

Clinical outcome following use of transconjunctival approach in reducing orbitozygomaticomaxillary complex fractures

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Abstract

Background: The increasing emphasis on the open reduction and internal fixation of orbito-zygomatico-maxillary complex fractures has led to a more critical appraisal of the various surgical approaches to the orbital and zygomatic skeleton. Transconjunctival approach popularized by Tessier although credited to Bourquet in 1924 offer excellent exposure of the orbito-zygomatico-maxillary complex fracture especially the infra-orbital rim, frontozygomatic suture and the orbital floor. The argument against a transconjunctival access focuses primarily on concern about limited exposure that apparently makes accurate reduction and osteosynthesis of displaced fracture fragments difficult or impossible. Also, due to close association with eye and various ocular complications reported in the literature, most of the surgeons feel skeptical about using this approach. **Aim:** The aim of this study is to analyze the efficacy of transconjunctival approach in the treatment of orbito-zygomatico-maxillary complex fractures by evaluating the functional and esthetic results and its associated complications. **Material and Method:** We report a series of eight patients who have undergone fracture repair of the orbito-zygomatico-maxillary complex via a transconjunctival approach. Postoperative patient evaluation was performed with specific attention paid towards wound healing, functional stability, esthetic appearance and postoperative ocular complications. Postoperatively clinical examination along with radiographic examination was done to evaluate the position of the zygoma and determine the adequacy of fracture reduction. **Results:** In all the patients excellent surgical exposure has been achieved for reduction and rigid fixation of the fracture fragments. None of the patients had any form of complication related to the approach. There were no postoperative ocular complications. Only one patient had postoperative chemosis which was transient and subsided subsequently. All the patients had excellent esthetic outcome, with symmetry of malar prominence restored and without any evident post-operative complications. **Conclusion:** Superior esthetic results and direct simultaneous access to the orbital rim, orbital floor and lateral orbital wall, support the use of the transconjunctival approach as a frontline approach to access the orbito-zygomatico-maxillary complex.

Keywords: Orbital fractures, orbitozygomaticomaxillary complex fractures, transconjunctival approach

Introduction

Precise repair of fractures of the orbitozygomatic complex requires four essential features: A thorough understanding of the regional anatomy, an accurate and precise diagnosis, an unimpeded exposure, and a rigid fixation of fracture to restore premorbid form. Although the zygomatic arch may

be fractured in isolation, more commonly, it is associated with complex orbitozygomaticomaxillary (OZM) and midface fractures. If the horizontal and vertical buttress of the OZM complex and orbital floor are not properly aligned, a variety of sequelae can occur including enophthalmos, diplopia, rotational zygomatic displacement, orbital dystopia, and midface widening; all of these conditions are difficult to address with revision.^[1]

The increasing emphasis on open reduction in the treatment of facial fractures has required a search for incisions which provide generalized exposure of all fracture sites. A requirement for these incisions is that the esthetic results be improved over those usually utilized for facial fracture reduction. The transconjunctival incision fulfills the requirements for patients with fractures of the orbital rim and floor. Through a single incision, the lateral rim and floor can be repaired.^[2]

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Access this article online	
Quick Response Code:	Website: www.contempclindent.org
	DOI: 10.4103/0976-237X.183067

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How to cite this article: Kumar S, Shubhalaksmi S. Clinical outcome following use of transconjunctival approach in reducing orbitozygomaticomaxillary complex fractures. *Contemp Clin Dent* 2016;7:163-9.

The advantage of using transconjunctival incision is that it produces nonvisible scar and carries a low incidence of postoperative ectropion.^[3] Simultaneous visualization of the infraorbital rim and lateral orbital rim is the greatest advantage of this technique as opposed to any other method. The anterior portion of the zygomatic arch can also be visualized through the transconjunctival incision combined with lateral canthotomy.^[4] The purpose of this study is to evaluate the effectiveness of transconjunctival approach for the treatment of OZM complex fracture and to report the associated ocular complications and esthetic outcome of this approach in management of these fractures.

Methodology

Source of data

This study is a prospective clinical study involving eight patients having displaced OZM complex fractures or an isolated orbital floor fracture, with insignificant medical history to evaluate the versatility of transconjunctival approach, for the management of these fractures, with emphasis on the wound healing, postoperative stability, functional and esthetic restoration of the prominence of cheek, and the complications encountered with this approach. This study was conducted in the Department of Cranio-Maxillofacial Plastic and Reconstructive Surgery at the College of Dental Sciences, Davangere.

Inclusion criteria

Patients reporting with OZM complex fractures without existing lacerations in the inferior and lateral periorbital regions.

Exclusion criteria

1. Patients medically contraindicated for surgery
2. Patients not willing for the treatment
3. Patients with comminuted fracture of the OZM complex region.

Method of study

Patients diagnosed with OZM complex fracture on the basis of thorough history and clinical and radiographic examination were included in the study after approval from the Institutional Ethical Committee.

The criteria used to determine the need for surgical correction consisted of both clinical and radiologic assessments. Radiographic evidence of displacement and combination of one or more of the following clinical signs and symptoms which included restricted mandibular movements, infraorbital dysesthesia, palpable step deformity of the orbital rim, tenderness at the fractured sites, subconjunctival or periorbital ecchymosis, diplopia, and visible depression of the prominence of the cheek were evaluated. A pro forma was completed for each patient requiring surgical treatment, detailing the name, age, sex, date of injury, etiology, medical history, site of injury, involved side of the face, type of fracture, clinical signs and symptoms, surgical approach used,

duration of the surgery, and postoperative evaluation in the form of assessment of wound healing, functional stability, esthetic appearance, and associated complications which were recorded in an exclusively designed pro forma.

Once informed written consent is obtained, ophthalmological evaluation of the patient was carried out by a senior ophthalmologist, Department of Ophthalmology, Bapuji Hospital, Davangere, for orbital assessment. After the patient undergoes open reduction and internal fixation through transconjunctival approach, postoperative patient evaluation was performed in cooperation with senior ophthalmologist, Department of Ophthalmology, Bapuji Hospital, Davangere, and attention was paid toward the following features:

- Wound healing
- Functional stability
- Esthetic appearance
- Postoperative ocular complications.

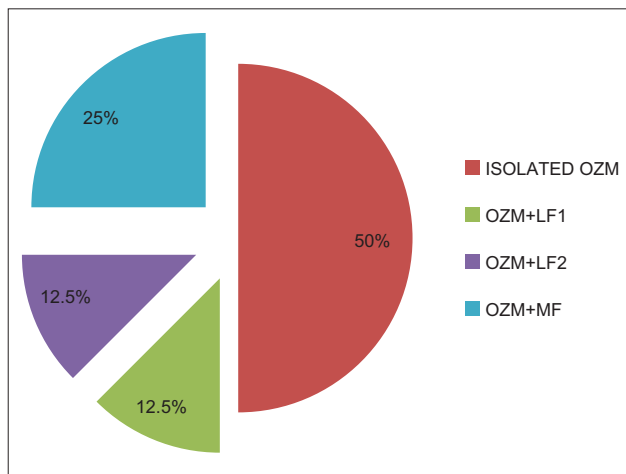
Parameters under consideration

- Visual acuity
- Diplopia
- Corneal abrasion
- Ectropion
- Enophthalmos
- Chemosis
- Symmetry of lateral canthus
- Restricted Ocular motility
- Asymmetry of OZM complex
- Infraorbital paresthesia
- Infection
- Scarring.

Paranasal sinus view radiograph was taken for the patients pre- and post-operatively and then later reviewed after 1 week and 1 month to evaluate the position of the zygoma and determine the adequacy of reduction of these fractured fragments, thus indicating the efficacy of this approach.

Results

Out of eight patients reporting to the Department of Cranio-Maxillofacial Plastic and Reconstructive Surgery, College of Dental Sciences, Davangere, all the patients were male, with age range between 19 and 38 years and mean age of 27.87 years. Four patients presented with isolated OZM complex fracture, and the remaining four patients presented with concomitant facial fractures. One of the four patients presenting with isolated OZM complex fracture had concomitant orbital floor fracture. Out of four patients presenting with concomitant facial injuries, two patients presented with associated fracture of the mandible, one patient had left angle fracture of the mandible, and the other had an associated fracture of right parasymphysis along with left subcondylar fracture of the mandible. One of the patients reported with concomitant LeFort I and one with LeFort II fracture [Graph 1].



Graph 1: Distribution of type of fracture among the study group. ISOLATED OZM: Percentage of cases with isolated orbito-zygomaticomaxillary complex fracture; OZM + LF1: Percentage of cases with isolated orbito-zygomaticomaxillary complex fracture along with LeFort one fracture of maxilla; OZM + LF2: Percentage of cases with isolated orbito-zygomaticomaxillary complex fracture along with LeFort two fracture of maxilla; OZM + MF: Percentage of cases with isolated orbito-zygomaticomaxillary complex fracture along with mandibular fracture

All of the patients reported with the chief complaint of facial pain. The most common cause of the trauma was road traffic accident in 5 (62.5%) of the patients followed by assault in 2 (25%) cases and self-fall in 1 (12.5%) of the cases. Four patients were operated within 5 days of the injury, and the remaining 4 patients were operated between 5 and 10 days after the injury. In all of the patients, the fracture site in the region of OZM complex was approached with transconjunctival route along with lateral canthotomy. Intraoperatively, there was no complication and all the patients recovered uneventfully.

In our study, we found that eight patients neither had any alteration in visual acuity nor had any ocular complications. None of the patients had postoperative infection or hematoma formation, and wound healing was satisfactory in all of the patients. In all the patients, we were able to achieve the anatomical reduction favoring functional stability. Malar symmetry was restored in all of the cases; none of them had any scarring at the incision line, and all the patients had a satisfactory esthetic appearance.

Access to the infraorbital rim and floor was excellent, and fractures were reduced directly and fixed with miniplates and screws in all the patients. With the aid of the lateral canthotomy incision, the orbital rim was explored to the lateral orbital wall region and up to the frontozygomatic region. Intraoperatively, there was no obvious herniation of the orbital fat and wide exposure of the fracture site was achieved. Healed incision tract was hardly visible in the lateral canthotomy region, and all the patients had esthetically acceptable results [Figures 1-9].



Figure 1: Preoperative paranasal sinus view

None of the patients had any major complication, and the only minor complication that occurred was chemosis of the bulbar conjunctiva in one patient during the first postoperative week. It appeared to be a transitory lesion and healed well after topical antimicrobial treatment. Chemosis subsequently decreased over the period and was absent at the second follow-up after 1 month. One patient who presented with diplopia in the lateral gaze showed complete regress of the signs following the surgery. There was no patient who presented with any corneal abrasion or had any sign of it after the surgery. One of the patients presenting with orbital floor fracture had enophthalmos which was treated by proper reduction of the orbito-zygomatic complex by utilizing this approach.

Ectropion, one of the reported complications of this technique in the literature was seen in none of the patients in our study. In all the patients, symmetry of the lateral canthus was maintained. Two patients who reported with the restricted ocular movement were treated successfully by this approach. All of the patients reported with asymmetry in the malar region; five of these patients had infraorbital paresthesia. Symmetry was restored in all of the patients, and none of them had any complaint of paresthesia following the surgery.

The transconjunctival incision by itself healed well and there was no scarring in the palpebral conjunctiva of any of the patients. No patient had the complaint of irritation caused by the sutures used for transconjunctival incision. The eyeball movements were preserved. The eyelid movements were normal in all the cases. Overall, the transconjunctival incision provided an excellent exposure of the infraorbital rim and the orbital floor. The reduction and fixation were performed as usual without any complication utilizing this approach. Moreover, all the patients had a cosmetically superior result with no cutaneous scarring [Graph 2a and b].



Figure 2: Incision

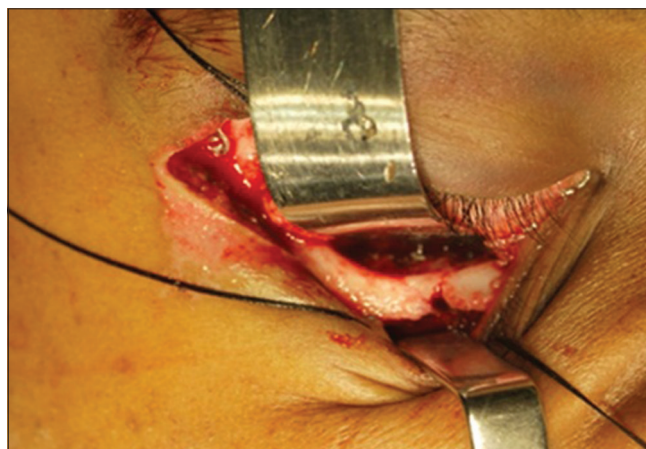


Figure 3: Fracture site at infraorbital rim

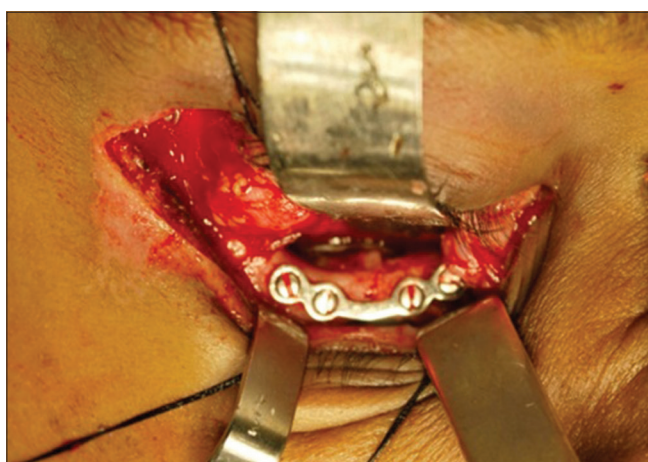


Figure 4: Plate fixation at infraorbital rim



Figure 5: Fracture site at frontozygomatic suture



Figure 6: Plate fixation at frontozygomatic suture

Discussion

A multitude of approaches has been used extensively for approaching the fractured zygomatic complex and orbit. Existing lacerations are often used for this purpose. However,



Figure 7: Closure

in the absence of lacerations, properly placed incisions offer excellent access with minimal morbidity and scarring. The three basic incisions used for accessing the infraorbital rim and the orbital floor are the infraorbital, subciliary, and transconjunctival incisions. They differ in the level at which the skin incision is made and the level of dissection to the infraorbital rim.



Figure 8: Postoperative paranasal sinus view

In our study, we used the transconjunctival incision to expose the inferior orbital rim and orbital floor in zygomaticomaxillary complex fractures. This approach, also called the inferior fornix approach, was originally described by Bourquet^[5] for the removal of herniated orbital fat. Tenzel and Miller^[6] developed the transconjunctival retroseptal technique and used this approach for repair of small orbital blow-out type fractures. Tessier^[7] elaborated the transconjunctival preseptal incision and popularized the approach for orbital floor exploration and maxillofacial surgery in cases of congenital deformities and trauma. Converse *et al.*^[8] added a lateral canthotomy incision to the retroseptal incision for improved lateral exposure of the orbital rim. Ilankovan *et al.*^[9] described the existence of a periorbital envelope which separates the orbital floor from the orbital septum and potential postseptal space as important anatomical landmarks when approaching the infraorbital rim and orbital floor through this approach.

The main advantage of the transconjunctival approach is that it produces excellent cosmetic results as the scar is hidden behind the conjunctiva. If a canthotomy is performed with the approach, the only visible scar is the lateral extension, which heals with an inconspicuous scar. Another advantage is that these techniques are rapid and no skin or muscle dissection is necessary. The only disadvantage of the transconjunctival approach is the limitation of medial extent of the incision by the lacrimal drainage system.

Zingg *et al.*^[10] conducted a 10-year study between 1978 and 1988 on 1025 zygomalateral orbital complex fractures, surgically treated and followed up for a minimum of 1 year and maximum of 5 years. Regardless of type and severity of fracture, concomitant fractures of orbital floor and rim were approached exclusively through the transconjunctival approach without a lateral canthotomy. They concluded that the advantages of this approach lie in the avoidance of a visible scar and decreased incidence of ectropion and edema, which were consistently observed in our study.

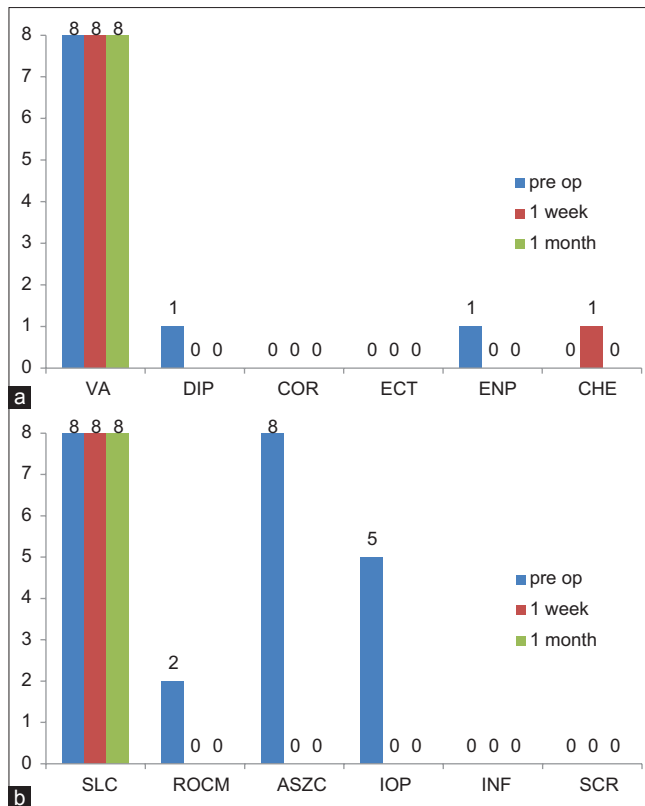


Figure 9: Incision site at 1 month postoperative

Appling *et al.*^[11] studied 98 consecutive inferior orbital rim and/or floor fractures, comparing transconjunctival approach with subciliary skin-muscle flap approach for orbital fracture repair and reported a 12% rate of transient ectropion and a 28% rate of permanent scleral show compared with no transient ectropion and a 3% rate of scleral show as reported with transconjunctival approach. Hence, it was concluded that this approach provided excellent exposure with less risk of postoperative eyelid retraction and ectropion. The same was observed in our study as none of the patients reported with eyelid retraction or ectropion, postoperatively.

As specified in the literature, most of the complications seen with the transconjunctival approach would tend to reduce with meticulous care and surgical expertise. Manganello-Souza and Rodrigues de Freitas^[4] presented their experience with the transconjunctival approach to access the orbital floor, infraorbital rim, and zygomaticofrontal and zygomaticotemporal sutures in 40 patients with fractures in the orbital and zygomatic region. The pre- and retro-septal approaches were used. This study stated that the transconjunctival incision allows sufficient exposure of the zygomatic bone or orbital floor and zygomaticofrontal suture to reduce and fix the fractures in this area despite a complication rate of 12.5% which should decrease with use of meticulous technique. The superior esthetic results along with direct and simultaneous access to the orbital rim and zygomaticofrontal region support the use of the transconjunctival approach.

In all the 8 cases included in our study, we used the retroseptal transconjunctival incision. In all, the transconjunctival incision was additionally supplemented with a lateral canthotomy incision to expose the orbital rim laterally according to the fracture line. The exposure to the infraorbital rim and orbital floor was excellent in all the cases. Open reduction and internal fixation of infraorbital rim with miniplates and



Graph 2: (a) Parameters evaluated number of patients presenting with specific orbital signs preoperatively, at 1 week and at 1 month postoperatively. VA: Visual acuity; DIP: Diplopia; COR: Corneal abrasion; ECT: Ectropion; ENP: Enophthalmos; CHE: Chemosis (b) Parameters evaluated number of patients presenting with specific orbital signs preoperatively, at 1 week and 1 month postoperatively. SLC: Symmetry of lateral canthus; ROCM: Restricted ocular motility; ASZC: Asymmetry of orbito-zygomaxillary complex; IOP: Inferior orbital paresthesia; INF: Infection; SCR: Scarring

screws was done in the routine fashion. In all the cases, the access was rapid.

The wound was closed in layers; the orbital periosteum with 4-0 polyglycolic sutures in an interrupted fashion and the transconjunctival incision with 6-0 absorbable, polyglycolic sutures in a continuous fashion. The necessity for periosteal closure is however controversial, owing to the possibility of entropion or ectropion with inadvertent suturing of the periosteum to the orbital septum or other layers. Improper suturing may result in “early ectropion” or “shortened lid”. None of the patients complained of suture irritation. The skin of lateral canthotomy incision was closed with 6-0 nylon sutures that were removed on the seventh postoperative day, and there was no dehiscence noticed in any of the cases. Some authors even suggest a sutureless transconjunctival approach, wherein the conjunctival incision is not sutured. The lateral canthotomy scar was almost imperceptible. The conjunctival incision was barely visible as well.

Zingg *et al.*^[12] treated 813 cases using the transconjunctival approach with only 21 min or complications. The only complication we faced in our study with this approach was chemosis that was transient. Chemosis occurred in one patient in the first postoperative week that was subsequently treated with a topical antimicrobial agent. In one case, we encountered herniation of periorbital fat, intraoperatively. The case was followed up for 6 months and no active intervention was necessary.

The transconjunctival approach is somewhat technique-sensitive; strong traction intraoperatively is required and this may result in considerable postoperative swelling. This however produces no long-term sequelae. In our study, we did not encounter significant postoperative edema or hematoma. The other complication associated with this approach is diplopia. It may result due to direct or indirect injury to the inferior oblique and/or inferior rectus. Inferior oblique injury presents with vertical diplopia, increasing in gaze contralateral to the operated eye. Recent anatomic dissections demonstrate a consistent relationship between the inferior oblique muscle and the inferior orbital rim, infraorbital foramen, and supraorbital notch. Precise anatomic knowledge coupled with avoidance of an excessively inferior conjunctival incision is recommended.

The transconjunctival approach with a lateral canthotomy incision poses the risk of inferior dislocation of the lateral canthus. The soft tissue contracture accompanying canthal malposition, which tends to return the soft tissue to its original configuration despite changes in bone position, reinforces the necessity of prior canthal reattachment. None of the cases in our study showed inferior dislocation of lateral canthal tendon, and symmetry of the lateral canthal tendon was maintained.

The choice of retroseptal over preseptal technique and the vice versa is still a matter of debate. Many authors advocate the use of the retroseptal approach for blepharoplasty procedures. It is also used in the treatment of orbital fractures because of the direct access to the orbital floor. The advantage of the retroseptal technique lies in the ability to preserve septal integrity and thus avoids inferior palpebral retraction. Some authors, however, use the preseptal approach because they believe that the connection between the septum and the inferior palpebrum plays the most important role in inferior palpebral position. We recommend the retroseptal technique because it is rapid, can be easily performed, and provides excellent access. Using a malleable retractor and preserving septal integrity obviate the problem of fat herniation.

Conclusion

The transconjunctival approach is a useful surgical approach not only for the orbital floor but also for the zygomaticomaxillary complex fractures. Often OZM complex fractures present with multiple site fractures involving frontozygomatic as

well as infraorbital rim, transconjunctival incision along with lateral canthotomy serve in providing adequate exposure for these fractures simultaneously. This surgical approach however requires surgical expertise which gives good functional and esthetic results with apparently no associated ocular complications if meticulous care is taken in hands of experienced surgeon. Because of the successful clinical experience with this approach, it is now recommended as the primary approach to the OZM complex region especially the orbital floor, the infraorbital, and the lateral orbital rim.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Acknowledgment

I would like to acknowledge Dr. David P. Tauro (Professor) and Dr. Shiva Bharani, (Professor) for their enduring support for the study.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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