Original Article

DOI: 10.7860/JCDR/2018/32107.11929

Dentistry Section

Versatility of Transconjunctival Approach in Maxillofacial Trauma-A Prospective Study and Review of Literature

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ABSTRACT

Introduction: Maxillofacial injuries are multiple and complex type of injuries which require multi-specialty management. Maxillofacial trauma can involve the skin, soft tissues, as well as bones resulting in single or multiple fractures. As a result of maxillofacial trauma that leads to disfigurement of the involved areas, patients experience temporary or long-term psychological issues.

Aim: The objective of this study was to evaluate the advantages and disadvantages of transconjunctival approach in management of Zygomatico-Orbito-Maxillary Complex (ZOMC) fractures.

Materials and Methods: A total of 160 cases of ZOMC fractures were treated from April 2009 to March 2010, in which 37.5% of them had orbital trauma and needed surgery based upon the bony displacement. A total of 10 patients who had sustained zygomatic maxillary complex and orbital fractures were included in this study with follow-up period of 3 years. Post-operative evaluation in the form of assessment of wound healing, functional stability, aesthetic appearance, and associated ocular complications, ectropion, entropion, granuloma formation, canthal displacement, epiphora, diplopia, and infection were evaluated in this study.

Results: Mean age of patients was 31.5 years; Mean time of exposure was 20.6 minutes and intra-operative complication was seen in 20% of the cases. In all cases post-operative aesthetic results were satisfactory and good. Acceptable minimal scar was seen in 2 cases (20%) with lateral canthal incision.

Conclusion: The transconjunctival incision offers a simple alternative for orbital floor and infraorbital rim fracture, without post-operative complications. This study shows that there were no disadvantages to transconjunctival retro-septal approach, if performed meticulously by an experienced surgeon with sound knowledge of the anatomy of periorbital tissues.

Keywords: Infra-orbital, Lateral canthotomy, Maxillofacial injury, Orbital fracture, Sub-ciliary, Zygomatic maxillary complex

INTRODUCTION

As a part of routine life, human beings are exposed to various hostile agents, making them prone to various kinds of injuries, including maxillofacial fractures. Facial trauma can be multifactorial, they can result from road traffic accidents, where motorcycle-related incidents play a major and significant role [1], occupational accidents constitute to various injuries due to various causes [2], accidents during various sports [3], accidents due to various domestic activities and interpersonal violence [4], terrorist attacks and injuries during war which is most common in soldiers and policemen [5]. Universally, various cultural, environmental, traditional customs and socioeconomic factors can lead to various maxillofacial injuries [6]. Several epidemiological studies have been done to analyse the incidence and pattern of aetiology, frequency, and severity of maxillofacial and dental trauma [7]. The face is crucial for human identity and any damage to face such as developmental or acquired deformities lead to temporary or permanent damage and disfigurement [8]. Surgical approaches for the management of facial bone fractures are based on their anatomical location and aesthetics. There should be a proper balance for the exposure needed for access and treatment with the aesthetic demands of the patient. Fractures involving the orbits need to be approached with caution. Injury to the eye, reduction in visual acuity, neurological involvement has to be assessed carefully. The transconjunctival incision is one of the recognised and acceptable approaches for the access of infraorbital rim and orbital floor. The transconjunctival approach was described for the first time by Bourguet in 1924 as surgical access in the aesthetic blepharoplasty to remove palpebral fat [9]. This transconjunctival approach has been described and has been in use for treating orbital trauma since 1970 [10]. Converse JM et al., have reported on treating patients with the orbital floor and rim fractures using pre-septal and retro-septal techniques and lateral canthotomy for better surgical exposure [11]. The major advantage of using transconjunctival incision/approach is that it produces minimal invisible scar and which ultimately carries a low incidence of post-operative ectropion and less intra-operative and post-operative complications, and good aesthetic results [11,12]. The aim of this study was to evaluate the advantages and disadvantages of transconjunctival approach in management of ZOMC fractures.

MATERIALS AND METHODS

This study was done at department of oral and maxillofacial surgery, Mamatha dental college and hospital, khammam, Telangana state, India. This study was done to evaluate the advantages and disadvantages of transconjunctival approach in management of ZOMC fractures. In the hospital, 160 cases of ZOMC fractures were treated between April 2009 and March 2010, in which 37.5% (60 cases) of them involved orbital trauma and needed surgery based upon the bony displacement. Institutional ethical committee clearance was obtained before the start of this study. The aetiology was RTA in 70% of cases. Infraorbital approach (20 cases); sub-ciliary approach (30 cases); transconjunctival approach (10 cases) were used in correction of ZOMC fractures respectively. Patients and patient's guardian were explained about the surgical procedure and informed consent was taken from each patient or the guardian of the patient; they were also explained about the academic use of CT films and clinical images for which they have given consent.

Only one patient gave consent for publishing his clinical and investigations images, remaining 9 patients refused for publishing their clinical images. The transconjunctival approach was indicated for patients with displaced and undisplaced fractures of infraorbital rim and orbital floor fractures. The main objective of this study was to evaluate the transconjunctival approach for the time of exposure of fracture site, adequacy of exposure (till the orbital rim and floor is palpated), intra-operative and post-operative complications, and aesthetic results. Post-operative evaluation in the form of assessment of wound healing, functional stability, aesthetic appearance, and associated ocular complications, ectropion, entropion, granuloma formation, canthal displacement, epiphora, diplopia, and infection were evaluated in this study. A total of 10 patients which had sustained zygomatic maxillary complex and orbital fractures were included in this study with follow-up period of 3 years.

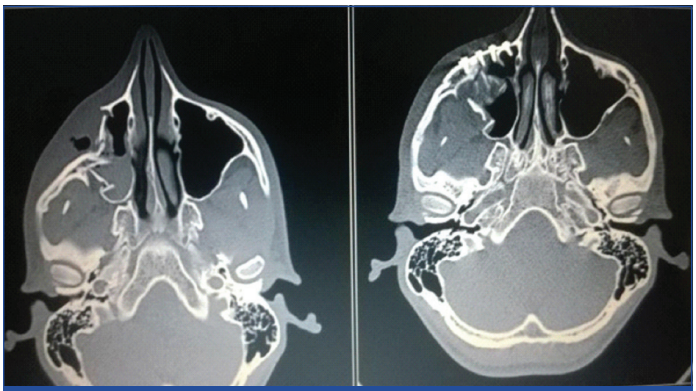
Inclusion criteria: Patients reporting with ZOMC fractures without existing lacerations in the inferior and lateral periorbital regions.

Exclusion criteria: 1) Patients medically contraindicated for surgery; 2) Patients not willing for the treatment; 3) Patients with comminuted fracture of the ZOMC complex region; and 4) patients who did not give consent to be a part of the study.

Thorough pre-operative assessment, clinical history, clinical and radiological examination of the patients was done. Initial evaluation of the patient was done to compare the size and shape of the pupils. Light reflex was tested for both direct and consensual response along with accommodation reflex [13]. The visual fields were appraised and the presence of diplopia was assessed in all six cardinal positions of gaze, similar to the evaluation of the visual fields. The movements of the eye were assessed in six positions of gaze for dis-conjugated movements, ophthalmoplegia, strabismus, or nystagmus. Forced duction test was performed, when limited extraocular movements were evident, and muscle entrapment was differentiated from the neurological deficit [14,15]. The conjunctiva was thoroughly examined for laceration ecchymosis or chemosis. The presence of entropion or ectropion of the lower eyelid was recorded. Intra-operative complications such as lid tear were also recorded.

SURGICAL PROCEDURE

The pre-operative CT scan images and patients images were obtained prior to the surgery for comparison post-operatively [Table/Fig-1,2].



[Table/Fig-1]: Pre and post-operative CT scan images.

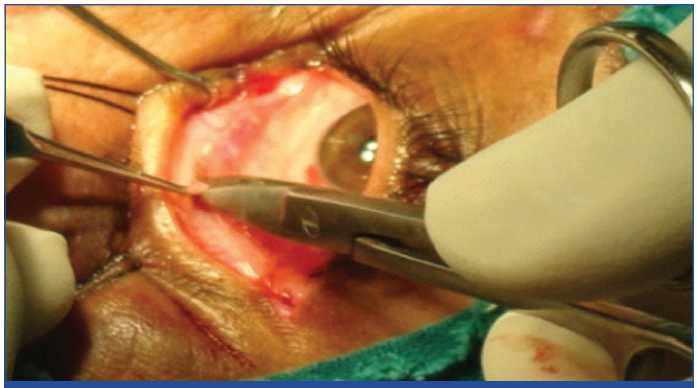
The surgical procedure was done under general anaesthesia with all aseptic precautions. The corneal shield was used for globe protection. Tarsorrhaphy suture was placed into margins of the lower eyelid and inferior conjunctival fornix was stabilized which facilitate incision [Table/Fig-3]. Excess traction was avoided to prevent lid tear. Lateral canthotomy was done using scissors for about 5 mm and inferior cantholysis was done. The conjunctival incision was given in a mid-way between the tarsal plate and inferior fornix using dissecting scissors from lateral canthus till lacrimal

[Table/Fig-2]: Pre-operative clinical picture of the patient.

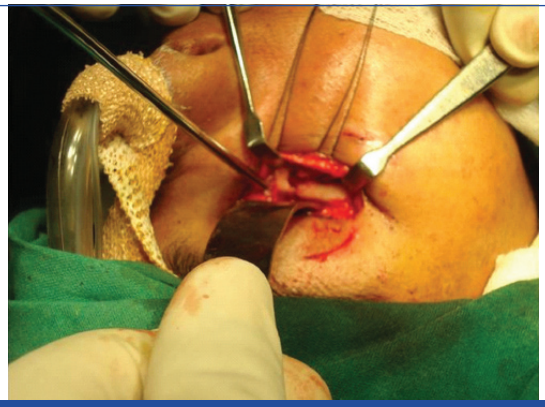
punctum by undermining and incising the palpebral conjunctiva and lower eye lid retractor posterior to orbital septum. Desmerres lid retractor was used to retract the lower eyelid [Table/Fig-4]. Blunt dissection was carried out post-septally to reach the infraorbital rim and once the infraorbital rim was identified; periosteum was incised anteriorly to the orbital rim using No. 15 scalpel blade. Blunt sub-periosteal dissection was done to expose the orbital rim and floor for the fractured region. Lid plate and the orbital retractor was used to protect the globe and also used to keep the orbital fat away from the operating site. Sub-periosteal dissection was done anteriorly to expose the infraorbital region. Careful dissection is important during exploring the floor of the orbit in order to prevent orbital fat herniation. High pressure suctioning should be avoided in this region. The fracture was identified and carefully reduced [Table/Fig-5,6]. Care should be taken to prevent injury to the globe. Therefore exposure of infraorbital rim and exploration of orbital floor were achieved through transconjunctival retro-septal approach. Intraorally vestibular incision was used for proper reduction of the zygomatic bone. Three point fixations were done using titanium mini plate system and reconstruction of the orbital floor was done using titanium mesh [Table/Fig-7a,b]. The conjunctival incision was sutured primarily with absorbable 7-0 vicryl suture material. Sutures were meant only for the approximation of conjunctival incision. Lateral canthal incision was closed with 5-0 proline suture [12,16]. Ophthalmic antibiotic ointment and eye pad were placed post-operatively for 72 hours. Ophthalmic eye drops were advised to protect the cornea and conjunctiva. For all the patients intra-operative and two days post-operative intravenous corticosteroid (Inj. decadron 8 mg twice a day) was given to reduce the inflammation and edema. Skin sutures were left in place for five days. Patients were evaluated as per intra-operative and post-operative protocols.

RESULTS

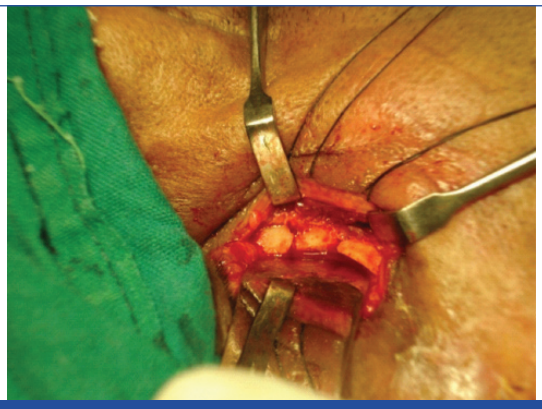
The average exposure time from the placement of incision till the exposure of the fracture site in this study was 20.6 minutes. Mean age of the patients in this study was 31.5 years. All patients were males 17 to 60 years. There was not much difference in the side involved-four cases were on the left side and six were on the right side. Mean time of presentation to the hospital was 4.3 days. Exposure obtained in all cases was good and it was adequate for the operating surgeon. The transconjunctival approach provides excellent access to the floor and infraorbital rim. Intra-operative complications included lid tear in two cases. None of the patients had post-operative complications except mild scar formation in two cases. Watering and itching of the operated eye were noticed in the first post-operative week. Pre-operatively circumorbital edema, ecchymosis, sub conjunctival hemorrhage was noticed in all cases, which resolved completely within two to four weeks after surgery. Pre-operative and post-operative interpalpebral distance was measured by comparing with normal side. The decrease in the palpebral distance was noticed in all the patients, which was normal after one



[Table/Fig-3]: Showing transconjunctival incision.



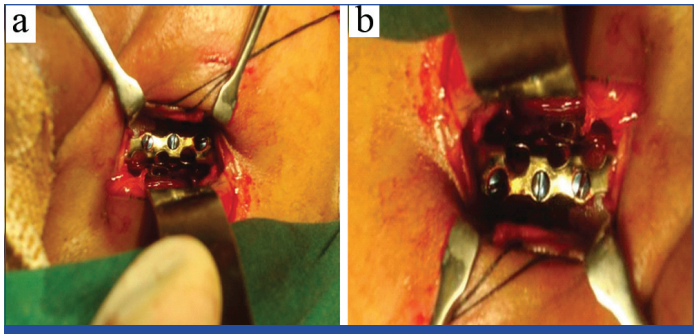
[Table/Fig-4]: Retraction of skin and subcutaneous tissues to expose the infra-orbital rim.



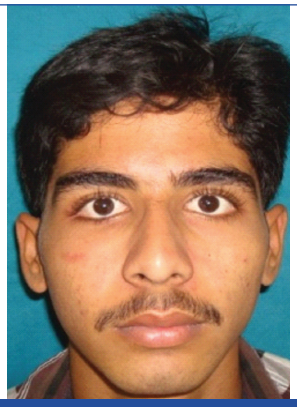
[Table/Fig-5]: Fractured orbital rim-exposed.

[Table/Fig-6]: Fixation of the reduced fracture.

month of post-operative period [Table/Fig-8]. In all the cases post-operative ocular movements and vision were normal. During post-operative follow-up all the patients were evaluated for ectropion, entropion, granuloma formation, canthal displacement, epiphora, diplopia, and infection. None of the patients have the mentioned complications. In all cases post-operative aesthetic results were good and satisfactory [Table/Fig-9]. Acceptable minimal scar was seen in two cases (20%) with lateral canthal incision.



[Table/Fig-7ab]: Showing orbital floor reconstructed with titanium mesh.



[Table/Fig-8]: Post-operative clinical picture of the patient.
Patient consent was taken for publishing his clinical images

Serial no	Age of patient	Time required for exposure	Adequacy of exposure	Complications		Aesthetic Result
				Intra-opera-tive	Post-opera-tive	
1	30 years/M	19 minutes	Adequate	None	None	Good
2	35 years/M	20 minutes	Adequate	Lid tear	Mild scar	Satisfactory
3	21 years/M	22 minutes	Adequate	Lid tear	Mild scar	Satisfactory
4	24 years/M	20 minutes	Adequate	None	None	Good
5	17 years/M	21 minutes	Adequate	None	None	Good
6	60 years/M	19 minutes	Adequate	None	None	Good
7	19 years/M	20 minutes	Adequate	None	None	Good
8	30 years/M	23 minutes	Adequate	None	None	Good
9	33 years/M	21 minutes	Adequate	None	None	Good
10	46 years/M	21 minutes	Adequate	None	None	Good

[Table/Fig-9]: Details of transconjunctival approach.
Aesthetic results were considered poor, good, bad and satisfactory based on anatomical reduction of the trauma site favouring functional stability of the affected area, restoration of malar symmetry and scarring of the incision line.

DISCUSSION

Orbital and Zygomatic maxillary complex is an important functional and aesthetic land mark of the face. Zygomatic complex fractures are usually associated with displacement of zygomatic bone. Protection of globe is one of the functions of zygomatic bone. The fractures which affect this bone extend to involve the antrum and orbital floor, and frontozygomatic suture. In our study, the aetiology of orbital fractures are mostly RTA (70%) which accounts least in the literature according to the study by Ellis E et al., followed by inter-personal violence (20%) and fall (10%) [17]. Around 40% of the patients were between the age group of 30-40 years. A 50% of orbital fractures were associated with zygomatic maxillary complex fractures and 10% are isolated infraorbital rim fractures. Choice of incision depends on training and experience with the eye surgery as well as understanding of anatomy and functions of orbit.

In all the cases, transconjunctival approach was supplemented with the lateral canthotomy to get adequate exposure. Intraoral vestibular (Keen's) approach is needed in case of complex ZOMC fractures.

The transconjunctival approach required more time when compared to other periorbital approaches and isolated transconjunctival incision provide good access for orbital rim and floor. Eppley BL et al., in their study stated that more central placement of incisions with respect to the globe provides nearly equal access, improved aesthetic outcome and results [18].

Converse JM et al., have described pre-septal and retro-septal techniques and lateral canthotomy for better surgical exposure [11]. Our experience was that, by using transconjunctival, retro-septal approach and lateral canthotomy provides adequate exposure for infraorbital rim and floor. It also provides good exposure to lower two-thirds of the medial wall, lateral wall, and lateral rim, and also gives better access for reconstruction and repair of ZOMC, exploration of the orbital floor, and gives better assess for elevation of simple depressed zygomatic arch fractures. In our study, we followed retro-septal technique which is easy for the surgeon and exposure were obtained by separation of Muller's muscle, lower eye lid fascia, and fat. Retro-septal is advantageous over pre-septal technique as it avoids inferior palpebral retraction and preserves the septal integrity. Ilankovan V in his study during post-septal dissection, noticed an envelope around the orbital fat and space between fat envelope and septum [19]. If dissection was done post-septally close proximity to the septum orbital fat herniation can be avoided. An additional gingivobuccal incision along with transconjunctival and lateral canthotomy incisions may be necessary for proper reduction and stable fixation of severely displaced fractures and to prevent excess retraction of the lower eyelid.

Westfall C et al., focused on complications of the transconjunctival approach used in a variety of clinical settings in 1200 cases and reported very low complication rates (10 complications in 1200 cases) [20]. The complications that did occur included, eyelid avulsion, button hole of the eyelid, canthal dehiscence, ectropion, entropion, lower eyelid retraction, sclera show, hematoma, abscess, prolonged chemosis and lacrimal sac laceration. In another study, a lower rate of complications in 200 cases; he reported one case of scarring causing shallowing of the fornix and one case of transient ectropion. No Intra-operative ocular complications like abrasion of the cornea, iatrogenic injury to the lacrimal system were seen in any of our cases. Lid tear occurred in two of our cases due to over retraction. After the fixation of fractures, the closure was done by taking proper care. The periosteum was not sutured. The muscle layer and conjunctiva was sutured with 7-0 vicryl suture. Sutures should be placed minimal and loose in order to avoid post-operative complications like lid malpositioning. Humphrey CD et al., proposed leaving the transconjunctival incision without suturing gives good results and there are no complications like lid malpositioning were seen [21]. Limited closure of the incision with fast absorbing suture prevents fornix scarring and wound inversion during healing, which was followed by us in our study. Canthal reattachment should be done by suturing the inferior limb to the periosteum. To prevent displacement of lateral canthal level, lateral canthal incision is closed with 5-0 proline suture, which can be removed after one week. Cantholysis leads to the minimum of scar tissue, and the range of complication is very low and in our study, the cantholysis incision scar was minimal initially and in about two months time became almost imperceptible.

The transconjunctival approach decreases the incidence of lower eyelid retraction. Wray RC et al., reported that according to their studies, they found that the incidence of ectropion after the sub-ciliary approach was 42% and 0% after the transconjunctival approach [22]. In another study of Appling WD et al., the incidence of permanent sclera show was 3% after transconjunctival approach and 28% after the sub-ciliary approach [23]. The incidence of ectropion decreases when surgeon is more experienced when compared to a less experienced surgeon. In our study, no post-operative complications were noted in any of the cases. All the cases were followed for three years post-operatively and evaluated for sclera show, entropion, ectropion, conjunctival granuloma, plate exposure, infection and conjunctival scarring. This finding was consistent with the observations of most authors. Complications encountered are technique sensitive and can be totally avoided. In the study by Tetsuji U et al., the average age for presentation is 20.8 years when compared to this study which was 31.5 years [16]. According to Tetsuji U et al., time for exposure of the orbit floor is 37.8 minutes which is slightly more when compared to this study where average time was 20.6 minutes.

CONCLUSION

The transconjunctival approach is most effective surgical access to infraorbital rim and orbital floor and even to medial orbital wall. This approach is surgically similar in providing access and exposure, but aesthetically superior to other approaches and has minimal complications. The advantages of this approach nullify the longer time taken for the procedure. Use of corneal shield reduces the risk of corneal damage and ocular damage, careful instrumentation is must to avoid complications. The transconjunctival approach in hands of an experienced surgeon seems to be the best approach for the orbital rim and floor fracture and has the advantage of aesthetics when compared with other periorbital incisions.

LIMITATION

This is a small study with limited sample size. More studies can be done with larger sample size for better understanding of the transconjunctival approach, advantages and disadvantages.

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FINANCIAL OR OTHER COMPETING INTERESTS: None.

Date of Submission: **Sep 01, 2017**
Date of Peer Review: **Nov 16, 2017**
Date of Acceptance: **May 02, 2018**
Date of Publishing: **Aug 01, 2018**