



RESEARCH ARTICLE

INCIDENCE, AETIOLOGY AND PATTERN OF MANDIBLE FRACTURES IN SONEPAT,
HARYANA (INDIA)

*Dr. Sunita Malik and Dr. Gurdarshan Singh

Department of Dental Surgery, B.P.S Govt. Medical College and Hospital for Women, Khanpur Kalan,
Sonapat, Haryana, India

ARTICLE INFO

Article History:

Received 05th January, 2013
Received in revised form
25th February, 2014
Accepted 09th March, 2014
Published online 23rd April, 2014

Key words:

Mandibular fracture,
Traffic accident,
Assaults,
Open reduction and
Internal fixation.

ABSTRACT

Background: Maxillofacial fractures are often associated with considerable long-standing functional, aesthetic and mental complications. Mandible is one of the most common facial fracture. As the numbers of cases are rising in recent years, the present study was aimed to describe Incidence, aetiology and pattern of mandibular fractures in Sonapat.

Materials and methods: A prospective Medical institute based study of maxillofacial injury patients was carried out from September 2011 to February 2013 at newly started B.P.S Government Medical College for women, Khanpur kalan, Sonapat. Patients data including sexual category, age, cause, fracture site and pattern were collected and analyzed.

Results: There were a total of 474 patients with 86 mandibular fractures. Males outnumbered females by a ratio of 2.9:1. Age range was 9 months to 72 years with the peak incidence occurring in the age group 18-34 years. Most injuries were caused by Road traffic accident (48.83 per cent), followed by assault (26.74 percent) and sport (13.95 per cent). Prominent site of mandibular fracture was Parasymphysis (27.90%) followed by Angle (24.41%) and body (18.60%). 30.23% of patients with mandible fractures were having multiple fracture sites. Also 10% of patients with mandible fracture had mid-facial fractures associated with it. Closed reduction was done in 13.6% of patients, Open reduction and internal fixation was performed in 46.4% of cases and 18.1% were managed conservatively. The mean duration of hospital stay was 10.14 ± 6.34 days.

Conclusion: This study highlights the importance of Dental surgery in the management of maxillofacial injuries. Moreover there is a need to reinforce legislation and the total enforcement of existing laws to reduce maxillofacial injuries among children and adults.

Copyright © 2014 Dr. Sunita Malik and Dr. Gurdarshan Singh. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

INTRODUCTION

One of the most prominent position in the human body is the maxillofacial region which renders it susceptible to injuries quite commonly (Wasiu *et al.*, 2005). Maxillofacial injuries are regularly encountered in the practice and are often associated with high morbidity resulting from increased expenses of care. These injuries have remained the topic of discussion among researchers due to varying degrees of physical, functional and cosmetic defacement. The sheer rapidity of contemporary life with express travel as well as progressively more violent and intolerant society has made facial trauma a form of societal disease from which no one is protected. There are changes in patterns of facial injuries, extent, clinical features, and so forth resulting in mild-to massive disfigurement of maxillofacial skeleton along with functional loss. Mandibular fractures are one of the most-frequent facial injuries encountered at a trauma centre. According to several studies, they account for

15.5% to 59% of all facial fractures (Brook and Wood, 1983; Ellis *et al.*, 1985; Scherer *et al.*, 1989; Van Hoof *et al.*, 1977). The epidemiological data for facial and mandibular fractures varies among countries and changes in due course. The aetiology of cranio-maxillofacial injuries varies from country to country and is multi-factorial, that can usually be attributed to socio-economic, demographic, cultural, technological and environmental factors. Therefore, the main mechanism of injury for mandible fractures is inconsistent in the literature (Edwards *et al.*, 1994; Oikarinen *et al.*, 1993; Gilthorpe *et al.*, 1999). Interpersonal violence is the most common cause for mandibular fractures in North-American countries (Fridrich *et al.*, 1992; King *et al.*, 2004; Ogundare *et al.*, 2003; Simsek *et al.*, 2007), North European countries (Ellis *et al.*, 1985; Depprich *et al.*, 2007; Oikarinen *et al.*, 2004), Australia (Allan and Daly, 1990; Schön *et al.*, 2001) and New Zealand (Kieser *et al.*, 2002; Lee, 2008). In newly industrialising and less developed countries such as Jordan (Bataneh, 1998) or Nigeria (Oji, 1999), road-traffic accidents are the most common cause for mandibular fractures. The management of injuries to the maxillofacial complex demands both skill and a high level of expertise, thus remains a challenge for oral and

*Corresponding author: Dr. Sunita Malik

Department of Dental Surgery, B.P.S Govt. Medical College and
Hospital for Women, Khanpur Kalan, Sonapat, Haryana, India

maxillofacial surgeons (Kamulegeya *et al.*, 2009; Al Ahmed *et al.*, 2004). Treatment of mandibular fractures has changed over the last 20 years in Western societies. The use of wire osteosynthesis and intermaxillary fixation has decreased and the preference is for open reduction and internal fixation with miniplates (Rix *et al.*, 1991; Renton *et al.*, 1996). This has helped in reducing malocclusion, non-union, improved mouth opening, speech and oral hygiene, decreased weight loss and increased the ability for patients to return to work earlier (Rix *et al.*, 1991; Hayter and Cawood, 1993). However, in resource-limited countries like ours, lack of expertise and facilities for open reduction and internal fixation and late presentation are a major problem in achieving acceptable cosmetic results in maxillofacial trauma patients. Sonapat district is a part of the Eastern Haryana Plain and area of 2260 Km² with estimated population of 1,480,080. The district has 328 villages and 6 towns. Most of the population lives in rural area. B.P.S Government Medical college for women, Khanpurkalan, Sonapat is the major maxillofacial trauma centre in the district. So a prospective study was conducted for a period of 18 months from September 2011 to February 2013 to assess the incidence, aetiology and pattern of mandibular fractures in sonapat (Haryana).



Fig.1. Map of Sonapat

Limited information is available regarding mandibular fracture patterns in Haryana (India), and no previous study particularly pertaining to mandibular fractures has been undertaken in Sonapat, India. The aim of the study was to examine the incidence, aetiology, age, sex, anatomical distribution and treatment of mandibular fractures presenting to the trauma centre in rural arena and to compare these with other studies. The results may aid in identifying aetiological factors and in scheduling strategies for prevention. Moreover to suggest the needs to improve safety standards and to educate the younger generation to prevent maxillofacial injuries.

MATERIALS AND METHODS

The prospective study was conducted in the Department of Dental Surgery. Data were collected from consecutive patients (with maxillofacial injuries) attending the Accident and Emergency Department as well as in Outpatient Department of Dental Surgery at B.P.S Government Medical College for women for a period from September 2011 to February 2013 and analyzed. A pre-tested questionnaire was used to record the data. Data collected included: patient's demography; cause, type, time and place of injury; status of prehospital care; mode

of arrival in the hospital; associated injuries; sternness of injury (GCS); treatment modalities and treatment outcome (i.e. post-operative complications, length of hospital stay and mortality). Information relevant to the study was obtained from the patient directly; when this was not possible, collateral history was obtained from either the police or relatives attending to the patients. Detailed clinical examination was done to record the soft tissue lacerations, tooth injuries, number and site(s) of fracture(s) Mandible, Associated injuries etc. The diagnosis was based on clinical and radiological findings. In relevant cases CT Scan and USG was done to rule out foreign bodies. The aetiological factors were divided into Road traffic accidents, assault and injury associated with fall, injuries due to variety of causes including sports, occupational and other related injuries (Dog bite, monkey bite, gunshot injuries etc). Data regarding prevalence, age and sex distribution, causes, types and site of injury, treatment modalities and trauma associated complications were reviewed and analyzed in detail emphasizing the importance of early management of Mandible fracture to prevent functional as well as aesthetic deformities.

RESULTS

In our study, total number of trauma patients reporting the Accident and Emergency Department and Outdoor Patient Department of Dental Surgery Unit of B.P.S Government Medical College for women were 474 with 86 mandibular fractures during 18 months period from September 2011 to February 2013.

Age and sex distribution

Patient age at the time of injury ranges from 9 months to 72 years. In most cases, the patient was between 17 to 34 years. Most of the patients were male (65:21) with male female ratio (3:1).

Table 1. Age and sex distribution

Age and gender distribution			
S.no	Age-group	Male	Female
1	0-17	10	3
2	18-34	25	9
3	35-51	17	5
4	52-68	9	3
5	69 and above	4	1
Total		65	21

Aetiology of mandibular fractures

The most common cause of mandibular fractures was Road traffic accident (48.83 per cent), followed by Assault (26.74 percent) and sport (13.95 per cent). In 9 (10 per cent) of the total patients (86), the mandibular fractures were associated with mid-facial fractures, and 77 patients (90 per cent) involved only the mandible. Of the mandibular fractures also involving the mid-facial area, Road Traffic accident had the highest incidence of 52 per cent, 44 per cent were caused by assaults and 4 per cent by a fall. No associated mid-facial fractures occurred in the other categories of aetiology.

Table 2. Aetiology of Mandibular fractures

Aetiology of Mandibular Fractures		
Cause	No.of cases	Percentage
Road traffic accident	42	48.83
Assault	23	26.74
Sport	12	13.95
Fall	5	5.81
Occupational	3	3.48
Miscellaneous	1	1.16
Total	86	100

Figure 2. Aetiology of mandibular fractures

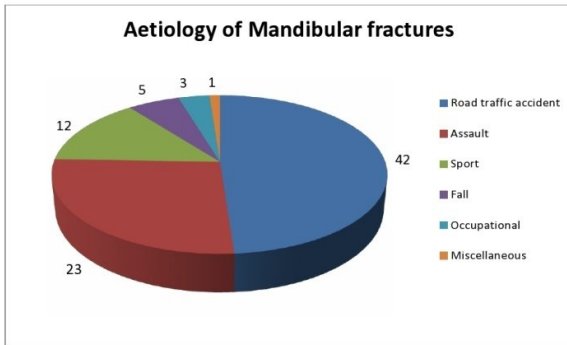
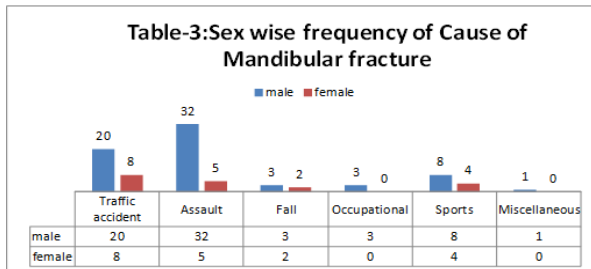


Table 3. Sex wise distribution of mandibular fracture



Anatomical location of mandibular fractures

The most prominent site of mandibular fracture was Parasymphysis (23.25%) followed by Angle (17.44%), body (12.79%), symphysis (8.13%), condyle (5.81%), ramus (2.32%) and coronoid (1.16%). 18.60% of patients had more than one fracture site. There was no significant difference between the right side (48.8 per cent) and the left side (51.2 per cent) of the mandible. The mandible had a single fracture in 53 per cent of the patients, 40.6 per cent had two fractures, 4.8 per cent three fractures, and 0.8 per cent had greater than three fractures

Table 3. Anatomical location of mandibular fractures

Anatomical location of mandibular fractures		
Site of fracture	Total	Percentage
1. Parasymphysis	20	23.25
2. Condyle	5	5.81
3. Angle	15	17.44
4. Body	11	12.79
5. Symphysis	7	8.13
6. Ramus	2	2.32
7. Coronoid	1	1.16
8. Combination (more than one site)	26	30.23
Total	86	100

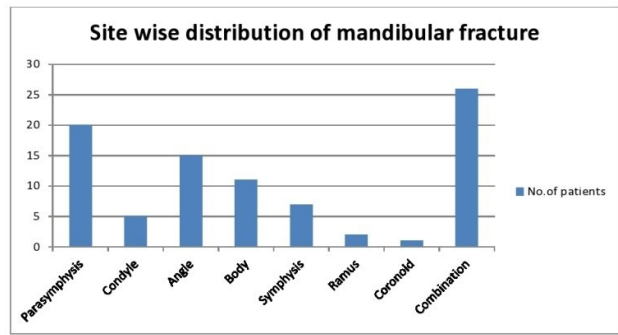


Figure 3. Sitewise distribution of mandibular fractures

Mandibular fracture pattern combinations

There were 26 different mandibular fracture combinations involving more than one fracture. The most common pattern combinations were angle/parasymphysis (34.61 per cent), followed by body/angle (30.76 per cent), subcondyle/parasymphysis (15.38 per cent) and subcondyle/body (11.53 per cent). Of the patients assaulted, the body/angle (40 per cent) was the predominant combination, followed by the angle/parasymphysis (30 per cent) and the subcondyle/parasymphysis (20 per cent).

Of the patients involved in sport the angle/parasymphysis (50 per cent) was the most common combination. Sports usually resulted in single fractures of the mandible, whilst RTA patients were dispersed over all the different combinations and single fractures.

Table 4. Mandibular fracture pattern combinations and aetiology

Mandibular fracture pattern combinations and aetiology					
Fracture	Assault	RTA	Sport	other	Percentage
Multiple/Combination fractures					
Body/angle	4	2	1	1	30.76
Angle/Parasymphysis	3	3	2	1	34.61
Subcondyle/body	1	1	1	1	15.38
Subcondyle/Parasymphysis	2	1	0	0	11.53
Other	1	1	0	0	7.69
Total	10	8	4	4	100

Month wise distribution of mandibular fractures

The monthly distribution showed January to have the highest incidence, followed closely by July. The lowest incidence was September.

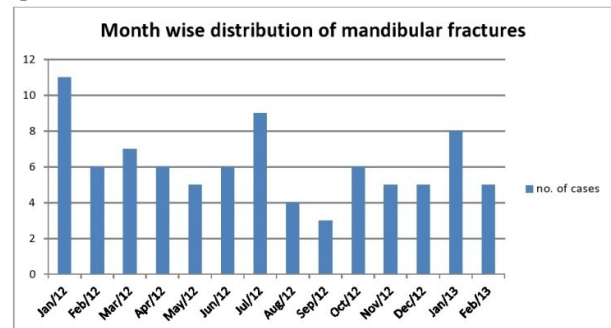


Figure 4. Month wise distribution of mandibular fractures

Treatment of mandibular fractures

Primary management of soft tissue injuries included suturing, pressure dressing, splinting of bony fragments, which was done in casualty department and further definite intervention in mandibular fracture with close or open reduction and follow up was done in department of Dental surgery BPSGMC, Khanpur kalan, Sonapat. The majority of patients with mandibular fractures were treated by open reduction and internal fixation (ORIF) with miniplates (46.4 per cent). There were 21.9 per cent whom also had ORIF, followed by postoperative intermaxillary fixation (IMF). These patients had multiple fractures and in most cases it involved the subcondyle region. Conservative treatment (18.1 per cent) usually involved a soft diet, analgesia, \pm diazepam, \pm antibiotics, and the patient was regularly observed over a six week period. Closed reduction was the treatment of least choice in 13.6 per cent of the patients, this involved a nonsurgical approach of IMF, using eyelet wires or archbars and wire or elastics for four to six weeks.

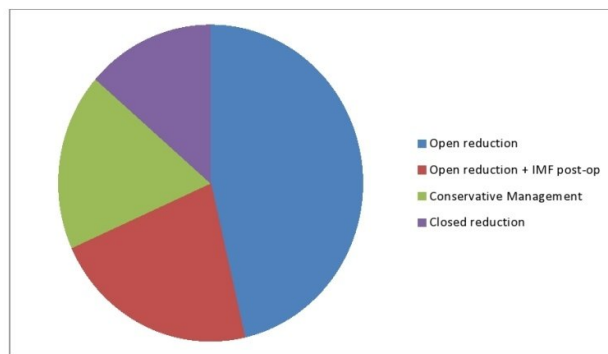


Figure 5. Treatment of mandibular fractures

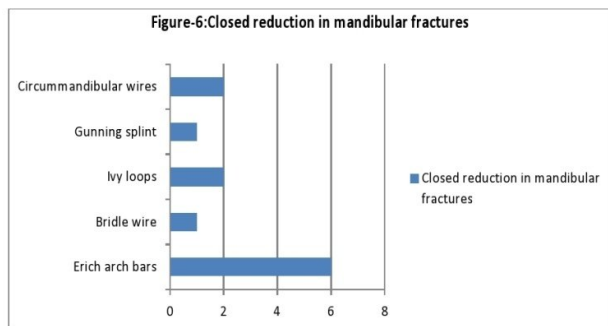


Figure 6. Closed reduction in mandibular fractures

The overall length of hospital stay ranged from 1 day to 26 days (mean stay: 10.14 ± 6.34 days). Patients with multiple maxillofacial fractures, associated injuries, maxillofacial burn and those with associated lower limb fractures had significantly longer hospital stay. The standard regimen of parental antibiotics was used beginning at the time of admission with amoxicillin (500 mg), cefotaxim 1 gm and metronidazole (500 mg) administered intravenously followed by the same antibiotics administered orally after 48 hours or at the time of discharge. In some patients who reported late with post-traumatic residual deformities and complications because of some reasons were also managed accordingly.

DISCUSSION

Maxillofacial injuries have continued to generate discussion among researchers all over the world due to functional and cosmetic deformities that affected individuals have to assert with. The aetiology and pattern of maxillofacial injuries vary from one geographical area to another depending upon the socioeconomic status, geographic condition and cultural characteristics (Leles *et al.*, 2010; Umar *et al.*, 2010; Wimon and Kasemsak, 2008). The predominance of injured males in the age group 18-34 years is consistent with the findings of published work (Kamulegeya *et al.*, 2009; Al Ahmed *et al.*, 2004; Leles *et al.*, 2010; Umar *et al.*, 2010). It may be credited to the fact that people in this period of life are more active regarding sports, fights, violent activities, industry and high speed transportation. The low frequencies in the very young and old age groups are due to the low activities of these age groups. The male predominance in our study agrees with what is reported in literature around the world, which had a male to female ratio of approximately 3:1 (Kamulegeya *et al.*, 2009; Al Ahmed *et al.*, 2004; Umar *et al.*, 2010; Qudah *et al.*, 2005). Males are at greater risk due to their greater participation in high risk activities which increases their exposure to risk factors such as driving vehicles, sports that involve physical contact, an active social life and drug use, including alcohol.

In our study the most common cause of mandibular fractures was Road traffic accident (48.83 per cent), followed by assault (26.74percent) and sport (13.95 per cent). These findings were converse to those found by Edwards *et al.* (1994); Dongas *et al.* (2002); Olosoji *et al.* (2002); Adi *et al.* (1990) and Ellis *et al.* (1985). These studies reported assault as the most common cause of fracture though incidence rate in these studies were around 55%. The assault rates reported by Rix *et al.* (72.5 percent) in Sydney, Australia (Rix *et al.*, 1991) and Asadi *et al.* (74 percent) in Manchester, United Kingdom, (Asadi and Asadi, 1997) are two of the highest reported. Both stated that the effects of social behaviour and alcohol, complicated by everyday stresses of residing in large city areas are associated with the increase in interpersonal violence. An earlier study by Larsen *et al.* (1976) in Denmark showed that MVA (57 per cent) were the most common cause of mandibular fractures, and that assaults accounted for 16 per cent. The present study shows that the most common cause of maxillofacial injuries was road traffic accidents, which is consistent with other studies in developing countries (Kamulegeya *et al.*, 2009; Umar *et al.*, 2010; Wimon and Kasemsak, 2008; Sunita Malik *et al.*, 2012).

These etiological differences reflect differences in socioeconomic factors, national infrastructure development (particularly roadways, traffic regulations and legislation), and other behavioral practices such as alcohol consumption and other criminal activities. The high number of maxillofacial injuries attributed to RTA in our study is attributed to inadequate road safety awareness; unsuitable road conditions without expansion of the motor work network; violation of the speed limit; old vehicles without safety features such as antibursts locks and energy absorbing materials; failure to wear seatbelt or helmets; violation of the right of the way; violation of the highway code; use of alcohol or other

intoxicating agents; inexperienced, young drivers; behavioural disorders and socio-cultural insufficiencies of some drivers. Mid-facial fractures were associated with only 10% cases of mandible fracture. Road traffic accidents were the predominant cause of mandibular fractures associated with a mid-facial fracture, as seen in other studies (Adi *et al.*, 1990; Larsen and Nielsen, 1976). In our study, the most common site of fracture in mandible was paramedian fracture (23.25%). These findings are consistent with the findings of study done by King *et al.*¹⁰ which founded a statistical significance between road traffic accidents and parasymphysis fractures. Atanasov (2003), Wong (2000) reported that motorcycle accidents (79.5%) were the major cause for fracture of mandible and the parasymphysis was the most common fracture site. Sunita malik *et al* (2012) also founded parasymphysis as the most common site of fracture in the mandible. But our study was not consistent with the findings of the study conducted by Adekeye (1980), Nair *et al.* (1986) and Adebayo *et al.* (2003) who reported the body as the most prominent site. Van Beek *et al.* (1999) found condyle as the most common site. Chalya *et al* (2011) founded angle as the most prominent site of fracture. The most common mandibular fracture combinations in this study were angle/parasymphysis followed closely by angle/body.

These often occurred as a result of assaults, with the mandible presumably fracturing in areas deficient in strength. This finding is consistent to Dongas and Hall³² who found parasymphysis with angle. This is in contrast to the study by Abiose (1986) in which the body bilaterally was reported as the most frequent mandibular fracture combination. However, RTA presented to be the most common cause in that study as is the case with our study too. O Gundare *et al* (2003) reported body with angle as the commonest combination. More fractures occurred in January than any other month – these mainly occurred in early January, when the winter season is at its full bloom with dense fog leading to RTA and also it coincides with marriage season so indulgence towards alcohol and Assaults increases. Mandibular fractures also prevailed in the month of July, which coincides with the Rainy season in Haryana, India.

There are many treatment regimens in maxillofacial fractures, but the treatment chosen may differ depending on many factors like cost of treatment, affordability by the patient, feasibility in the hospital, doctor's decision and skill, patient's willingness to avail the treatment advised - all of which may vary from one country to another. Majority of the patients treated in our hospital had closed reduction with arch bar fixation as the treatment and few patients were treated with open reduction and internal fixation, which is consistent with the studies conducted by Kamulegeya *et al* (2009), Chandra (2008), Erol *et al* (2004), Kilasara *et al* (2006) and Sunita Malik *et al.*³⁸ Open reduction and internal fixation has been reported to be the "gold standard" of treatment of maxillofacial fractures. However, this form of treatment has not become popular in our environment due to lack of expertise (i.e. maxillofacial surgeons) and facilities for open reduction and internal fixation are not readily available; and where available, the cost of treatment is usually quite prohibitive. The average length of hospital stay (LOS) in our study (10.14days) was found to be

shorter than that reported by Martins Junior *et al* (2010), Chalya *et al* (2011).

Conclusion

Road traffic accidents (RTA) was the major etiological factor of maxillofacial injuries in our setting and the young adult males were the main victims. In our study large number of trauma victims with maxillofacial injuries highlights the importance of Dental Surgery unit along with other disciplinaries for the emergency management of these patients to prevent functional as well as esthetic morbidity.

REFERENCES

- Wasiu LA, Akinola LL, Mobolanle OO, Olutayo J. Trends and characteristics of oral and maxillofacial injuries in Nigeria: a review of the literature. *Head & Face Medicine* 2005; 1:1-9.
- Brook IM, Wood N. Aetiology and incidence of facial fractures in adults. *Int J Oral Surg* 1983;12(5):293-8.
- Ellis E 3rd, Moos KF, el-Attar A. Ten years of mandibular fractures: an analysis of 2,137 cases. *Oral Surg Oral Med Oral Pathol* 1985; 59(2):120-9.
- Scherer M, Sullivan WG, Smith DJ Jr, Phillips LG, Robson MC. An analysis of 1423 facial fractures in 788 patients at an urban trauma center. *J Trauma* 1989; 29(3):388-90.
- Van Hoof RF, Merckx CA, Stekelenburg EC. The different patterns of fractures of the facial skeleton in four European countries. *Int J Oral Surg* 1977; 6(1):3-11.
- Edwards TJ, David DJ, Simpson DA, Abbott AA. Patterns of mandibular fractures in Adelaide, South Australia. *Aust NZ JSurg* 1994;64:307-311.
- Oikarinen K, Ignatius E, Kauppi H, Silvennoinen U. Mandibular fractures in Northern Finland in the 1980's – A 10-year study. *Br J Oral Maxillofac Surg* 1993;31:23-27.
- Gilthorpe MS, Wilson RC, Moles DR, Bedi R. Variations in admissions to hospital for head injury and assault to the head Part 1: Age and gender. *Br J Oral and Maxillofac Surg* 1999;37:294-300.
- Fridrich KL, Pena-Velasco G, Olson RA. Changing trends with mandibular fractures: a review of 1,067 cases. *J Oral Maxillofac Surg* 1992;50(6):586-9.
- King RE, Scianna JM, Petruzzelli GJ. Mandible fracture patterns: a suburban trauma center experience. *Am J Otolaryngol* 2004;25(5):301-7.
- O Gundare BO, Bonnick A, Bayley N. Pattern of mandibular fractures in an urban major trauma center. *J Oral Maxillofac Surg* 2003;61(6):713-8.
- Simsek S, Simsek B, Abubaker AO, Laskin DM. A comparative study of mandibular fractures in the United States and Turkey. *Int J Oral Maxillofac Surg* 2007;36(5): 395-7.
- Depprich R, Handschel J, Hornung J, Meyer U, Kübler NR. Causation, therapy and complications of treating mandibular fractures – a retrospective analysis of 10 years. *Mund Kiefer Gesichtschir* 2007;11(1):19-26.
- Oikarinen K, Schutz P, Thalib L, Sándor GK, Clokie C, Meisami T, *et al.* Differences in the etiology of mandibular fractures in Kuwait, Canada, and Finland. *Dent Traumatol* 2004; 20(5):241-5.

- Allan BP, Daly CG. Fractures of the mandible a 35-year retrospective study. *Int J Oral Maxillofac Surg* 1990; 19(5):268-71.
- Schön R, Roveda SI, Carter B. Mandibular fractures in Townsville, Australia: incidence, aetiology and treatment using the 2.0 AO/ASIF miniplate system. *Br J Oral Maxillofac Surg* 2001;39(2):145-8.
- 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(2):206-9.
- Lee KH. Epidemiology of mandibular fractures in a tertiary trauma centre. *Emerg Med J* 2008;25(9):565-8.
- Bataineh AB. Etiology and incidence of maxillofacial fractures in the north of Jordan. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 1998;86(1):31-5.
- Oji C. Jaw fractures in Enugu, Nigeria, 1985-95. *Br J Oral Maxillofac Surg* 1999;37(2):106-9.
- Kamulegeya A, Francis L, Kate K: Oral maxillofacial fractures seen at a Ugandan tertiary hospital: a six-month prospective study. *Clinics* 2009;64:843-8.
- Al Ahmed HE, Jaber MA, Abu Fana 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; 98:166-170.
- Rix L, Stevenson ARL, Punmia-Moorthy A. An analysis of 80 cases of mandibular fractures treated with miniplate osteosynthesis. *Int J Oral Maxillofac Surg* 1991; 20:337-341.
- Renton TF, Wiesenfeld D. Mandibular fracture osteosynthesis: a comparison of three techniques. *Br J Oral Maxillofac Surg* 1996;34:166-173.
- Hayter JP, Cawood JI. The functional case for miniplates in maxillofacial surgery. *Int J Oral Maxillofac Surg* 1993;22:91-96.
- Leles JL, Santos ÊJ, Jorge FD, Silva ET, Leles CR: Risk factors for maxillofacial injuries in a Brazilian emergency hospital sample. *J Appl Oral Sci* 2010; 18:23-9.
- Umar KB, Shuja RA, Ahmad K, Mohammad TK, Abdus S: Occurrence and Characteristics of Maxillofacial Injuries – A Study. *Pakistan Oral & Dental Journal* 2010; 30:57-61.
- Wimon S, Kasemsak P: The Epidemiology of Mandibular Fractures Treated at Chiang Mai University Hospital: A Review of 198 Cases. *J Med Assoc Thai* 2008; 91:868-74.
- Qudah MA, Al-Khateeb T, Bataineh AB, Rawashdeh M: Mandibular fractures in Jordanians: a comparative study between young and adult patients. *J Craniomaxillofac Surg* 2005; 33:103-6.
- H. O. Olasoji, A. Tahir, and G. T. Arotiba. Changing picture of facial fractures in northern Nigeria. *British Journal of Oral and Maxillofacial Surgery* 2002; 40 (2):140-143.
- M. Adi, G. R. Ogden, and D. M. Chisholm. An analysis of mandibular fractures in Dundee, Scotland (1977 to 1985). *British Journal of Oral and Maxillofacial Surgery* 1990; 28(3):194-199.
- P. Dongas and G. M. Hall. Mandibular fracture patterns in Tasmania, Australia. *Australian Dental Journal* 2002; 47(2):131-137.
- Asadi SG, Asadi Z. The aetiology of mandibular fractures at an urban centre. *J Roy Soc Health* 1997;117:164-167.
- Larsen OD, Nielsen A. Mandibular fractures. I. An analysis of their etiology and location in 286 patients. *Scand J Plast Reconstr Surg* 1976;10:213-218.
- Eriksson L, Willmar K. Jaw fractures in Malmo 1952-62 and 1975-85. *Swed Dent J* 1987;11:31-36.
- Atanasov DT. A retrospective study of 3326 mandibular fractures in 2252 patients. *Folia Med (Plovdiv)* 2003;45(2):38-42.
- Wong KH (2000) Mandible fractures: a 3 year retrospective study of cases seen in an oral surgical unit in Singapore. *Singapore Dent J* 23(1 Suppl):6-10.
- Sunita Malik et al. Analysis of maxillofacial trauma at Rohtak (Haryana), India: five years prospective study. *Journal of Maxillofacial Trauma* 2012 August;1(2):43-50
- Adekeye EO. The pattern of the fractures of the facial skeleton in Kaduna, Nigeria : a survey of 1447 cases, *Oral Surg. Oral Med. Oral Pathol* 1980; 49 : 491 – 5.
- Nair BK, Paul G (1986) Incidence and aetiology of maxillofacial skeleton in Trivandrum- A retrospective study. *Br J Oral Maxillofac Surg* 24:40-43.
- Adebayo ET, Ajike OS, Adekeye EO (2003) Analysis of the pattern of Maxillofacial fractures in Kaduna, Nigeria. *Br J Oral and Maxillofac Surg* 41(6):396-400.
- Van Beek GJ, Merckx CA (1999) Changes in the pattern of fractures of the maxillofacial skeleton. *Int J Oral maxillofac Surg* 28(6): 424-428.
- Chalya et al. Etiological spectrum, injury characteristics and treatment outcome of maxillofacial injuries in a Tanzanian teaching hospital. *Journal of Trauma Management & Outcomes* 2011, 5:7.
- Abiose BO. Maxillofacial skeleton injuries in the western states of Nigeria. *Br J Oral Maxillofac Surg* 1986;24:31-39.
- 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.
- Erol B, Tanrikulu R, Gorgun B: Maxillofacial fractures: analysis of demographic distribution and treatment in 2901 patients (25-years experience). *J Craniomaxillofac Surg* 2004; 32:308-13.
- Kilasara DB, Mecky IM, Shubi F: Epidemiology and management of maxillofacial fractures treated at Muhimbili National Hospital in Dar es Salaam, Tanzania 1998-2003. *International dental journal* 2006; 56:131-134.
- Martins Junior JC, Frederico SK, Ernani TSH: Epidemiological characteristics of trauma patients maxillofacial surgery at the Hospital Geral de Blumenau SC from 2004 to 2009. *Intl Arch Otorhinolaryngol, São Paulo - Brazil* 2010; 14:192-198.
