→	1.9
Group IV	→	2.1

Complications - There were no intraoperative complications in any of the

incisions used. One patient in group I developed ectropion (Fig. 1a, 1b, 1c), two patients in group IV had prolonged edema following surgery (Fig. 2a, 2b, 2c). None of the patients developed any scar hypertrophy or corneal damage. There were no complications associated with group II and III patients.

Factor of time and its effect on scar and complications (Table 3):

Fig. 1a Preoperative **Fig. 1b** 1 month postoperative **Fig. 1c** 6 months postoperative **Fig. 2a** 1 month postoperative **Fig. 2b** 3 months postoperative **Fig. 2c** 6 months postoperative

In group I patients, no effect of time was seen on scar or on complications.

In group II and III patients, the scar faded over time, with considerably higher values at first and third month compared to the sixth month.

In group IV patients too the scars faded with time and edema seemed to resolve within the first month of surgery.

Discussion

The zygomatic bone is an essential element of facial configuration as it constitutes the prominence of the 'cheek bone'. Because of its prominence and exposed location the zygoma is highly susceptible to fractures in facial trauma (Marcus Zingg [3]). The zygoma is geometrically unique because it articulates with four bones—the frontal, temporal, maxilla and sphenoid. Zygoma fractures are typically described as being tetrapod (Zachariades et al. [4]). Zygomatic complex fractures present challenging diagnostic and reconstructive problems for the surgeon. Anatomic reduction of lateral, inferior orbital rims and orbital floor are necessary to reestablish facial symmetry and position of the globe and to restore normal sensation to the structures innervated by the infraorbital nerve (Fonseca [5]). The increasing emphasis on open reduction and bone grafting techniques in the treatment of facial fractures needs a search for incisions which provide good exposure of fracture sites and

minimal cosmetic deformity. The lower orbital rim and orbital floor can be exposed transcutaneously through the subciliary, subtarsal and infraorbital incisions or by means of transconjunctival incision with lateral canthotomy.

Anatomical consideration

The anatomical consideration is of importance while placing transconjunctival incision at the dissection plane (preseptal and postseptal) [6] and the level of incision in the fornix. A preseptal [7–10] approach is the preferred plane of dissection as it avoids complications like herniation of the orbital fat associated usually with postseptal approach. Incisions placed too high on the fornix usually results in fibrosis and shortening of the tarsal plate [11] and a too low incision results in injury to the lower lid retractor muscle. To avoid such complication we placed incision 2–3 mm inferior to the tarsal plate in the conjunctiva in our patients and gained access via a preseptal approach to the infraorbital rim. This incision allowed dissection of only a part of the inferior tarsal muscle and the capsulopalpebral fascia.

In transcutaneous incisions, the stress is laid more to the plane of dissection rather than the placement of incision. After the skin has been incised, the surgeon has three dissection options: a) raising the skin only flap, b) raising the skin–muscle flap, and c) step incision. In our study the step

incision was used in cases of subciliary and subtarsal approaches to the orbital rim and floor [18]. We believe that it is an exceptionally easy approach even to the novice and produces consistently good results. Step incision is a combination of skin only and skin–muscle flap. The dissection proceeds subcutaneously for few millimeters and is followed by incision through the muscle at a lower level producing a step. Dissection is then preseptal to expose the rim. The strip of muscle attached to the lower tarsus remains functional or not is debatable.

The more direct the approach, more rapid exposure of the fracture was noted. Infraorbital, subtarsal, single eye lid incision, provided more rapid access to infraorbital rim (8, 10, 14 minutes) than did trans-conjunctival incision (22 minutes). Wray et al. [12] reported the time as 5 minutes for infraorbital, 8 minutes for subciliary and subtarsal and 20 minutes for trans-conjunctival. They however did not state if a lateral canthotomy was included or not. Adequate fracture exposure was achieved with all the four incisions. The aesthetic appearance of the scars seemed to deteriorate from the ciliary margin downward. The reason for this tendency is not clear. The skin of the eyelid is thinner and has a finer texture than cheek or brow skin. It seems to have a propensity to form scars aesthetically superior to those of cheek or brow skin. The level of the infraorbital incision corresponds with the transition from lid skin superiorly to cheek skin inferiorly. The cheek–skin component would mean that the infraorbital

incision is more likely to form conspicuous scar (Bahr et al. [13]). These findings are however, in contrast to those of Wray et al. [12] in 1977. Their grades were 1.8 for infraorbital, 1.7 for subciliary, 1.9 for transconjunctival with lateral canthotomy and 1.6 for subciliary. The best scar was for subciliary, and the worst for transconjunctival with lateral canthotomy. Heckler et al. [14] noted superior scar formation following subciliary incision and Schmidseider and Esswein [15] reported four cases of undesirable scar formation among 28 patients with infraorbital incisions. The aesthetic appearance of the scar may be influenced by proper closure of the soft tissues. It is best to close in layers starting with the periosteum. We observed no denting or inversion at the level of the infraorbital rim when any of these incisions were used. One patient in group I and two patients in group VI developed ectropion and prolonged edema. We felt that there was an association between postoperative ectropion and the tendency towards senile ectropion in this patient (patient was a 70-year-old male). We felt this might have been due to transection of lymphatic vessels. No complications were noted in group II and III.

Wray et al. [12] reported one case of transient ectropion, 2 scar hypertrophies after subciliary incision in their series of 62 patients. No complications were reported following the use of transconjunctival, infraorbital and sub tarsal incisions. Goldberg et al. [16] in 1990 reported 2 cases of transient ectropion and one case of suture granuloma in their series of 25 patients with transconjunctival approach. Byron et al. [17] reviewed 400 cases of transconjunctival incision and reported 8 cases of conjunctival granuloma, 2 cases of entropion, single case of ectropion, lower eyelid laceration, hematoma and lower eyelid avulsion. Ectropion which was seen in group I did not seem to resolve with time. No effect of 'time' was seen and considering the patients age corrective surgery for ectropion was decided against. The prolonged edema seen in 2 cases in group IV seemed to resolve with time and had completely disappeared by the 3rd month after surgery.

Based on these results we have attempted to solve the dilemma trans-conjunctival or cutaneous incisions for orbital floor/infraorbital rim fractures. The choice of incision must be based on anatomic and technical factors which must be weighed before surgery. In an ideal scenario we always advocate the use of transconjunctival incision

to expose the infraorbital rim. Conditions which preclude the use of individual incisions are listed below. Persistent periorbital edema, worsened by surgical manipulation can lead to technical difficulty or failure of reinsertion of the canthus at the end of the operation. Correct transconjunctival incision placement and closure can be nearly impossible in the face of persistent edema and may lead to inadvertent destruction of the conjunctiva or foreshortening of the fornix. Open globe injury or high risk corneal injury such as hyphema necessitate delay in orbital fracture reduction. In these cases, corneal protection (corneal shield, temporary tarsorrhaphy) and a cutaneous approach to the orbit afford an extra measure of safety during fracture repair. The decision on which skin incision to use is based on personal preference and the amount of lid edema present. The infraorbital rim incision is indicated in the presence of marked periorbital edema that precludes canthotomy and impedes identification or placement of higher lid incisions. Other than for this clinical situation we do not advocate the use of this incision.

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