

Original Research Article

A study of pattern of maxillofacial fractures and its complications

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ABSTRACT

Background: Incidence of maxillofacial fractures is quite high worldwide. A very important aesthetic function is served by maxillofacial skeleton moreover the prominent position of maxillofacial skeleton makes it more susceptible to fracture.

Methods: A prospective study was done to assess the main etiology and pattern of maxillofacial fractures of 60 patients who came to the emergency department of Sri Guru Ram Das Institute of Medical sciences and Research between January 2018 and June 2019.

Results: Total number of patients taken for this study were 60. The number of male patients were 56 (93.33%) and number of female patients were 4 (6.66%) and male to female ratio was (14:1). The age range spanned from 11 years to 70 years with (mean age=37.30 years, SD=14.27). Primary etiologic factor for maxillofacial fractures was road traffic accidents (49, 81.66%), followed by fall (8, 13.33%), and assault accounted for (3, 5%). Total 229 fractures were present in 60 patients. Concerning the anatomical site of fractures, it was explored that most common site of fractures is orbit (59, 25.72%) followed by fractures of maxilla (55, 24%) and zygomatic complex (35, 15.28%). Infection was most common complication and was present in 2 (3.33%) of the patients during hospital stay. 21 (35%) of the patients had associated head injury and maximum patients 49 (81.66%) were treated by open reduction and internal fixation.

Conclusions: It is concluded, that main etiology of maxillofacial trauma is road side accidents. Therefore, strict compliance of traffic rules can avoid such injuries.

Keywords: Head Injury, Maxillofacial fractures, Mild face fractures, Road side accidents, Open reduction and internal fixation, Orbital wall fractures

INTRODUCTION

A very important aesthetic function is served by maxillofacial skeleton.¹ The facial skeleton is vulnerable to trauma because it is highly exposed part of the body. Sight, hearing, smell, facial expression, eating and breathing are all mediated by face therefore fractures of maxillofacial skeleton requires repair and reconstruction with passage of time after injury.¹ The incidence of maxillofacial fractures is common throughout the world but their pattern is different in different societies.² Road

traffic accident is the most common etiological factor responsible for most devastating facial injuries.³ Road traffic accidents accounts for twenty time higher death rate in India as compared to developed countries.⁴ Maxillofacial fractures can be classified into upper third, middle third, and lower third.⁵ Present study was conducted to document the patterns and etiology of maxillofacial fractures at Sri Guru Ram Das Institute of Medical Sciences and Research, Sri Amritsar, Punjab, India.

METHODS

The study was conducted in the department of General Surgery at Sri Guru Ram Das Institute of Medical Sciences & Research, Sri Amritsar. Total 60 patients were studied after taking informed consent. The study recorded age, sex and, mode of injury, Complications during hospital stay and management modalities used. The age range of the present sample was 11 to 70 years. The sample consisted of both genders i.e. males and females. The present research was conducted prospectively. Period of study was from January 2018 to June 2019. After stabilizing the patient detailed history, examination, and 3D CT scan of Face was done. Any investigation according to associated injuries was done. According to patient's general condition and neurosurgery fitness, management was planned.

Inclusion criteria

All the patients of any age and either sex presenting with maxillofacial trauma to the emergency department of Sri Guru Ram Das University of Health Sciences, Sri Amritsar were included in the study.

Exclusion criteria

Previously maltreated cases, too old fractures with malunion (more than two weeks), patients having contra - indications for local and general anaesthesia were excluded.

Data was analyzed using Statistical Package for Social Sciences (SPSS) version 19 for windows.

RESULTS

In the present study, data of the 60 patients with 229 maxillofacial fractures was analyzed prospectively. The age range spanned from 11 years to 70 years. Mean age was 37.30 years with SD=14.27. Males accounted for 93.33% of patients of the present study. Females constituted 6.66% of the total sample. Male to female ratio was reported as (14:1). The significant male preponderance for various etiologies was indicated by chi-square. Results indicated that males accounted for (56, 93.33%) of the patients of the present study and females constituted (4, 6.66%) of the total sample. The male to female ratio was 14:1 ($X^2=40.32$, $df=1$, $p<0.01$). Therefore, the difference is statistically significant.

It is clear from study that 3.33% of the patients were in the age group of 11-20 years, 36.66% patients were in 21-30 years of age, 28.33% of patients were in the age group of 31-40 years, 16.66% of patients were of 41-50 years whereas 5% of the patients were in the age group of 51-60 years, whereas 10% of the patients were in the age group of 61-70 years. Mean age of patients was 37.30 years with SD=14.27.

As shown in the Table 1 road traffic accidents accounted for (49, 81.66 %) of the reported cases of maxillofacial

fractures followed by fall (8, 13.33%), and assault accounted for (3, 5%), of all the fractures ($X^2=63.70$, $df=2$, $p<0.001$). Therefore, the difference is statistically significant.

Table 1: Etiology of maxillofacial fractures.

Etiology	Number of patients	Percentage
Road traffic accidents	49	81.66
Fall	8	13.33
Assault	3	5
Total	60	100

Table 2: Anatomical distribution of maxillofacial fractures.

Fractures	Number of fractures	Percentage
Frontal bone	17	7.42
Frontal sinus	14	6.11
Orbit	59	25.72
Temporal bone	9	4
Nasal bone	21	9.17
Maxilla	55	24
Zygomatic complex	35	15.28
Mandible	19	8.27
Total fractures	229	100

It is evident from the Table 2 that total fractures were 229. Among these fractures the most commonly fractured bone was of the orbit 59 (25.72%), followed by fractures of maxilla 55 (24%), zygomatic complex 35 (15.28%), Nasal bone 21 (9.17%) mandible 19 (8.27%), frontal bone 17 (7.42%), 14 (6.11%), temporal bone 9 (4%) ($X^2=88.86$, $df=7$, $p<0.001$). Therefore, the difference is statistically significant. It has been found from current study that 17 (7.42%) fractures were of frontal bone while 14 (6.11%) were the fractures of frontal sinus.

Table 3: Anatomical distribution of orbital roof fractures.

Fractures of orbital roof	Number of fractures	Percentage
Fractures of left side	4	1.74
Fractures of right side	5	2.18
Bilateral fractures	2	0.87
Total	11	4.79

Table 3 indicated that 6 (1.74%) of the experienced fractures were of left orbital roof whereas 5 (2.18%) fractures were of right orbital roof. It was also revealed from the table that 2 (0.87%) of the fractures were of orbital roof on both the sides ($X^2=1.27$, $df=2$, $p\geq 0.05$). Therefore, the difference is statistically non-significant.

Table 4: Anatomical distribution of orbital medial wall fractures.

Fractures of orbital medial wall	Number of fractures	Percentage
Fracture of left side	5	2.18
Fracture of right side	4	1.74
Bilateral fracture	3	1.31
Total	12	5.23

Table 4 illustrated that 7 (2.18%) of the fractures were of left medial orbital wall. There were 4 (1.74%) fractures of left orbital medial wall whereas 3 (1.31%) Fracture were of bilateral orbital medial wall ($X^2=0.50$, $df=2$, $p\geq 0.05$). Therefore, the difference is statistically non-significant.

Table 5: Anatomical distribution of temporal bone fractures.

Fractures of temporal bone	Number of fractures	Percentage
Fracture of left side	1	0.43
Fracture of right side	7	3.05
Bilateral fracture	1	0.43
Total	9	3.91

It was evident from Table 5 that left temporal bone fractures were 1 (0.43%) while 7 (3.05%) of the fractures were of right temporal bone. 1 (0.43%) of the experienced fractures were present bilaterally. It is evident from study that 21 (9.17%) of fractures were of nasal bone.

Table 6: Anatomical distribution of fractures of alveolar process of maxilla.

Fractures of alveolar process	Number of fractures	Percentage
Fracture of left side	4	1.74
Fracture of right side	6	2.62
Total	10	4.36

Table 6 demonstrates that 4 (1.74%) of total fractures faced were of the left alveolar process of maxilla whereas 6 (2.62%) of the fractures encountered were of right alveolar process ($X^2=0.04$, $df=1$, $p\leq 0.05$). Therefore, the difference is statistically significant.

Table 7: Anatomical distribution of fractures of maxillary sinus.

Fractures of maxillary sinus	Number of fractures	Percentage
Fracture of left side	18	7.86
Fracture of right side	8	3.49
Bilateral fractures	12	5.24
Total	38	16.59

It can be inferred from Table 7 that 18 (7.86%) of the fractures were of left maxillary sinus while 8 (3.49%) of the fractures experienced were of right maxillary sinus and 12 (5.24%) were bilateral fractures of maxillary sinus ($X^2=4.00$, $df=2$, $p\geq 0.05$). Therefore, the difference is statistically non-significant.

Table 8: Anatomical distribution of fractures of zygomatic complex.

Fractures of zygomatic complex	Number of fractures	Percentage
Fracture of left side	18	7.86
Fracture of right side	12	5.24
Bilateral fracture	5	2.18
Total	35	15.28

It is revealed from the Table 8 that 18 (7.86%) of the total fractures were of left zygomatic complex and 12 (5.24%) of the fractures were of right zygomatic complex while 5 (2.18%) of the fractures were of zygomatic complex bilaterally ($X^2=7.25$, $df=2$, $p\leq 0.05$). Therefore, the difference is statistically significant. Results showed that 7 (3.05%) of the fractures were of hard palate.

Table 9: Anatomical distribution of orbital lateral wall fractures.

Fractures of orbital lateral wall	Number of fractures	Percentage
Fracture of left side	7	3.05
Fracture of right side	8	3.49
Bilateral fracture	1	0.43
Total	16	6.97

Table 9 illustrates that 7 (3.05%) of the fractures were of left lateral orbital wall. There were 8 (3.49%) fractures of right orbital lateral wall whereas 1 (0.43%) of the fractures were of bilateral orbital lateral wall ($X^2=5.37$, $df=2$, $p\geq 0.05$). Therefore, the difference is statistically non-significant.

Table 10: Anatomical distribution of orbital floor fractures.

Fractures of orbital floor	Number of fractures	Percentage
Fracture of left side	6	2.62
Fracture of right side	11	4.80
Bilateral fracture	3	1.31
Total	20	8.83

Table 10 illustrates that 6 (2.62%) of the fractures were of left floor of orbit. There were 11 (4.80%) fractures of right orbital floor whereas 3 (1.31%) of the fractures were of bilateral orbital floor ($X^2=4.9$, $df=2$, $p\geq 0.05$). Therefore, the difference is statistically non-significant.

It is inferred from present study that 5 (2.18%) of the total fractures were of body of mandible, 5 (2.18%) were of ramus, 2 (0.87%) were of condylar process and TMJ, symphysis had 5 (2.18%) of the total fractures, while 1 (0.43%) were of angle, 1 (0.43%) were of the angle, 1 (0.43%) were of alveolar process. It has been found from present study that 21 (35%) of the patients suffered head injury while head injury was absent in 39 (65.1%) of the total patients.

Study indicated that 2 (3.33%) of the patients had infection during hospital stay, moreover 1 (1.66%) of the patients experienced malocclusion while 1 (1.66%) of the patients developed diplopia. The sample of the present research consisted of 60 patients. Among these patients 6 (10%) were treated conservatively. 49 (81.66%) of the patients were treated by ORIF. ORIF, IMF and Orbital Mesh was used for treatment of 2 (3.33%) of the patients. Globe repair along with orbital mesh and ORIF was done for 1 (1.66%) of the patients. Closed reduction of fractures was done in 2 (3.33%) patients.

DISCUSSION

Maxillofacial fractures are the major cause of serious injuries and simultaneously it also impose significant burden on the society due to high mortality rate of the individuals sustaining maxillofacial fractures. Moreover not only mortality but the rate of morbidity is also high. Maxillofacial fractures also leads to loss of function along with loss of aesthetics of the face.

We did a prospective study of patients of roadside accidents sustaining maxillofacial fractures who came to Sri Guru Ram Das Institute of Medical Sciences and Research and Studied pattern of fractures, its management and post-operative complications

The pattern of maxillofacial fractures varies not only from country to country but significant variation can be seen in the different geographical regions of the country. This variation may be attributed to differences in lifestyle, different environment and varying socioeconomic status. Moreover cultural variations are also present in the secular country like India.⁶

Review of literature has indicated that road traffic accidents are the major etiological factors responsible for maxillofacial fractures.⁷ Same trend has been observed in the present study. 49 (81.66%) of the total patients experienced maxillofacial fractures due to road traffic accidents. The probable explanation for the same is that developing nations like India lack the stringent implementation of the speed limits. This result is consistent with the previous studies.^{7,8} Present study concluded that males frequently exhibited fractures with male to female ratio being 14:1. It was observed that there was male preponderance regarding the number of fractures which is comparable with the past research.⁹

Present research found that the mean age of the patients who sustained the maxillofacial trauma was third decade (37.30 years) with SD=14.27 which is in line with the results reported by Maliska and Vahdati who also reported that third decade is vulnerable time period for maxillofacial fractures.^{10,11} The possible explanation for the same is that people in this age drive carelessly and also participate in the dangerous exercises.

It was revealed from the study that maximum fractures were present in the orbital region (59, 25.72%). The floor of orbit was most commonly fractured bone. It was also revealed from the results that right orbital floor 11 (4.80%) was fractured most frequently followed by left side of orbital floor 6 (2.62%). Bilateral orbital floor fractures were encountered 3 (1.31%) of total fractures. This finding is in line with the study conducted by Manana et al, who also found that orbital fractures were most frequently encountered fractures.¹² Wahdati et al, Abosadegh, Maurya et al, also found that orbital walls were most frequently fractured bones.^{6,11,13} Rayes et al, concluded that right orbit was most frequently fractured bone among orbital fractures and this finding is in accordance with the present study.¹⁴ They also found that left orbital wall was fractured most frequently after the right orbital wall followed by bilateral fractures of orbital wall which is again in line with the findings of the present research.

Research also found that floor of right orbit was most frequently fractured which in accordance with the findings of Manana et al.¹² Reyes et al were also able to reach at the conclusion that floor of the orbit was the most common isolated fracture encountered.¹⁴

The main reason of the orbital fracture can be attributed to the inherent structural weakness of orbital walls.¹⁴ The anatomical details suggest that orbital floor is the thinnest bone of the orbit along with medial wall. Moreover morphometric variations in the different races regarding the orbital anatomy can be possible explanation that orbital floor fractures are encountered most frequently. It has been observed from the previous studies that Asian sustain orbital floor fractures most frequently as compared to Africans.¹²

The next important finding of the present study suggested that maxilla was the second most commonly fractured bone 55 (24%). Ortakoglu had also found that maxilla 22 (14.01%) was second most frequently fractured bone.¹⁵

Maxillary fractures occur mostly when a sufficient amount of force such as in road traffics accident hits the face.¹⁶

Zygomatic complex was the third most frequently encountered fracture 35 (15.28%). Among the fractures of zygomatic complex, the left side was fractured most frequently 18 (7.86%) followed by right side 12 (5.24%) while the bilateral fractures were 5 (2.18%). Bahdati also concluded that fracture of zygomatic complex was present in 34.93% of all the fractures.¹¹

The fracture of zygomatic complex occurs when kinetic force is applied. The zygomatic bone act as the buttress between skull and maxilla. Due to prominent position of zygomatic bone, it becomes vulnerable to injury.¹⁷

The nasal bone encountered the 21 (9.17%) of the total fractures. It is in concordance with the findings of Pungrasmi, Chrcanovic and Arslan who also reported that 17.8% of the nasal bone fractures were present out of total 10526 fractures.¹⁸⁻²⁰

Nasal bone fracture can occur frequently because of the prominence of the nose. This fracture may occur in isolation or may occur in combination of other fractures. The fracture of this bone produces asthetics deformity along with the functional disturbance. Therefore, prompt treatment is mandatory to restore the functional deformity.^{21,22}

Results of present research also indicated that mandible experienced 19 (8.27%) of the total fractures. The results are in agreement with the observation of Pungrasmi who also concluded that 21.8% of the total fractures were of mandible.²⁰

Among the mandibular fractures the most commonly fractured part was body 5 (2.18%) and ramus 5 (2.18%). This finding is in line with the other study conducted by Ortakoglu. This study indicated that body experienced 30.43% of the total fractures.¹⁵ Oboimakinde also found that body was also frequently fractured bone.¹⁶ Body was most frequently fractured bone among mandibular fractures as reported by Aggarwal.²

Mandible is the largest and strongest bone in the facial anatomy. This bone is also vulnerable to the fractures because of its prominent position in the face. Moreover vulnerability of jaw varies from one individual to another and from time to time in same individual.^{22,23} There are two principles that are involved in the fracture of mandible: the dynamic factor (blow) and the stationary factor (Jaw). The dynamic factor is characterized by intensity of blow and its direction. A light blow may cause greenstick fracture. Whereas heavy blow can cause comminuted fracture while static factor has to deal with the jaw itself.^{22,23}

It is clear from the results that frontal bone and frontal sinus experienced 17 (7.42%) and 14 (6.11%) of the total fractures respectively. A protective role is served by frontal bone which represents a transition between cranium and facial skelton. These fractures are encountered only due to high velocity trauma to the craniofacial region mainly due to road traffic accidents specially collisions.²⁴

The frontal sinus is less commonly fractured because it gets protection from thick cortical bone as compared to other bones of the face. This finding is in concordance with the study of strong who reported that the fractures of the

frontal sinus constitute only 5% to 15% of all the maxillofacial fractures.²⁵

The least commonly fractured bone in the present study is temporal bone (9, 4%) of the total fractures. The fracture of the temporal bone is least commonly encountered because it requires both blunt and penetrating trauma.

Findings of present study also indicated that mid-face fractures were maximum in number accounting for 111 (48.45%) of the total fractures. This finding is in contrast to the most of the studies conducted by (Bali, Obimakindi, Gupta, and Subashraj) who found that mandible was most frequently fractured bone.^{9,26-28}

Mid-face accounted for maximum maxillofacial injuries, the probable reason for the same is that mid-face is considered as dependent structure because it makes the connection between stable frontal bone superiorly and mandible inferiorly, moreover it is considered as inherently weak due to its position. These findings are in line with the results of Agarwal et al, Ugboko et al, Al ahmed et al.^{2,29,30}

The complication which were observed in the present research during the 2 week's hospital stay of the patients was infection, diplopia and malocclusion with the frequency of 2 (3.33%), 1 (1.66%) and 1 (1.66%) respectively. Findings of the present research are in agreement with the findings of Motamedi.⁷

Head injury was sustained by 21 (35%) of the patients. The 6 (10%) were treated conservatively. 49 (81.66%) of the patients were treated by ORIF. ORIF, IMF and Orbital Mesh was used for treatment of 2 (3.33%) of the patients. Globe repair along with orbital mesh and ORIF was done for 1 (1.66%) of the patients. Closed reduction of fractures was done in 2 (3.33%) patients.

This result is consistent with the studies conducted by Aggarwal et al, Rayes et al, Ortakoglu et al. The major imaging technique used was 3D CT face.^{2,14,15}

CONCLUSION

It is concluded from the findings that main etiology of maxillofacial trauma is road side accidents. Therefore strict compliance of traffic rules should be ensured to avoid such injuries. It is also concluded that in the present scenario Open reduction and internal fixation is the main choice of treatment. It results in good fracture reduction and early functional outcomes which further promotes patient's quality of life.

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REFERENCES

1. Wilson JN. Watson- Jones fractures and joint injuries. 6th ed. New Delhi: B.I. Churchill Livingstone; 2000: 162.
2. Agarwal P, Mehrotra D, Agarwal R, Kumar S, Pandey R. Patterns of Maxillofacial Fractures in Uttar Pradesh, India. *Craniomaxill of Trauma Reconstruct.* 2017;10(01):48-55.
3. Motamedi MH, Dadgar E, Ebrahimi A, Shirani G, Haghighat A, Jamalpour MR. Pattern of maxillofacial fractures: a 5-year analysis of 8,818 patients. *J Trauma Acute Care Surg.* 2014;77(4):630-4.
4. Park K. Epidemiology of chronic non-communicable diseases. In: Park P, eds. *Park's textbook of preventive and social medicine.* 17th ed. Jabalpur: Banarsidas Bhanot; 2002: 303-307.
5. Williams NS, Bulstrode CJK, Oconnell, PR. *Bailey & Love's Short practice of surgery.* 26th ed. London: Taylor and Francis; 2013: 344-346.
6. Abosadegh MM, Saddki N, Al-Tayar B, Rahman SA. Epidemiology of maxillofacial fractures at a teaching hospital in Malaysia: a retrospective study. *BioMed Res Int.* 2019;2019.
7. Motamedi MH, Dadgar E, Ebrahimi A, Shirani G, Haghighat A, Jamalpour MR. Pattern of maxillofacial fractures: a 5-year analysis of 8,818 patients. *J Trauma Acute Care Surg.* 2014;77(4):630-4.
8. Ogunmuyiwa SA, Gbolahan OO, Ayantunde AA, Odewabi AA. Patterns, severity, and management of maxillofacial injuries in a suburban southwestern Nigeria tertiary center. *Niger J Surg.* 2015;21(1):38-42.
9. Obimakinde OS, Ogundipe KO, Rabiun TB, Okoje VN. Maxillofacial fractures in a budding teaching hospital: a study of pattern of presentation and care. *Pan Afr Med J.* 2017;26.
10. Maliska MC, Lima Júnior SM, Gil JN. Analysis of 185 maxillofacial fractures in the state of Santa Catarina, Brazil. *Brazilian Oral Res.* 2009;23(3):268-74.
11. Vahdati SS, Ala A, Falaki R, Fahimi R, Safapour A. Demographic study of maxillofacial injury in multiple trauma patients. *Emerg Med.* 2016;6(343):2.
12. Manana W, Odhiambo WA, Chindia ML, Koech K. The Pattern of Orbital Fractures Managed at Two Referral Centers in Nairobi, Kenya. *J Crani Surg.* 2017;28(4):338-42.
13. Maurya RP, Jain P, Singh VP, Singh MK, Mishra CP. Etiology and pattern of orbital fractures in a teaching hospital. *IP Int J Ocular Oncol Oculopla.* 2017;3(3):184-92
14. Reyes JM, Vargas MF, Rosenvasser J, Arocena MA, Medina AJ, Funes J. Classification and epidemiology of orbital fractures diagnosed by computed tomography. *Rev Argent Radiol.* 2013;77(2):139-46.
15. Ortakoglu K, Gunaydin Y, Aydintug YS, Bayar GR. An analysis of maxillofacial fractures: a 5-year survey of 157 patients. *Mil Med* 2004;169:723-7.
16. Most SP. Fractures of jaw and midface. Stanford University School of Medicine. 2018. Available at: <https://www.msmanuals.com/en-in/professional/injuries-poisoning/facial-trauma/fractures-of-the-mandible-and-midface>. Accessed on 7 March 2020.
17. Wilson DJ. Zygomatic fractures. Available at: <https://www.news-medical.net/health/Zygomatic-Fractures.aspx>. Accessed on 29 February 2019.
18. Chrcanovic BR. Factors influencing the incidence of maxillofacial fractures. *Oral Maxill Surg.* 2012;16(1):3-17.
19. Arslan ED, Solakoglu AG, Komut E, Kavalci C, Yilmaz F, Karakilic E, et al. Assessment of maxillofacial trauma in emergency department. *World J Emerg Surg.* 2014;9(1):13.
20. Pungrasmi P, Haetanurak S. Incidence and etiology of maxillofacial trauma: a retrospective analysis of King Chulalongkorn Memorial Hospital in the past decade. *Asian Biomed.* 2018;11(4):353-8.
21. Kapoor V. *Textbook of oral & maxillofacial surgery.* 2nd ed. New Delhi: Arya Medi Publishing House; 2011
22. Malik NA. *Textbook of oral and maxillofacial surgery.* New Delhi: Jaypee Brothers; 2012.
23. Kruger GO, editor. *Textbook of oral and maxillofacial surgery.* 5th ed. Saint Louis: Mosby; 1979.
24. Schultz K, Braun T, Truong T. Frontal Sinus Fractures. *Semin Plast Surg.* 2017;31(02):080-4.
25. Strong EB. Frontal sinus fractures: current concepts. *Craniomaxill Trauma Reconstruct.* 2009;2(03):161-75
26. Subhashraj K, Ravindran C. Maxillofacial intervention in trauma patients aged 60 years and older. *Ind J Dent Res.* 2008;19(2):109.
27. Bali R, Sharma P, Garg A, Dhillon G. A comprehensive study on maxillofacial trauma conducted in Yamunanagar, India. *J Injury Viol Res.* 2013;5(2):108
28. Gupta A, Babu AK, Bansal P, Sharma R, Sharma SD. Changing trends in maxillofacial trauma: A 15 years retrospective study in the Southern Part of Haryana, India. *Ind J Dent Res.* 2018;29(2):190
29. Ugboke VI, Odusanya SA, Fagade OO. Maxillofacial fractures in a semi-urban Nigerian teaching hospital. A review of 442 cases. *Int J Oral Maxillofac Surg.* 1998;27(4):286-9.
30. Al Ahmed HE, Jaber MA, Abu Fanas SH, Karas M. The pattern of maxillofacial fractures in Sharjah, United Arab Emirates: a review of 230 cases. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2004;98(2):166-70.

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