

Mandibular Fractures: an Epidemiological Survey at the Oral and Dental Hospital, Pretoria

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ABSTRACT

Objective: The objective of this retrospective analysis was to study the etiology, distribution, treatment modalities and complications of mandibular fractures of patients who attended the Maxillo-Facial and Oral Surgery (MFOS) unit at the School of Dentistry, University of Pretoria.

Method: The records of a representative sample of patients who presented at the MFOS unit with mandibular fractures between January 1999 and December 2003 were captured on a data form specifically designed for this purpose. The data were then analysed using the Statistix 8 programme.

Results: Of the 501 patients who were included in the survey, 67,6% were in the age group 21 to 40 years. The majority of the patients (83,2%) were male. Assault (72,5%) was the most common cause of injury followed by road traffic accidents (14,2 %) and falls (8,8%). Of the 501 cases, 41,3% were bilateral, 32,7% on the left side and 26% on the right side. With regard to the location of the fractures, the majority occurred in the body of the mandible (411%), followed by those in the area of the symphysis/parasymphysis (23,1%). In the majority of cases (51,7%) the treatment modality used was a closed reduction with intermaxillary fixation. Complications were reported in 14,6% of the 501 cases of which malunion (32%) was the most prevalent.

Conclusions: Mandibular fractures are more common in males in the age range 21 to 40 years. Interpersonal violence is the main cause of these fractures. The majority of mandibular fractures occur in the body region while malunion is the most common complication.

INTRODUCTION

The vast majority of mandibular fractures during peace time result from road traffic accidents and assaults¹. Other important causes include falls, school and domestic accidents, sports injuries, industrial accidents and gunshots². It appears that road traffic accidents are the main cause of maxillofacial injuries in some developing nations³, where the tradition and enforcement of highway discipline are yet to be established⁴. In developed countries the main cause of mandibular fractures is interpersonal violence³.

Unequivocally, most mandibular fractures occur in male subjects, in a ratio of approximately 3:1. The largest percentage (35%) of mandibular fractures occur in individuals between the ages of 20 to 30, followed by the age groups 10 to 20 and 30 to 40. The site of the fracture on the mandible varies from case to case but the most common site of fracture is the body (corpus), followed by the condyle and the angle. Fractures of the ramus and coronoid process are comparatively rare¹. The results of several studies relating to the epidemiology of maxillofacial injuries in general and mandibular fractures in particular are available for Southern Africa. Snijman⁵ studied 1699 cases of facial fractures at the Department of Maxillofacial and Oral Surgery of the University of Pretoria. He concluded that in black persons the mandible is the most vulnerable part of the maxillofacial skeletal structure to any form of violence. Rosenberg and Smith (1976)⁶ studied the relationship between the site of impact of the blow, the instrument used and the

resulting fractures of the mandible and the nature of the displacement of the mandibular fragments. They found that the displacement of the mandibular fragments is due essentially to the force and direction of the blow and not to muscular traction, direction of lines of fracture or the instrument used. Duvenage,⁽¹⁹⁷⁹⁾⁷, reported on various aspects pertaining to the epidemiology of maxillofacial injuries in 5074 cases of maxillofacial fractures over a period of 6 years in Pretoria, while Khan (1988)⁸ studied 311 patients with facial bone fractures at the Maxillofacial Unit of the Harare Central Hospital in Zimbabwe. In these studies, mandibular fractures accounted for between 70% to 80% of all cases of maxillofacial fractures; 79,4% for the South African study and 74,6% for the Zimbabwean study. Melmed and Koonin (1975)⁹ reviewed 909 cases of mandibular fractures at the Plastic Surgery Department of the Groote Schuur Hospital in Cape Town. They found that almost 50% of the cases presented initially more than 48 hours after the injury and that this delay, plus the high percentage of carious teeth present, contributed seriously to the problems of management and complications.

Beaumont *Women in Dentistry*¹⁰ and Bamjee et al¹¹ analysed the records of patients who were treated at the Department of Maxillofacial and Oral Surgery of the University of the Witwatersrand. The study by Bamjee et al was restricted to South Africans under 18 years of age. In the Southern African studies referred to above, most mandibular fractures occurred in male subjects⁵⁻¹¹ in the age group 20 to 40 years⁵⁻¹⁰. In general, assault appeared to be the major cause of

mandibular fractures in these studies^{5,7-10}, while vehicular accidents are a major contributor to mandibular fractures in the White group^{9,10}. The majority of studies^{5-6,8-10} reported that most of the fractures occurred on the body of the mandible, followed by the angle. In contrast, Strydom and Jacobs¹², who studied the anatomical distribution of mandibular fractures at the Medunsa Oral and Dental Hospital near Pretoria, found that the angle of the mandible was the most common site of fracture.

Goal and Objectives

The aim of this study was to review cases of mandibular fractures that were treated at the Department of Maxillofacial and Oral Surgery of the School of Dentistry of the University of Pretoria between January 1999 and December 2003.

Specific objectives were:

- To identify the causes of mandibular fractures;
- To describe the distribution of mandibular fractures in terms of the demography;
- To describe the distribution of mandibular fractures in the different sites of the mandible;
- To report on the modalities of treatment and the most common complications.
- To identify possible changes in the causes, demographic variables and treatment modalities compared to various other South African studies.

MATERIALS AND METHODS

The study sample comprised 501 patients selected from a data base of just over 2000 patients who were admitted to the Oral and Dental Hospital, Pretoria, for the treatment of mandibular fractures during the period January 1999 to December 2003. The records and radiographs of every fourth case, stored in the data base of the Department of Maxillofacial and Oral Surgery and presenting with a mandibular fracture or fractures, were selected for inclusion. All patients, whether admitted to hospital and treated in the operating room or seen as outpatients, were included. Patient information was collected by means of a medical data form specifically designed for this survey. Data regarding age, gender, occupational group, population group, cause of the injury, treatment modality and postoperative complications were gathered from the pertinent records. Only records that were complete with regard to the data mentioned were included in the survey. The data was captured and processed using Access and Excel computer programmes (Microsoft) while the Statistic⁸ programme (Analytical Software) was used to perform the statistical analysis. Simple Chi-square analysis was

used to compare differences. The population groupings referred to in the results are defined as follows: Blacks, 79% of the total South African population, descendants of African peoples who migrated in a southerly direction from central Africa, and Whites, 9,5% of the population, descendants of the European settlers, mainly Dutch, British, German, French, Portuguese, Greek, Italian and Jewish¹³.

RESULTS

The sample of 501 patients was randomly selected from all the patients who were treated at the Oral and Dental Hospital, Pretoria during the period 1 January 1999 to 31 December 2003. The socio-demographic characteristics of the sample are reflected as follows: Most of the patients were male (83,2%), with females accounting for less than one-sixth of the cases. The age distribution of the sample is shown in table 1.

Table 1: Age distribution of patients treated for mandibular fractures

Age Group	0-20	21-30	31-40	41-50	51-60	>60
%	11.3	38.5	29.8	14.7	4.6	1.0
n	56	191	148	73	23	5

The results of the study show that the vast majority of the patients (68,3%) were in the age group 21 to 40. Very few mandibular fractures occurred in patients over the age of 50. These findings are consistent with the findings of other studies conducted in South Africa⁵⁻¹⁰.

Causes of Mandibular fractures. The causes of mandibular fractures are shown in Table 2. As in many other countries, assault (interpersonal violence) accounted for the majority of mandibular fractures (72,5%) followed by Road Traffic Accidents (RTA's) at 14,2 % and falls at 8,8%. The 363 cases in the assault category also included 17 shooting incidents of which most were due to interpersonal violence. The figure of 72,5% reported for assault being the cause of the mandibular fractures appears to be high compared to the findings by Fonseca and Walker¹ who studied the results of 23 surveys in which the causes of mandibular fractures were determined. Higher levels of assault as a cause of mandibular fractures were only reported in Greenland¹ (89%) and Zimbabwe (82%⁸ and 73 %¹). However, these results should be interpreted with caution. Although assault (56%) was also the major cause of mandibular fractures in females, RTA's accounted for a much larger proportion (31%) of mandibular fractures in women. In the current study, only one

Table 2: Causes of mandibular fractures and gender differences in the causes of mandibular fractures.

Cause	Total		Male		Female	
	N	%	N	%	N	%
Assault (Including shooting incidents)	363	72.5	316	75.8	47	56.0
Fall	44	8.8	35	8.4	9	10.7
Sport Injury	8	1.6	7	1.7	1	1.2
Road Traffic Accidents (RTA'S)	71	14.2	45	9.0	26	31
Pathological conditions	1	0.2	1	0.2	0	0
Other	14	2.8	13	2.6	1	1.2

female sustained a mandibular fracture from a sporting injury. *Associated injuries.* Injury manifestations associated with mandibular fractures were recorded and the distribution of these was as follows; swelling (44,3%) was the most common injury associated with mandibular fractures, followed by lacerations (33,5%), bruising 6,2% and fractures of other facial bones, 0,8%. Lacerations are more commonly associated with RTA's (43,6%) than with assault, while swelling was more often found in cases of assault (57,3 %) than in RTA's (32,6%). Often the patient presented with more than one injury manifestation associated with the mandibular fracture. Mandibular fracture site and type of the fracture. In 32,7% of the cases the fracture occurred on the left side of the mandible, in 26% on the right side and the remaining 41,3% were bilateral. A total of 750 fractures were recorded in the 501 patients, or a mean of 1,5 fractures per patient. The distribution of fractures in the different anatomical sites of the mandible is shown in Table 3.

Site	N	Percentage
Symphyseal	35	4.6
Parasymphyseal	139	18.5
Corpus	308	41.1
Angle	92	12.3
Ramus	37	4.9
Coronoid	4	0,5
Condyle neck	104	13.9
Condyle	5	0.7
Dento-alveolar	26	3.5

Most fractures (41,1%) occurred in the body, followed by fractures in the parasymphyseal and symphyseal area (23,1%), the condyle neck (13,9%) and the angle (12,3%). Fractures of the coronoid process and the condyle are relatively rare. The anatomical site of the fracture depends to a large extent on the direction of the force causing the fracture⁶. The anatomical distribution of fractures of the mandible according to the two major causes of these fractures is shown in Table 4.

	Assaults		RTA'S	
	N	%	n	%
Symphyseal and Parasymphyseal	111	21.4	37	31.4
Corpus	225	43.4	38	32.2
Angle	73	14.1	3	2.5
Ramus	35	6.8	1	0.8
Coronoid	3	0.6	0	0
Condyle neck	53	10.2	29	24.6
Condyle	3	0.6	2	1.7
Dento-alveolar	15	2.9	8	6.8

Table 4 shows that fractures due to assaults are more common in the body and the angle of the mandible (57,5%), while fractures due to RTA's are more common in the symphyseal and parasymphyseal area (31,4%) and the condyle neck (24,6%). It would appear that in the case of assault, the direction of the force is usually from the side, aimed at the body, the angle or the ramus. In the case of RTA's, the direction of the force is usually from the front and aimed at the symphyseal and parasymphyseal areas.

Type of fracture. Fractures were classified according to the classification system described by Bütow in 1988¹⁴. About half of the fractures (48,6%) could be classified as simple fractures, which are fractures that do not produce a wound open to the external environment, 2,4% as greenstick, where one side of the bone is broken and the other being bent. Open fractures in which an external wound communicates with the break in the bone were recorded in 37,1 % of the fractures, comminuted fractures where the bone is splintered or crushed in 6,8% of the fractures and compound fractures, where there are two fractures in the same segment or side of the mandible in 5,1%.

Treatment modalities. In approximately half (51,7%) of the 501 cases of mandibular fractures in the sample, a closed approach involving intermaxillary fixation (ivy wiring – eyelets with vertical and cross wires), Jelenco arches and interdental splinting (eyelet wiring around adjacent teeth) was used. In just over one third (33,9%) of the cases, open reduction with plates and screws and intra-osseous ligatures was used and in 46 cases (9,2%) no treatment except a soft diet and a follow up visit was recommended. In some of the latter cases the patients were referred for the extraction of loose teeth.

Complications. Complications occurred in 14,6 % (73) of the cases reviewed. Most of the complications (7%) were reported where closed reductions were performed. Of these, non-union accounted for 2,4%. Complications were reported in only 3% of the cases where open reduction was performed. The most common complications associated with mandibular fractures were non-union (32%) followed by sepsis (28%). Sequestrae and occlusal changes each accounted for 7,7% of the complications. In 14% of the cases where complications occurred, uncooperative behaviour of the patient, such as the removal of wires without the permission of the surgeon, was reported.

DISCUSSION

The results of epidemiologic surveys on the causes, incidence and distribution of mandibular fractures tend to vary with geographic region, socio-economic status, culture and era^{2,3,5,8}. The predominance of males in the age group 21 to 40 years in the present study is consistent with the findings of previously published work⁵⁻¹¹. A lower incidence of maxillofacial fractures in females, with a male to female ratio ranging from 9:1 to 2:1¹, is also shown in previous studies and confirmed by the current study. In studies where assault was the major cause of the injury the ratio (male to female) tends to be higher and in cases where RTA's were the major cause, the ratio (male to female) tends to be lower^{3,14}. In spite of the many variables associated with the etiology of mandibular fractures there is no doubt that assaults

and road traffic accidents are the primary causes of mandibular fractures throughout the world. In the present study and probably Southern Africa as a whole⁵⁻¹⁰, physical violence with intentional assault accounted for the majority (72,5 %) of mandibular fractures. The 72,5 % incidence of mandibular fractures in the current study caused by assault contrasts vividly with the figure of 16,9% reported from Jordan, a finding that may be related to differences in social customs such as alcohol intake¹⁵. In a study conducted in Finland, 44% of mandibular fractures were associated with alcohol abuse¹⁶. In 1963, Snijman⁵ performed a similar survey at the same institution (Oral and Dental Hospital, University of Pretoria) and the results of the two surveys (Snijman⁵ and the current survey) are compared in table 5.

Table 5: A comparison of causes mandibular fractures in 1963 (Snijman⁵) and the current survey

Cause	Snijman 1963 ⁵	Current survey
Assault	75.5	72.5
Road Traffic accidents	15.2	14.4
Sport	1.3	1.6
Falls	3.8	8.8
Other	4.2	2.8

Except for large differences in the fall category the two studies show marked similarities in the causes of mandibular fractures. In the Snijman survey, falls from vehicles were excluded from the fall category and this exclusion could account for the differences in the two surveys in this category. The wearing of seatbelts became compulsory in December 1977⁷ in South Africa and one would have expected a dramatic decline in the incidence of mandibular fractures due to road traffic accidents after this date. It appears that this is not the case. As far back as 1979, Duvenage⁷ reported no dramatic changes in maxillofacial trauma due to seatbelt wearing. He did, however, concede that fatal injuries due to car accidents decreased because of the Act but that a lack of compliance and proper instructions in the use of seatbelts were the main reasons for the lack of protection.

With regard to the distribution of fractures between the two sides of the mandible, the majority of fractures occurred on the left hand side. The reason for the preponderance of left side fractures of the mandible appears to be that the majority of patients treated were the victims of assault and that most people are right handed and therefore will aim blows to the left side of an opponent's face. Fractures of the body of the mandible accounted for almost half of the fractures. The cause of the injury, and more particularly the direction of the force, to a large extent will determine the site of the fracture on the mandible⁶. Other factors which could possibly play a role include anatomical features of the mandible⁶, the presence of pathology, and racial differences³. Closed reduction (51,7%) with intermaxillary fixation and Jelenco arches was the most commonly used treatment modality. Open reduction involving plates and screws and intra-osseous ligatures was necessary in just over one third (33,9%) of the cases. In 9,2% of the fractures no treatment was performed and only

a soft diet and follow-up were recommended. The treatment of mandibular fractures varies from country to country and it appears that in more developed countries the inclination for the treatment of mandibular fractures leans more towards open reduction whereas in developing countries a more conservative approach using closed reduction is often followed. Patients treated at this institution over the period of evaluation were followed post-operatively. The frequency of post-operative complications was relatively low. Of the 501 study patients only 73 (14,6%) experienced complications. Non-union was the most common complication found. This rate is lower than those reported by authors in Nigeria² and Zimbabwe⁸. In those studies infection appears to be a major complication.

CONCLUSIONS

Mandibular fractures are most common in males in the age range 21 to 40 years. Interpersonal violence is the main cause of mandibular fractures in Pretoria. The majority of mandibular fractures are situated in the body while malunion is the most common complication.

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