Dental Traumatology

Dental Traumatology 2011; **27**: 257–262; doi: 10.1111/j.1600-9657.2011.00996.x

Pattern of maxillofacial fractures at a tertiary hospital in northern India: a 4-year retrospective study of 718 patients

Sumir Gandhi, Laxman Kumar Ranganathan, Manisha Solanki, George C. Mathew, Inderjot Singh, Saurab Bither

Department of Oral & Maxillofacial Surgery, Christian Dental College, Christian Medical College, Ludhiana, Punjab, India

Correspondence to: Sumir Gandhi, Department of Oral & Maxillofacial Surgery, Christian Dental College, Christian Medical College, Ludhiana, Punjab, India
Tel.: +919814433393
Fax: +911612220410
e-mail: sumirgandhi@gmail.com

Accepted 17 February, 2011

Abstract – *Purpose*: Pattern and aetiology of maxillofacial injuries varies from one country to another and even within the same country depending on prevailing socio-economic, cultural and environmental factors. Various studies have been carried out in various countries to study the epidemiology and demographics of the maxillofacial injuries but the studies from India are few. *Material and methods*: Retrospective study was undertaken at Christian Medical College Ludhiana (India) from January 2006 to December 2009. Treatment records of the patients was checked and age, gender, aetiology of injury, associated injuries, maxillofacial fractures and treatment offered were recorded. *Results*: A total of 1075 fractures were recorded in 718 patients, ranging from 11 months to 85 years of age. Male:female ratio was 6.6:1. Maxillofacial injuries were most common in third decade of life. A total of 517 patients suffered injuries because of road traffic accident, 115 because of accidental fall and 67 because of interpersonal violence. A total of 184 patients had 221 associated injuries of which 56.1% head injuries, 29.0% orthopaedic injuries and 14.9% other injuries were present. Of 596 middle third fractures, 29.8% were managed conservatively; for 21.7% and 48.7% of fractures, closed reduction and open reduction were performed respectively. Of 479 mandibular fractures, 1.8% was managed conservatively; for 16.7% and 81.5% fractures, closed reduction and open reduction were performed respectively. *Conclusion*: Better socio-economic status of people, increased vehicular movements and non-implementation of road safety norms have increased road traffic accidents. Proper education of the people who are most commonly involved in the RTA can be one of the possible ways to reduce the maxillofacial injuries.

India has the second largest population of the world and is one of the emerging economies. It has people of different religion and different culture.

Maxillofacial region is very prone to injuries because of the prominence of the face and moreover, it is first area of attack in case of interpersonal violence. The aetiology of maxillofacial injuries varies from one country to another and even within the same country depending on the prevailing socio-economic, cultural and environmental factors (1–3). Developing business and emerging employment opportunities are increasing the per capita income of the country and hence increasing socio-economic status. Increasing road network and socio-economic status increase the movements of the population and hence increase in accidents and thereby leading to injuries.

Various studies have been carried out in various countries of world to study the epidemiology and demographics of the maxillofacial injuries but the studies from India are very few (1, 4, 5). Hence, this study was undertaken at one of the tertiary health centres of Ludhiana, which is the biggest city of Punjab state, from January 2006 to December 2009.

Methodology

Ludhiana is one of the biggest cities of the state of Punjab in the northern part of India and has a population of about 310,00,00.The Christian Medical College and Hospital, Ludhiana is a 112-year-old tertiary centre which gets referrals from the city, its adjoining villages and three neighbouring states. A retrospective study of maxillofacial injuries was undertaken at Christian Medical College and Hospital, Ludhiana. The files of all patients who had been treated for maxillofacial trauma between 1st January 2006 and December 31st 2009 were retrieved, reviewed and data extracted and documented on an Excel datasheet.

The variables documented include age, gender, cause of injury, nature of injuries and associated injuries if any (head injury, orthopaedic injury, ophthalmological or abdominal injury).For this study, the middle third was divided into dentoalveolar, nasal, zygomatic arch, zygomatico-maxillary complex (ZMC), Le Fort I, Le Fort II and Le Fort III regions, while the mandible was divided into dentoalveolar, symphysis, body, angle, ramus, condyle and coronoid regions.

Inclusion and exclusion criteria

All patients who reported to the emergency and trauma centre of CMC Hospital Ludhiana with maxillofacial fractures were included in the study. Patients who were admitted as well as those who were treated as outpatients were included in the study. However, patients who expired before examination, refused to undergo treatment, admitted with soft tissue injuries and readmitted with complications were excluded from the study.

Results

A total of 1075 fractures were recorded in 718 patients from January 2006 to December 2010. Data of 22 patients were incomplete and hence not included.

Age and gender distribution

The age of patients ranged from 11 months to 85 years. The mean age was 31.8 years with a standard deviation of 14.1.There was an overwhelming male preponderance in all age groups. The overall male:female ratio was 6.6:1.

Aetiology

A total of 517 (72.0%) patients suffered fractures because of road traffic accidents while accidental fall and interpersonal violence accounted for the fractures in 115 (16.0%) and 67 (9.3%) patients respectively. However, sports related injuries (n = 6, 0.8%), industrial injuries (n = 9, 1.3%) and trauma caused by animals (n = 4, 0.6%) were few in our series.

Road traffic accidents were the most common cause of injury in all age groups except the 0 to 10 age group where accidental falls were the most common cause of maxillofacial fractures. (Fig. 1).

Associated injuries

Of the total 718 patients, 184 patients [25.6%] studied had associated injuries; 56.1% (n = 124) of these were head injuries, 29.0% (n = 64) were orthopaedic injuries and 14.9% (n = 33) were other injuries (Ophthalmic, abdominal etc.). A total of 177 associated injuries were observed in 146 patients who suffered maxillofacial injuries due to RTA of these, 54.2% (n = 96) were head injuries and 26% (n = 46) were orthopaedic injuries (Fig. 2).

Anatomical sites of fractures

A total of 231 patients had isolated mandibular injuries while 394 patients had isolated middle third injuries. In 93 patients, middle third injuries were associated with mandibular injuries. Of these 70 patients (75.3%) suffered injuries due to road traffic accident.

A total of 324 patients suffered 479 mandibular fractures. Symphysis was the most commonly fractured site (n = 237, 49.5%) followed by angle (n = 88, 19.2%), condyle (n = 69, 14.4%), body (n = 47, 9.8%), dentoalveolar region (n = 35, 7.6%) and ramus (n = 3, 0.7%). There were no coronoid fractures in our series. Of the 237 symphysis fractures, 25 were midline symphysis fractures. The most common combination of injuries, among mandibular fractures, was that of the symphysis and angle (n = 49 patients) followed by symphysis and condyle (n = 38). (Table 1) Most common cause of mandibular injuries was road traffic accident (Table 2).

'In 487 patients, 596 middle third fractures were observed. The most common fracture was that of the ZMC and the nasal bone (n = 172, 28.9% each).This was followed by the Le fort II (n = 88, 14.8%), Le fort I (n = 60, 10.1%), dentoalveolar component (n = 52, 8.7%), Le Fort III (n = 27, 4.5%) and zygomatic arch (n = 25, 4.2%). A total of 133 patients had an isolated nasal fracture (Table 1). Most common cause of middle third fractures was road traffic accident (Table 2).

Treatment

For 204 symphysis fractures, 83 angle, 43 body, 39 condyle, three ramus and 18 dentoalveolar fractures

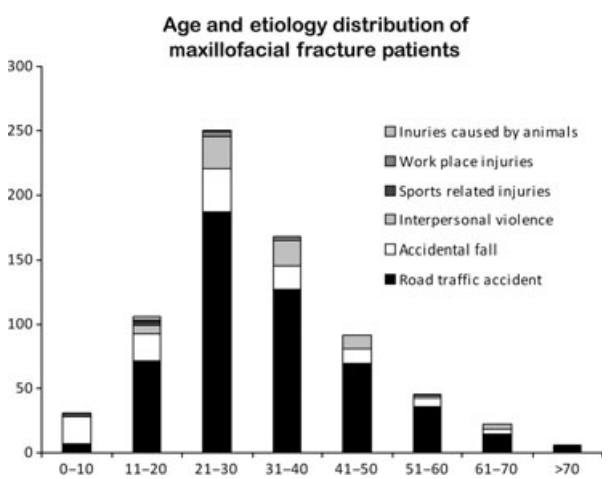

Fig. 1. Age and Aetiology distribution of maxillofacial fracture patients.

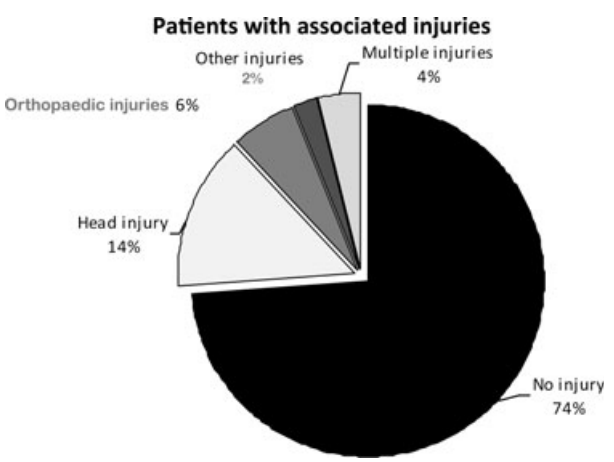

Fig. 2. Figure showing associated injuries in maxillofacial fracture patients.

Table 1. Site, age and gender distribution of maxillofacial injuries

Region	Anatomic site	0–10	11–20	21–30	31–40	41–50	51–60	61–70	>70	Male	Female	Total	Percentage	% of all fractures	% of patients
Mandible	Mandibular dentoalveolar	2	5	10	7	10	1	0	0	29	6	35	7.3	3.3	4.9
	Symphysis	16	45	87	54	16	9	8	2	214	23	237	49.5	22	33
	Body	3	8	19	10	3	3	1	0	38	9	47	9.8	4.4	6.5
	Angle	1	13	34	28	8	3	1	0	74	14	88	18.4	8.2	12.3
	Ramus	0	0	0	3	0	0	0	0	3	0	3	0.6	0.3	0.4
	Condyle	6	12	22	15	6	2	5	1	60	9	69	14.4	6.4	9.6
	Total mandible fractures	28	83	172	117	43	18	15	3	418	61	479	100.0	44.6	45.1
Middle Third	Maxillary dentoalveolar	3	9	20	12	3	5	0	0	35	17	52	8.7	4.8	7.2
	Le Fort I	1	7	24	12	10	3	2	1	52	8	60	10.1	5.6	8.4
	Le Fort II	2	8	36	20	11	6	4	1	81	7	88	14.8	8.2	12.2
	Le Fort III	0	2	13	6	2	2	2	0	26	1	27	4.5	2.5	3.8
	Nasal	5	30	55	40	22	13	6	1	147	25	172	28.9	16	23.4
	Zygomatico maxillary complex	4	21	68	36	23	13	5	2	154	18	172	28.9	16	23.4
	Zygomatic arch	0	0	9	4	7	4	0	1	22	3	25	4.2	2.3	3.5
	Total maxillary fractures	15	77	225	130	78	46	19	6	517	79	596	100.0	55.4	81.9
Total fractures		43	160	397	247	121	64	34	9	935	140	1075			

Table 2. Aetiology and distribution of maxillofacial fractures

	Site														
	Mandible							Maxilla							
Cause of injury	Dentoalveolar	Symphysis	Body	Angle	Ramus	Condyle	Total	Dentoalveolar	Nasal	Zygomatic arch	ZMC	Le Fort I	Le Fort II	Le Fort III	Total
RTA	23	158	35	62	2	38	318	35	115	22	140	52	77	23	464
Fall	6	52	5	18	0	26	107	12	22	3	17	7	8	3	72
IPV	5	15	4	7	1	3	35	4	30	0	13	1	1	0	49
Sports-related injuries	1	4	1	0	0	0	6	0	2	0	0	0	0	0	2
Work place injuries	0	5	1	0	0	2	8	1	3	0	2	0	2	1	9
Injuries caused by animals	0	3	1	1	0	0	5	0	0	0	0	0	0	0	0
Total	35	237	47	88	3	69	479	52	172	25	172	60	88	27	596

ZMC, zygomatico-maxillary complex.

open reduction and fixation was performed. For 30 symphysis, 28 condylar fractures, four angle, 15 dentoalveolar and three body fractures closed reduction was performed. However, no treatment was given for two dentoalveolar, three symphysis, one angle, one body and two condylar fractures. (Table 3).

One dentoalveolar, 76 nasal fractures, 14 zygomatic arch fractures, 72 ZMC, 10 Le fort I and four Le Fort II fractures were not treated. Thirty eight dentoalveolar, 72 nasal, two zygomatic arch, 10 ZMC, two Le Fort I, four Le fort II, and one Le fort III fractures were managed with closed reduction.

Thriteen dentoalveolar, 24 nasal fractures, nine zygomatic arch fractures, 90 ZMC fractures, 48 Le Fort I fractures, 80 Le Fort II fractures and 26 Le Fort III fractures were managed with open reduction and fixation (Table 4).

Discussion

Maxillofacial injuries are becoming very common in the urban as well as rural areas. There has been a changing trend in the developing countries (2) as well as in the developed countries. Change in socio-economic status is largely responsible for the changes in pattern. In the developed nations, the major cause of the injuries is the interpersonal violence (2, 6) while in the developing nations it is mainly attributed to road traffic accidents (2, 6, 7). Strict road traffic laws and implementation of safety norms like mandatory seat belts, air bags, helmet wearing for motorized two-wheelers and speed limits have greatly reduced maxillofacial injuries due to RTA in the developed countries (8, 9). But in developing countries like India, traffic and safety laws are not implemented strictly, hence RTA is responsible for 72.0% maxillofacial fractures in our study. In a study conducted by Sawhney and Ahuja (5) in Chandigarh (which is the capital of Punjab state and represents almost the same population as of Punjab), 50% of cases had maxillofacial trauma due to RTA. This truly proves that increase in socio-economic status of people in the last 22 years has led people to own the cars and two-wheelers and hence an increase in RTA is observed. In a study conducted by Bither1 in a rural population with mandibular fractures, only 42.9% cases had RTA while interpersonal violence had accounted for 20.68% of cases. A difference in socio-economic status and lesser vehicular movements in rural areas explain the lower percentage of RTA while unemployment, alcohol consumption, narcotic abuse and illiteracy are the reasons attributed for interpersonal violence (3, 9, 10). However, in similar studies conducted by Chandra Shekhar and Reddy (4) and Subhasraj et al. (7) on urban population, 60.0% and 61.3% maxillofacial injuries were caused by road traffic accidents.

Second most common cause in developed countries is sports related injuries (6, 7) while in developing countries, interpersonal violence is the second leading cause of maxillofacial injuries (6, 9) but in our study the second most common reason for the injury was accidental falls (16.0%), Al Khateeb & Abdullah (2) and Cheema & Amin (6) has also reported fall as the second most common reason for facial injuries in their study. Contact sports are not very popular in this part of the country and hence very few sports related injuries (0.8%) were observed in our study as well as previously reported studies from India (1, 4), Pakistan (6) and United Arab Emirates (2).

The incidence of work place injuries varies between 1% and 12% in the literature (11). We had found few ($n = 9$, 1.3%) work place injuries in our series. One case of a 12-year-old male child was reported, who suffered work place injury. Despite Union Government of India having passed the legislation against the child labour, such practices are common. Poverty, illiteracy and lack of implementation of laws are the factors for the same.

Other injuries associated with maxillofacial fractures reported in our study were 25.6% cases which are higher than that in various studies in Nigerian (12) and UAE (13) series which reported 23% and 22.2% associated injuries respectively. High number of maxillofacial fractures due to RTA and a higher incidence of associated injuries, in our study, clearly indicate poor traffic and safety law implementation.

Predominance of men in such patient population is a relatively consistent finding in most of the studies. Male:female ratio of 6.6:1, as in our study, is comparable with all such studies in which it varies from 2:1 to 8:1(3, 4, 7, 9). This is attributed to the fact that men are involved in most of the outdoor activities and work in India and most of the women especially in rural areas are confined to the house works. Male vehicle drivers outnumber female drivers (2, 4). Recent literature shows a trend towards a more equal male-to-female ratio 9. This trend can be attributed to a changing workforce and the fact that increasing numbers of women are working outdoors in more high-risk occupations, thus becoming

Table 3. Anatomical sites and treatment of mandibular fractures

	No treatment		Closed reduction		Open reduction		Total	
Mandibular fracture	Number of patients	% age of patients	Number of patients	% age of patients	Number of patients	% age of patients	Number of patients	% age of patients
Dentoalveolar	2	0.4	15	3.1	18	3.8	35	7.3
Symphysis	3	0.6	30	6.3	204	42.6	237	49.5
Body	1	0.2	3	0.6	43	9.0	47	9.8
Angle	1	0.2	4	0.8	83	17.3	88	18.3
Ramus	0	0	0	0	3	0.6	3	0.6
Condyle	2	0.4	28	5.9	39	8.2	69	14.5
Total	9	1.8	80	16.7	390	81.5	479	100

Table 4. Anatomical sites and treatment of middle third injuries

Middle third fractures	No treatment		Closed reduction		Open reduction		Total	
	Number of patients	% age of patients	Number of patients	% age of patients	Number of patients	% age of patients	Number of patients	% age of patients
Dentoalveolar	1	0.2	38	6.4	13	2.2	52	8.8
Nasal	76	12.8	72	12.1	24	4.0	172	28.9
Zygomatic arch	14	2.3	2	0.3	9	1.5	25	4.1
ZMC	72	12.1	10	1.7	90	15.1	172	28.9
Le Fort I	10	1.7	2	0.3	48	8.1	60	10.1
Le Fort II	4	0.7	4	0.7	80	13.4	88	14.8
Le Fort III	0	0	1	0.2	26	4.4	27	4.6
Total	177	29.8	129	21.7	290	48.7	596	100

ZMC, zygomatico-maxillary complex.

more exposed to RTAs and other causes of maxillofacial fracture (2).

Major cause of trauma in women has been due to road traffic accident followed by accidental falls, while no case has been reported with domestic violence. Arosarena et al. (14) suggested that most of the females who suffer injuries due to domestic violence report their injuries due to fall. Lesser nuclear families and live in relations are probably the reasons for low domestic violence incidence in India.

In terms of age groups, facial fractures occur most frequently in people of third decade which is in concurrence with the other studies (3, 6, 8–10). In our series, highest number of men and women (30.4% and 4.5% of total cases) suffered trauma in this age group. The most likely reason for this is that they are more socially interactive than other age groups (3). Proper education to these groups may reduce their involvement in such accidents (7). As a result of increasing active elderly population, more maxillofacial injuries occur in the population than ever before. The absolute increase in trauma victims in the elderly population relates to more active lifestyles, increased life expectancy and a general increase in the percentage of elderly persons in the population (2).

In this study, middle third was the most commonly fractured than mandible which is in concurrence with study conducted by Subhasraj et al. (7) but in contrast to studies conducted by Bakardjiev et al. (8) and Keiser et al. (15), who have reported mandible to be commonly fractured than maxilla.

In terms of individual bones, ZMC (28.9%) was the commonest bone to be fractured in middle third which is consistent with the literature (2, 6, 10). In accordance with various previous studies, Symphysis (22.0%) was commonest site to be fractured in mandible (1, 7).

Our study had low incidence of Nasal fractures (16.0%) which is in concurrence with various studies conducted by Subhasraj et al. (7), Bakardjiev & Pechalova (8), Ugboko et al. (10) and Al Khateeb & Al-Khateeb (2), who had also reported low incidence of nasal factures (8%, 4%, 11% and 18.1% respectively). Higher incidence of nasal fractures (42.5%) in a study from Korea is attributed to more violence in that region (3).

All such studies including our study have reported very few cases of dentoalveolar injuries (6, 7) (n = 86) and Isolated condylar fractures (n = 13). Incidence of condylar fractures is relatively low when compared with studies by Van Baek and Merkx (9) (46%) and Chandra Shekar and Reddy (4) (36.7%).This is probably attributed to the reason that such patients are usually treated at smaller hospitals and remain unreported.

A total of 390 mandibular injuries (81.4%) and 290 middle third injuries (48.7%) were treated with open reduction and fixation. Increasing expertise of the surgeons and better infrastructure in developing countries led to increased number of patients undergoing open reduction and fixation in the recent times than to past (4).

Our results exhibit that due to better socio-economic status of Indian population in the last two decades have changed the pattern of maxillofacial injuries as road traffic accidents have become the major cause of maxillofacial injuries. Periodic verification of the aetiology of maxillofacial injuries helps us to recommend ways in maxillofacial injuries can be averted (6). Moreover, Proper education and strict implementation of road safety laws can reduce the road traffic accidents as all types of injuries accompany with loss of working hours and increase in litigation and hence act as a deterrent to the rising economy of the country.

Acknowledgements

Authors are thankful to Dr Mini Elizabeth Jacob, Assistant Professor Department of Community Medicine, Christian Medical College for doing statistics for the study.

Conflict of interest

Nil.

References

1. Bither S, Mahindra U, Halli R, Kini Y. Incidence and pattern of mandibular fractures in rural population: a review of 324 patients at a tertiary hospital in Loni, Maharashtra, India. Dent Traumatol 2008;24:468–70.
2. Al-Khateeb T, Abdullah FM. Craniomaxillofacial injuries in the United Arab Emirates: a retrospective study. J Oral Maxillofac Surg 2007;65:1094–101.
3. Lee JH, Cho BK, Park WJ. A 4-year retrospective study of facial fractures on Jeju, Korea. J Craniomaxillofac Surg 2010;38:192–6.

4. Chandra Shekar BR, Reddy C. A five-year retrospective statistical analysis of maxillofacial injuries in patients admitted and treated at two hospitals of Mysore city. Indian J Dent Res 2008;19:304–8.
5. Sawhney CP, Ahuja RB. Faciomaxillary fractures in north India. A statistical analysis and review of management. Br J Oral Maxillofac Surg 1988;26:430–4.
6. Cheema SA, Amin F. Incidence and causes of maxillofacial skeletal injuries at the Mayo Hospital in Lahore, Pakistan. Br J Oral Maxillofac Surg 2006;44:232–4.
7. Subhasraj K, Nandakumar C, Ravindran C. Review of maxillofacial injuries in Chennai, India: a study of 2748 cases. Br J Oral Maxillofac Surg 2007;45:637–9.
8. Bakardjiev A, Pechalova P. Maxillofacial fractures in Southern Bulgaria—a retrospective study of 1706 cases. J Craniomaxillofac Surg 2007;35:147–50.
9. Van Beek GJ, Merkx CA. Changes in the pattern of fractures of the maxillofacial skeleton. Int J Oral Maxillofac Surg 1999;28:424–8.
10. Ugboko VI, Olasoji HO, Ajike SO, Amole AO, Ogundipe OT. Facial injuries caused by animals in northern Nigeria. Br J Oral Maxillofac Surg 2002;40:433–7.
11. Eggenspeger NM, Heinz Z, Iizuka T. Occupational maxillofacial fractures: a 3-year survey in Central Switzerland. J Oral Maxillofac Surg 2006;64:270–6.
12. Oji C. Jaw fractures in Enugu, Nigeria, 1985–95. Br J Oral Maxillofac Surg 1999;37:106.
13. Klenk G, Kovacs A. Etiology and pattern of facial fractures in the United Arab Emirates. J Craniofac Surg 2003;14:78.
14. Arosarena OA, Fritsch TA, Hsueh Y, Aynehchi B, Haug R. Maxillofacial injuries and violence against women. Arch Facial Plast Surg 2009;11:48–52.
15. Kieser J, Stephenson S, Liston PN, Tong DC, Langley JD. Serious facial fractures in New Zealand from 1979 to 1998. Int J Oral Maxillofac Surg 2002;31:206–9.