

DIPLOPIA FOLLOWING MID FACE FRACTURES- A PROSPECTIVE CLINICAL STUDY

ABSTRACT

BACKGROUND AND OBJECTIVE: Mid face trauma needs careful ophthalmological evaluation to assess the presence of vision threatening injuries. Injuries like diplopia mostly occur in midface fractures involving orbit. Inappropriate treatment can be a devastating experience for the patients. It can also lead to medico-legal allegations. Timely detection and correction of injuries reduces morbidity. The prevalence and co-relationship of diplopia in midface fractures and frequency of surgical correction needed is assessed in this study.

METHODS: This study assessed 401 patients with Lefort I, Lefort II, Lefort III, zygomatic complex and naso-ethmoid fracture. Assessment of diplopia in facial fractures was done through clinical examination and specific tests. Ophthalmological evaluation was completed under the guidance of a registered ophthalmologist. Orbital injuries that lead to diplopia was assessed clinically and radiographically. The statistical test used in the study was chi square test and software employed is SPSS

RESULTS: The incidence of diplopia was 15.7% in the present study. Zygomatic complex fractures with involvement of the lateral wall of orbit and the infra orbital rim along with extension to the orbital floor showed highest association with diplopia. Among 401 patients 68 presented with diplopia and among this majority was having zygomatic complex fractures

CONCLUSION: Based on the study it can be concluded that all mid face fracture need a comprehensive ophthalmological evaluation to rule out vision threatening injuries. Early surgical intervention was needed in the correction of hypoglobus, diplopia etc. Zygomatic- complex fracture was the main midface fracture associated with highest incidence of ophthalmic and orbital injuries.

KEY WORDS: Diplopia, supraorbital rim, infraorbital rim, floor fracture, extraocular movements.

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INTRODUCTION

Diplopia is a frequently encountered complications of mid face fractures that involve the orbital walls causing enlargement of orbit leading to displacement of orbital contents. Human orbit is a small cavity having the shape of a pyramid with the apex pointing posteriorly. Within this crowded space are juxtaposed a complex array of tightly packed structures serving the ultimate function of vision¹. Orbital fat and connective tissue fascia act as a cushion protecting orbital contents and together they serve as a functional unit of vision, whose complexity and precision are unmatched elsewhere in the vertebrate body. Maxillofacial injuries especially those affecting the middle third of the face disrupts the orbital anatomy and cause entrapment and displacement of orbital contents. These injuries causes an alteration in the level of globe leading to diplopia.

Diplopia occurring in mid face fractures is a devastating experience for the patient. Two types are there monocular and binocular diplopia. Alteration in the visual axis with respect to the opposite eye causes diplopia in orbital floor fractures. Displaced orbital floor fracture can causes entrapment of periorbita and inferior rectus muscle leading to diplopia². Usually patients presents with downward displaced eyeball, accentuated superior palpebral groove, extrocular movement restriction. Entrapment and scarring of inferior rectus and inferior oblique muscle between fracture is the cause of limitation of movement of eyeball.

Determination of the prevalence and co-relationship of diplopia in mid face trauma was the objective of this study. This study also assessed the pattern of orbital injuries mostly associated with diplopia. This study emphasis the need for early ophthalmological examination to avoid vision threatening complications.

MATERIALS AND METHODS: The duration of study was from May 2014 to May 2016 in Department of oral and maxillofacial surgery, Government Dental college, Kottayam. Total number of patients assessed was 401, among those who presented with mid face fractures. Stratified sampling method was used grouping the patients into major mid face

fracture patterns, Majority of patients were between 20 to 50 years of age in this prospective clinical study. All patients received a comprehensive ophthalmological evaluation. Clinical, Radiographic/ CT evaluation was done to assess various orbital fractures and patterns of injury.

Inclusion criteria : All patients sustaining confirmed midface fractures.

Exclusion criteria: Those with solitary fractures of the dentoalveolar process or pure dental injuries, only soft tissue injuries in facial region, isolated mandibular fractures.

Informed consent and Ethical clearance was obtained from the institutional ethical committee of Government Dental College, Kottayam for the study(IEC/M/07/2014/DCK). Patient evaluation included history, clinical examination, ophthalmological assessment, radiographic evaluation, and treatment given. History included personal details, date of injury, causes of trauma to mid face. Pre-existing ophthalmic injuries, alterations in visual acuity related to conditions like diabetes, and due to other ocular diseases were noted.

Clinical examination: Restriction of extraocular movements assessed by asking patient to sit or stand with head up and looking straight ahead. A pen or finger was held about 14 inches from the patient's eyes; ask the patient to follow the finger as it is moved through the six cardinal fields of gaze. A cover/uncover test was also done. In forced duction test a cotton tip applicator soaked in topical anesthetic was held on the conjunctiva for one minute. A small non-toothed forceps was used to grasp the conjunctiva and extraocular muscle insertion about 8 mm from the cornea and the globe is rotated both towards and away from the muscle. Resistance suggested muscle entrapment⁷. Diplopia assessed by red-glass test⁷. A red plane glass is placed in front of one eye and light source was moved in all nine directions of gaze. Red glass helped to dissociate the eyes and makes diplopia more recognizable by perceiving both white light and red light when diplopia is present. A horizontal line is drawn through the center of the pupil of both eyes. Depression of level of pupil below this line suggest hypoglobus. All the four orbital rims were palpated for any tenderness or step defect. Extraocular muscles entrapment lead to restriction of extra ocular movements and diplopia.

Radiological evaluation: waters view was the main plain X-ray view used. CT scan; axial and coronal views were used to assess the involvement of various orbital walls and rims. Mid face fractures were radiographically confirmed using waters view, PA skull, lateral skull views and axial, coronal and sagittal sections of CT Scan’.

Results: The results are summarized in the form of tables and graphs as follows. The statistical test used in the study was chi square test and software employed is SPSS.



Figure 1. Superior gaze restriction



Figure 3: Coronal CT view



Figure 2 : Diplopia test



Figure 4 : Intraop view



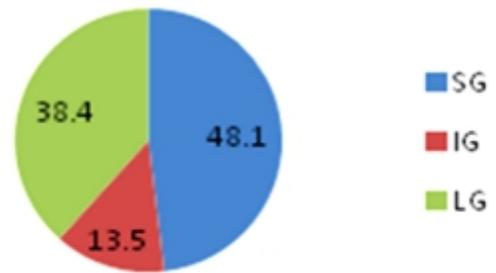
Figure 5: Floor Repair

Restriction	Frequency	Percentage
SG	75	48.1
IG	21	13.5
LG	60	38.4
MG	0	0
Total gaze restrictions	156	0.1

Table 1: Distribution of restriction of extraocular movement in various gazes.

LG-Lateral gaze restriction, SG-Superior gaze restriction, MG-Medial gaze restriction, IG-Inferior gaze restriction.

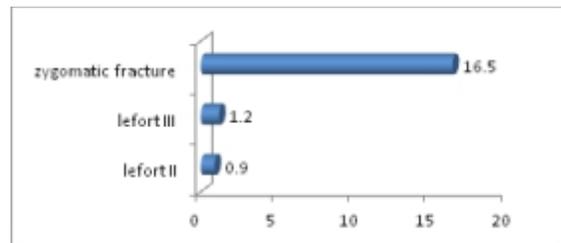
The major gaze restriction observed in the study was superior gaze restriction followed by lateral gaze restriction



Graph 1: The restriction of extraocular movement in various gazes.

Midface fracture	Frequency	Percent
Lefort I	0	0.0
Lefort II	4	0.9
Lefort III	5	1.2
Zygomatic complex fractures	66	16.5
Naso ethmoid fractures	0	0
No injury	326	81.4
Total	401	100.0

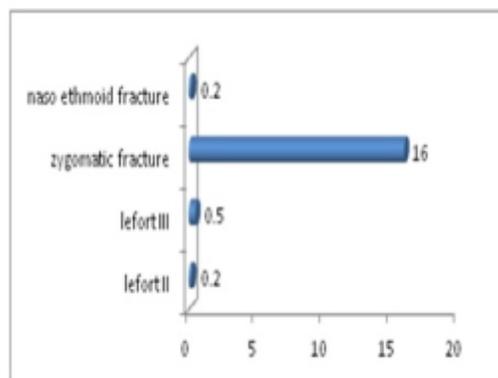
Table 2: Superior gaze restriction in mid face fractures



Graph 2 : Superior gaze restriction in mid face fracture

Midface fracture	Frequency	Percent
Lefort II	1	0.2
Lefort III	2	0.5
Zygomatic complex fractures	64	16.0
Naso ethmoid fractures	1	0.2
No injury	333	83.1
Total	401	100.0

Table 3: Distribution of diplopia in mid face fractures.



Graph 3: Distribution of diplopia in midface fractures.

18.6 % of patients in the study presented with superior gaze restriction and of this 16.5 % were having zygomatic complex fractures.

Among 401 patients 68 presented with diplopia and among this majority was having zygomatic complex fractures.

Discussion: Ophthalmic injuries occur frequently during mid facial trauma. There are many studies associating maxillofacial fractures and ophthalmic injuries in literature. Road traffic accidents followed by assault, falls, and sports injury are the major etiological factors¹. Assaults stand as the main etiology in recent studies². In our study 401 patients with midface trauma were assessed. The main etiology was road traffic accident (80.5%) followed by assaults (16.7%) and accidental falls. (2.8%). 345 males (86%) and 56 females (14%) were assessed for the percentage of occurrence of ophthalmic injuries like diplopia in various mid face fractures.

Restriction of extraocular movements were seen in 38.9% of cases, 156 patients had restriction of extraocular movement. Out of the patients 48.1% have superior gaze, 13.5% have inferior gaze, 38.4% have lateral gaze and none have medial gaze. The percentage of occurrence of diplopia was 16.9%.

Diplopia in primary position or downward gaze is an embarrassing experience for the patient. Frequency of diplopia in association with mid face reported in literature is 5 to 37 %³. Incidence of persisting diplopia is 5-7 %^{4,5}. Types of diplopia is monocular or binocular. Lens opacification and displacement are the usual causes of monocular diplopia. Binocular diplopia occurs secondary to trauma. Edema and hematoma due to trauma can lead to diplopia which resolves as it subsides. Persistent diplopia can be due to restriction of extraocular movements caused by muscle entrapment and scarring, neurogenic injuries causing atrophy of orbital muscles and fat or alteration in the level of orbit and visual axis due to orbital trauma. Orbital floor fracture with muscle entrapment commonly result in diplopia. Diplopia not resolving as edema subsides needs combined maxillofacial and ophthalmological evaluation. Diplopia is a common complaint among the patients with maxillofacial trauma. In study by Jamal et al.(2009) reported 16% incidence of persistent diplopia⁶. In the present study, among 401 cases

16.9% had diplopia. 16.0% of the diplopia was associated with zygomatic complex fractures, 0.2% with Lefort II, 0.5% with Lefort III and 0.2% with naso ethmoid fracture. Occurrence of diplopia in mid face fracture was around 19.8 % in previous studies by Al- Qurainy et al in 1991 and Barry C in 2008 and Marin MI in 1998^{7,8,9}.

Considerable deformity of bony orbit and globe can lead to esthetic and functional handicap. Evaluation of the extent of comminution of the orbital wall, timing of surgery, and a precise surgical technique is important in the correction of diplopia. Correction of diplopia should not be delayed for more than 1 week as irreversible scarring of orbital soft tissues and necrosis of prolapsed fat can occur in extreme positions of gaze. The result of correction surgery depends on the state of soft tissue and restoration of bony form of zygoma and orbital floor. Proper reduction and fixation of fractured bones along with release of the soft tissue entrapment and three-dimensional reconstruction of the orbital floor using auto graft, allograft or alloplastic material assures correction of diplopia. Surgery must be gentle with meticulous hemostasis and steroid cover. Bone must be placed behind the equator to push the globe forward. Autogenous materials include cranial bone, iliac crest, rib maxillary anterior wall, or auricular cartilage. Resorbable and non-resorbable alloplastic materials include Teflon, Marlex, Prolene, polyethylene and metallic alloys like titanium mesh Resorbable mesh and plate and homografts like lyodura and zenoderm are other options.

Conclusion

Zygomatic complex fracture was the most common middle third fracture that resulted in diplopia. Expansion of orbital volume due to disruption of the orbital walls lead to these ophthalmic injuries. The midface fractures definitely alters the normal sequential pattern of orbital contents, thus producing effects like diplopia altering the normal quality of life. Timely surgical intervention and proper restoration of orbital contour can correct these disabling and aesthetic consequences of mid face trauma.

REFERENCES

1. Michael Perry, Anne Dancey, Kamiar Mireskandari, Peter Oakley, Simon Davies, Malcolm Cameron. Emergency care in facial trauma—a maxillofacial and ophthalmic perspective. *Injury, Int. J. Care Injured* 2005; 36:p 875—896.
2. Nichola zachariades ,Demetrius Papavassiliou, Panos Christopoulos: Blindness after facial trauma. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology and Endodontology* 1996; 81:p 34-37
3. L.Folkestad, L.Aberg-Bengtsson ,G.Granstorm : Recovery from orbital floor fractures :A prospective study of patients and doctors experiences. *International Journal of Oral and Maxillofacial surgery* 2006; 35:p 499-505
4. Hawes MJ, Dortzbach RK Surgery on orbital floor fractures. Influence of time of repair and fracture size. *Ophthalmology* 1983; 90:p 1066–1070
5. Tadj A Hawes MJ, Kimble FW Fractured zygoma. *ANZ J Surg* 2003; 73:p 49–54
6. Jamal BT, Pfahler SM, Lane KA, Bilyk JR, Pribitkin EA, Diecidue RJ, et al Ophthalmic injuries in patients with zygomaticomaxillary complex fractures requiring surgical repair. *J Oral Maxillofac Surg.* 2009; 67: p 986–989
7. Al-Qurainy IA, Stassen LF, Dutton GN, Moos KF, el- Attar A. The characteristics of midfacial fractures and the association with ocular injury: a prospective study. *British Journal of Oral and Maxillofacial Surgery* 1991; 29:p 291-301.
8. Barry C, Coyle M, Idrees Z, Dwyer MH. Ocular findings in patients with orbito-zygomatic complex fractures: A retrospective study. *J Oral Maxillofacial Surg* 2008; 66: p 888-892.
9. Marin MI, Tejero TR, Dominguez FM, et al. Ocular injuries in midfacial fractures. *Orbit.* 1998; p 17:41.