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Frequency of Diplopia and its Management in Patients with Midfacial Fractures at A Tertiary Institute of Dentistry

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ABSTRACT

Objective: To determine the frequency of diplopia and its various management options in midfacial fractures.
Study Design: Cross-sectional study.
Place and Duration of Study: Armed Forces Institute of Dentistry, Rawalpindi Pakistan, from Apr 2017 to Apr 2019.
Methodology: All patients who presented with midfacial fractures were included in the study. Patients were categorized into 6 age-groups. All patients underwent CT scan of the skull and a forced duction test was performed. Patients with a positive forced duction test underwent early repair surgically either with open reduction and internal fixation or closed reduction. Conversely, patients who had a negative forced duction test were treated conservatively if there was no other indication for early surgical repair.
Results: Out of 80 patients, 69(86.3%) were males. Diplopia was present in 16(20%) patients and forced duction test was positive in 9(56.25%). Sixty-five (81.3%) patients were managed surgically and 15(18.8%) conservatively. Resolution of diplopia was also significantly associated with early surgical intervention (p<0.01). One patient who presented after 3 weeks of injury did not have any resolution of diplopia even after 3 weeks of surgery.
Conclusion: Diplopia was commonly found in midfacial fractures due to trauma. Early presentation and surgical intervention were associated with better outcomes.

Keywords: Closed reduction, Diplopia, Midfacial bone fractures, Open reduction and fixation.

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INTRODUCTION

The bones of the middle-third of the face contain vital organs such as eyes, nose and oral cavity which serve important functions such as seeing, smelling, breathing, eating, and speaking[1]. Trauma to the face commonly results in midfacial bone fractures,[2] which are associated with complications such as enophthalmos, diplopia and blindness due to optic nerve injury or fracture of the optic canal.[3,4] Types of midface fractures which lead to ocular injuries include zygomaticomaxillary (ZMC), Le Fort II, Le Fort III, orbital blowout and combined midfacial fractures since these fractures commonly involve the orbit.[5,6] The most common etiology of these fractures is road traffic accident (RTA) in developing nations whereas assault is more common in the developed world.[7,8] Fractures involving the orbital floor can result in diplopia which has an incidence of 15-86% in different studies.[9,10]

The objective of this study was to determine the frequency of diplopia in patients presenting with midfacial fractures and the outcomes of conservative versus surgical approaches on resolution of diplopia.

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METHODOLOGY

The cross-sectional study was conducted at Armed Forces Institute of Dentistry (AFID), Rawalpindi Pakistan, from April 2017 to April 2019 after obtaining approval from Institutional Review Board (Letter number: 905/Trg-ABP1K2). Sample size of n=80 was calculated with the help of WHO sample size calculator using confidence interval 95% and frequency of diplopia 9% in midface fractures according to a study done by Rajkumar GC *et al.*[3] Sampling was done using non-probability consecutive method.

Inclusion Criteria: All patients above the age of 13, of either gender, who presented with midfacial fractures with no previous medical or surgical comorbidity were included.

Exclusion Criteria: Patients with isolated Le Fort I or maxillary dentoalveolar fractures and those with existing eye problems, such as blindness, were excluded.

Patients who had diplopia with midfacial fractures were identified and forced duction test was performed under topical anesthesia in cooperative

patients and under general anesthesia in uncooperative patients. Corneal scleral junction point limbus was grasped with the help of tooth forceps and moved in the direction of diplopia to differentiate between extraocular muscles mechanical restriction and neurological paresis. Patients were categorized into six age-groups. Age groups started from 13 years to avoid mixed dentition stage. All patients underwent CT scan of the skull to identify detailed fracture anatomy. Patients were also sub-categorized into 4 fracture types: Le Fort II, Le Fort III, ZMC and combined midfacial fractures. We also noted the time of presentation since the injury compared to the time taken for diplopia to resolve with conservative or surgical management. According to time of presentation since injury, patients were further sub-categorized into 4 categories: less than 3 days, less than a week, less than 3 weeks and more than 3 weeks. Resolution of diplopia after surgical or conservative option was noted during the following time periods, which were: less than 1 week, less than 2 weeks, less than 3 weeks or no resolution after 3 weeks. All patients with a positive forced duction test underwent early repair surgically with Open Reduction and Internal Fixation (ORIF) and those who had a negative forced duction test were treated conservatively if there was no other indication for early surgical repair.

Data was recorded on a predesigned proforma, and all analysis was done using Statistical Package for Social Sciences (SPSS) version 20.0. Categorical variables were described as frequency and percentages and continuous variables were described as Mean±SD. Chi-square test was applied to look for any significant associations between resolution of diplopia on age, gender, type of fracture, time of presentation and management approach.

RESULTS

A total of 80 patients were included in the study out of which 69(86.3%) were males. Fracture types were composed of Le Fort III 7(8.8%), Le Fort II 16(20%), ZMC 5(56.3%) and combined midfacial fractures 12(15%). Diplopia was present in 16(20%) patients and forced duction was positive in 9(56.25%) patients. Upward gaze diplopia was present in 11(68.75%) and downward gaze diplopia in 5(31.25%) patients. Most (65,81.3%) patients were managed surgically and 15(18.8%) were managed conservatively. Overall, age was not significantly associated with diplopia (p=0.207). However, in subgroup analysis, two age-groups were more likely to present with diplopia after midfacial fractures, i.e. 21-30 years (9,56.25%) and 31-40 years (1,6.25%). Likewise, diplopia was associated with certain fracture types than others (p<0.05) as it was more likely seen with Le Fort II and ZMC fractures as shown in Table. Resolution of diplopia was also significantly associated with early surgical intervention (p<0.001). Moreover, patients who presented early had earlier resolution of diplopia compared to those who presented late. One patient who presented after 3 weeks of injury did not have any resolution of diplopia even after 3 weeks of surgery.

Table: Frequency of Diplopia in Subgroup Analysis (n=80)

Variables	Diplopia		*p*-value
	Present	Absent	
Age-groups			
13-20 years	6(37.5%)	11(17.8%)	0.207
21-30 years	9(56.25%)	29(45.31%)	
31-40 years	1(6.25%)	9(14.06%)	
41-50 years	-	5(7.81%)	
51-60 years	-	8(12.5%)	
Above 60 years	-	2(3.12%)	
Gender			
Male	15(93.75%)	54(84.37%)	0.33
Female	1(6.25%)	10(15.62%)	
Types of Fracture			
Lefort III	-	7(10.93%)	0.001
Lefort II	3(18.75%)	13(20.31%)	
ZMC	7(43.75%)	38(59.37%)	
Combined MFF*	6(37.5%)	6(9.37%)	

MFF= midfacial fractures

DISCUSSION

Diplopia is due to entrapment of the orbital contents between fracture fragments, orbital contents falling down into maxillary sinuses, edema and hematoma[11]. Diplopia is of two types monocular and binocular diplopia. In binocular diplopia, eye symptoms improve when one of the eyes is closed, due to misalignment of vertical axis of the eye. Conversely, in monocular diplopia, eye symptoms persists even after closure of one eye. Monocular diplopia requires detail ophthalmological examination because it is due to intraocular pathology. Thus, the management options for midface fractures with potential for diplopia can vary from conservative approach to urgent surgery.[12,13] Some studies suggest a better outcome for resolution of diplopia if early repair is done.[14,15] Other authors advocate two weeks to be an acceptable duration if there is no urgent indication for early surgical intervention.[16,17]

We found a frequency of 20% for diplopia after midfacial fractures which was comparable to the findings of Bartoli *et al*.[18] and Haider *et al*.[19] who reported it to be 20.2% and 19.2%, respectively. We also found that males were more likely to present with midfacial fractures (69,86.3%). This finding was universal in majority of the studies and similar high male to female ratios have been reported by Samieirad *et al*. 20(80.3% males), and others.[8,21] This observation may be due to the cultural norms of patriarchal society where men play a more active role in outdoor life and a very small number of women drive. This makes males more likely to present with serious facial injuries in a society where few people follow traffic rules or wear helmets while riding motorcycles. In our study, we also found that younger individuals were more likely to present with midfacial fractures. In subgroup analysis of age, we found that the age-groups between 21-30 years and 31-40 years were more likely to present with diplopia due to the severity of their injuries. This finding was also in conjunction with surveys by AlGhadouni *et al*. 22 (39.0% patients with midfacial fractures were <20 years), Barry *et al*.[23] (mean age: 34 years) and Ravindran *et al*.[24] (34.26% of midfacial fractures reported in 20-30 years age group). This can be explained by over-speeding and rash driving seen among young male adults resulting in more frequent road accidents.

In the analysis of the type of midfacial fractures associated with diplopia, we found that ZMC (p<0.01) and Le Fort II (p<0.05) fractures were associated significantly with diplopia which was comparable to the results of another previous study[21]. In addition, patients treated through early surgical approach had a better outcome compared to those who were treated conservatively with ten patients (77%) having resolution of diplopia within one week compared to three weeks for those treated conservatively. One patient who presented to us 3 weeks after trauma did not have resolution of diplopia even after 3 weeks of surgery. This could mean that early intervention could be key to the outcome of diplopia possibly because the injured extraocular muscles develop fibrosis over a longer time.

LIMITATIONS OF STUDY

Our hospital is a tertiary care center and patients are referred to us from far flung areas with difficult and complicated fractures which often need early surgical intervention, but they are often late in their presentation.

CONCLUSION

Our study found that early presentation and surgical intervention are associated with better outcomes in patients. Diplopia was common after trauma to the midface resulting in midfacial fractures. Therefore, early presentation and early surgical intervention were associated with better outcomes.

Conflict of Interest: None.

Authors Contribution

Following authors have made substantial contributions to the manuscript as under:

WM & IS: Conception, study design, drafting the manuscript, approval of the final version to be published.

AB & SM: Data acquisition, data analysis, data interpretation, critical review, approval of the final version to be published.

KN & HS: Data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

REFERENCES

1. Jose A, Nagori SA, Agarwal B, Bhutia O, Roychoudhury A. Management of maxillofacial trauma in emergency: An update of challenges and controversies. J Emerg Trauma Shock 2016; 9(2): 73. https://doi.org/10.4103/0974-2700.179441
2. Norozy A, Motamedi MH, Ebrahimi A, Khoshmohabat H. Maxillofacial fracture patterns in military casualties. J Oral Maxillofac Surg 2019; 78(4): 611. https://doi.org/10.1016/j.joms.2019.06.005
3. Rajkumar GC, Ashwin DP, Singh R, Prashanth R, Rudresh KB. Ocular injuries associated with midface fractures: A 5-year survey. J Maxillofac Oral Surg 2015; 14(4): 925-929. https://doi.org/10.1007/s12663-015-0805-1
4. Zachariades N, Papavassiliou D, Christopoulos P. Blindness after facial trauma. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1996; 81(1): 34-37. https://doi.org/10.1016/S1079-2104(96)80141-0
5. Runci M, De Ponte FS, Falzea R, Bramanti E, Lauritano F, Cervino G, et al. Facial and orbital fractures: A fifteen-year retrospective evaluation of Northeast Sicily treated patients. Open Dent J 2017; 11:546. https://doi.org/10.2174/1874210601711010546
6. Becker ST, Terheyden H, Fabel M, Kandzia C, Möller B, Wiltfang J. Comparison of collagen membranes and polydioxanone for reconstruction of the orbital floor after fractures. J Craniofac Surg 2010; 21(4): 1066-1068. https://doi.org/10.1097/SCS.0b013e3181e1f3a8
7. Elarabi MS, Bataineh AB. Changing pattern and etiology of maxillofacial fractures during the civil uprising in Western Libya. Med Oral Patol Oral Cir Bucal 2018; 23(2): e248. https://doi.org/10.4317/medoral.22258
8. Zaleckas L, Pečiulienė V, Gendvilienė I, Pūrienė A, Rimkuvienė J. Prevalence and etiology of midfacial fractures: A study of 799 cases. Medicina 2015; 51(4): 222-227. https://doi.org/10.1016/j.medici.2015.04.005
9. Tong L, Bauer RJ, Buchman SR. A current 10-year retrospective survey of 199 surgically treated orbital floor fractures in a

nonurban tertiary care center. Plast Reconstr Surg 2001; 108(3): 612-621.
https://doi.org/10.1097/00006534-200109000-00006
10. Folkestad L, Westin T. Long-term sequelae after surgery for orbital floor fractures. Otolaryngol Head Neck Surg 1999; 120(6): 914-921.
https://doi.org/10.1016/S0194-5998(99)70331-5
11. Wang S, Xiao J, Liu L, Lin Y, Li X, Tang W, et al. Orbital floor reconstruction: a retrospective study of 21 cases. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2008; 106(3): 324-330.
https://doi.org/10.1016/j.tripleo.2007.09.013
12. Burnstine MA. Clinical recommendations for repair of isolated orbital floor fractures: An evidence-based analysis. Ophthalmology 2002 Jul 1; 109(7): 1207-1210.
https://doi.org/10.1016/S0161-6420(02)01056-5
13. Maus M. Update on orbital trauma. Curr Opin Ophthalmol 2001; 12(5): 329-334.
https://doi.org/10.1097/00055735-200110000-00011
14. Clavero MA, Sanz MV, Til AM, Ferrer ÚM. Factors influencing postsurgical diplopia in orbital floor fractures and prevalence of other complications in a series of cases. J Oral Maxillofac Surg 2018; 76(8): 1725-1733.
https://doi.org/10.1016/j.joms.2018.03.023
15. Putterman AM. Management of blow-out fractures of the orbital floor: III. The conservative approach. Surv Ophthalmol 1991 Jan 1; 35(4): 292-298.
https://doi.org/10.1016/0039-6257(91)90140-T
16. Yu DY, Chen CH, Tsay PK, Leow AM, Pan CH, Chen CT. Surgical timing and fracture type on the outcome of diplopia after orbital fracture repair. Ann Plast Surg 2016; 76: S91-95.
https://doi.org/10.1097/SAP.0000000000000570
17. Manson PN, Iliff N. Management of blow-out fractures of the orbital floor: II. Early repair for selected injuries. Surv Ophthalmol 1991; 35(4): 280-292.
https://doi.org/10.1016/0039-6257(91)90139-M
18. Bartoli D, Fadda MT, Battisti A, Cassoni A, Pagnoni M, Riccardi E, et al. Retrospective analysis of 301 patients with orbital floor fracture. J Cranio-Maxillofac Surg 2015; 43(2): 244-247.
https://doi.org/10.1016/j.jcms.2014.12.001
19. Haider AK, Hameed H. Evaluation of ocular injuries associated with midfacial trauma. Pak Oral Dent J 2018;38(1):38-41.
20. Samieirad S, Aboutorabzade MR, Tohidi E, Shaban B, Khalife H, Hashemipour MA, et al. Maxillofacial fracture epidemiology and treatment plans in the Northeast of Iran: A retrospective study. Med Oral Patol Oral Cir Bucal 2017; 22(5): e616.
https://doi.org/10.4317/medoral.21962
21. Erol B, Tanrikulu R, Görgün B. Maxillofacial fractures. Analysis of demographic distribution and treatment in 2901 patients (25-year experience). J CranioMaxillofac Surg 2004; 32(5): 308-313.
https://doi.org/10.1016/j.jcms.2004.04.006
22. AlGhadouni M, AlOtaibi Y, ElTahir M, Alanezi M. Prevalence, patterns and etiology of maxillofacial fractures in Qassim Province, Saudi Arabia. Saudi Dent J 2019; 31: S15.
https://doi.org/10.1016/j.sdentj.2019.01.004
23. Barry C, Coyle M, Idrees Z, Dwyer MH, Kearns G. Ocular findings in patients with orbitozygomatic complex fractures: a retrospective study. J Oral Maxillofac Surg 2008; 66(5): 888-892.
https://doi.org/10.1016/j.joms.2007.07.035
24. Ravindran V, Nair KR. Meta-analysis of maxillofacial trauma in the northern districts of Kerala: one-year prospective study. J Maxillofac Oral Surg 2011; 10(4): 321-327.
https://doi.org/10.1007/s12663-011-0181-0