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# A RETROSPECTIVE EVALUATION OF A MAXILLOFACIAL AND ORAL SURGICAL UNIT IN AN INNER CITY SOUTH AFRICAN ACADEMIC HOSPITAL .

By Mark Nissenbaum.

# A RETROSPECTIVE EVALUATION OF A MAXILLOFACIAL AND ORAL SURGICAL UNIT IN AN INNER CITY SOUTH AFRICAN ACADEMIC HOSPITAL.

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Mark Nissenbaum.

A Research Report submitted to the Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, in partial fulfillment of the requirements for the Degree of Master of Dentistry in the branch of Maxillofacial and Oral Surgery.

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Johannesburg, 2000.

## DECLARATION.

I, Mark Nissenbaum, hereby declare that this research report is my own work and has not been submitted previously nor incorporated in another dissertation or thesis for any other degree.

The work reported in this research report was performed in the Medical Research Council / University of the Witwatersrand Dental Research Institute and the Division of Maxillofacial and Oral Surgery, in the Department of Surgery of the University of the Witwatersrand.



MARK NISSENBAUM

31st May 2000

Johannesburg
South Africa.

**DEDICATION.**

To my wife Patty and precious children Daniel and Jarryd.

**ACKNOWLEDGEMENTS.**

I would like to express my special thanks and deep appreciation to the following:

My supervisors: Professor P.E. Cleaton-Jones and Prof R Lurie for their support, guidance and encouragement throughout this research.

The Dental Research Institute and the Division of Maxillofacial and Oral Surgery, Department of Surgery for giving me the opportunity to undertake this research.

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My wife, Patty, for her continuous support and encouragement during this research.

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# CHAPTER 1

## INTRODUCTION

### 1.0 History of maxillofacial and oral surgery.

The surgical discipline of maxillofacial and oral surgery was born largely as a result of facial injuries that were sustained during wartime experiences in the early part of the 20th century. At Rooksdown House, England, one of the first major plastic and maxillofacial units was created under the direction of Sir Harold Gilles and later Sir William Kelsey Fry to treat patients with severe maxillofacial injuries. Despite the cessation of wartime hostilities, the demand for the treatment of these facial injuries has not decreased. Maxillofacial and oral surgery from these mainly traumatic beginnings has evolved into a diverse speciality where in addition to trauma, pathology, dentofacial and craniofacial deformities and facial reconstruction today all form part of the maxillofacial and oral surgical speciality.

### 1.1. The speciality of Maxillofacial and Oral Surgery.

The diagnosis and treatment of trauma, pathology and skeletal and soft tissue deformities of the head and face is well described and essentially three defined specialist groups play a part in this field. Maxillofacial and Oral surgery, Ear, Nose and Throat surgery and Plastic and Reconstructive surgery all have formal training in certain aspects of facial trauma and pathology and it is largely a regional difference worldwide that determines the role of each discipline in the management

of these patients. In the United Kingdom, for example, traumatic injuries, pathology, deformities and reconstruction of the face and jaws are undertaken solely by maxillofacial and oral surgeons with the latter two disciplines playing no part at all. In South Africa, however, a closer relationship exists between maxillofacial and oral surgeons and their ear, nose and throat and plastic and reconstructive surgical colleagues where, for example, head and neck malignancies are treated as a team approach as are craniofacial deformities.

Each major city in South Africa has an academic teaching hospital associated with a University involved in both undergraduate and postgraduate teaching of medicine and dentistry. The hospitals have a maxillofacial and oral surgical unit comprising of trained specialists, registrars in training and house officers, the number of which may vary from unit to unit.

In common with other developing countries, trauma due to interpersonal violence is very common. In South Africa maxillofacial and oral surgeons have the primary responsibility for the treatment of traumatic injuries to the facial skeleton and this constitutes the main work load in state hospitals. The lesser proportion is the treatment of pathology, reconstruction and deformities of the head and face. Anecdotal evidence indicates that in private practice the proportions are reversed.

## 1.2 General remarks.

As a result of the prominent and exposed position of the facial skeleton on the head, any impact, be it in the form of interpersonal violence, or motor vehicle accidents,

or others, often results in fractures of the facial bones. Documentation of these injuries, their classification, and their treatment extends as far back as 1600BC when an Egyptian military surgeon described the clinical features and principles of treatment for facial bone fractures (Rowe and Killey, 1968)

## 1.3 The facial skeleton

The facial skeleton consists essentially of two components, the first is a dense layer of bicortical thick bone which encloses and protects the brain. The second part consists of many thinner, fragile bones which make up the face and which absorb the brunt of an impact thereby giving some protection to the cranial contents. (Gwyn. et al., 1971)

From a surgical point of view, the facial skeleton can be divided into 3 regions which will be discussed in turn. The detailed osteology has been extensively described in standard textbooks and only information pertinent to this report will be mentioned here. (Moore, 1985)

### 1.3.1 The mandible

The mandible is the largest and strongest bone of the face consisting of a horizontal body, and a vertical ramus which articulates with the skull via the articular condyle and temporomandibular joint. The structure of the mandible is composed of mostly dense basal bone with weaker alveolar bone which houses the dentition.
Certain areas of the mandible have a predeliction to fractures. These include:

a. The junction of the broad body and narrow ramus – the angle of the mandible.

b. The neck of the articular condyle. Snijman, (1963) noted a racial variation in the strength of the condylar neck between black and white South Africans which might contribute to the ease of fracture. White patients had an increased tendency to condylar fractures. Bilateral condylar fractures associated with a symphyseal fractures are known as Guardsman fractures.

c. The parasymphyseal region due to the length of the canine tooth.

d. The angle of the mandible in the presence of an unerupted third molar tooth.

e. The loss of alveolar bone in the elderly, as well as numerous tooth buds in the young may also predispose the mandible to fracture.

1.3.2 The middle third of the facial skeleton.

The orbits, maxilla, zygomas, zygomatic process of the temporal bone, palatine, nasal, lacrimal bones bilaterally, vomer and ethmoids comprise the middle third of the facial skeleton. The posterior limit is formed by the pterygoid plates of the sphenoid bone bilaterally. In addition, the relationship of the middle third of the facial skeleton to the anterior cranial fossa, paranasal sinuses and orbits account for some of the more dire complications associated with trauma to this region. While forces directed in a vertical direction are more easily dissipated, little resistance is present to forces in a horizontal direction. (Rowe and Williams, 1985)

1.3.3 The upper third of the facial skeleton.

This comprises the area directly above the supra-orbital rims and is made up predominantly of the frontal bones. Fractures of this area are rare and are associated usually with severe intra-cranial complications. (Rowe and Williams, 1985)

1.4 Classification of fractures of the facial skeleton.

1.4.1 The Mandible.

Fractures of the mandible, as with any other human bone, may be classified by the type of fracture present or by the anatomical site of the fracture.

***Classification by type.***

This classification is a common sense description of each fracture.

1. **Simple fracture:** A fracture line that has no communication with the external enviroment.
2. **Compound fracture:** These fractures have communication with the external enviroment usually due to loss of continuity in the overlying soft tissue.
3. **Greenstick fracture:** This type of fracture occurs typically in children and involves incomplete loss of continuity of the bone. Due to the elasticity of the bone, usually one cortex is fractured and the other is bent leading to distortion without complete section and no mobility between proximal and distal segments.
4. **Comminuted fracture:** These fractures exhibit multiple fragmentation of the bone at the fracture site. It is usually as a result of a high velocity injury eg. gunshot.

5. **Complex fracture:** This type of fracture implies not only damage to the bony skeleton but also to adjacent blood vessels, nerves and joint structures.
6. **Telescoped fracture:** This type of fracture implies that one bony segment is forcibly driven into the other.
7. **Indirect fracture:** This type of fracture arises at a point distant to the site at which the trauma has taken place.
8. **Pathological fracture:** This is a fracture that originates as a result of normal function or minimal trauma due to an underlying pathological condition that has weakened the bone. This may be a result of a local pathological lesion eg. cyst or tumor or as a result of a generalised pathological skeletal disorder eg. osteoporosis.

*Classification by anatomical site.*

A useful anatomical classification, and the one used in the Division of Maxillofacial and Oral Surgery at the University of the Witwatersrand, is that of Rowe and Williams (1985).

1. **Condyle:** These fractures may be intracapsular or extracapsular depending on their relationship to the capsular attachment. They may be also associated with dislocation of the condylar head.
2. **Coronoid Process:** Although rare, these fractures do arise in a small percentage of patients.
3. **Ascending Ramus:** These fractures extend horizontally through both the anterior and posterior borders of the ramus or vertically from the mandibular notch to the inferior border of the mandible.
4. **Angle and body:** These fractures may be further subclassified radiographically into horizontally and vertically favourable and unfavourable depending on their displacement on panoramic and antero-posterior Xray.
5. **Canine Region:** This area is sometimes also known as the parasymphyseal region of the mandible.

6. **Symphysis:** These fractures rarely pass through between the genial tubercles and generally pass obliquely to one side of the tubercles where they then may be classified with the parasymphyseal fractures.
7. **Dentoalveolar:** Although not included in this classification, fracture of any portion of the dentoalveolar region of the mandible may also occur.

From clinical experience it is clear that these fractures may occur in any combination either unilaterally or bilaterally. The use of both these classifications is essential in deciding the ideal treatment for a specific fracture.

1.4.2 The middle third of the facial skeleton.

Fractures of the middle third of the facial skeleton are classified according to the traditional descriptions of the French mortician Rene le Fort, these are divided into le Fort 1, le Fort 2 and le Fort 3 fractures, the latter being the most extensive injury. In addition fractures of the middle third of the facial skeleton may also be subclassified according to the individual facial bone injured ie. Separate classifications exist for injuries to the orbital, nasal, maxillary, zygomatic and maxillary bones. (Rowe and Williams, 1985)

Facial injuries together with pathology in the region account for the majority of cases treated by hospital maxillofacial and oral surgical units in South Africa. Little research, however, exists in South Africa on retrospective analyses of patients treated in maxillofacial and oral surgical units as a whole.

Most of the studies previously done focused on a specific aspect or etiology of facial fractures. The salient features of some of the previously done South African studies is summarized in Table 1.

Table 1. Summary table of previous studies done in South Africa.

| STUDY | SAMPLE SIZE, CITY | FRACTURE SITE | FINDINGS |
|---|---|---|---|
| Snijman (1963) | 1699 cases<br>Pretoria | Facial skeleton | 83% of cases in blacks<br>Mandible most common<br>Intentional violence most common etiology |
| Muller and Schoeman (1977) | 1233 cases<br>Pretoria | Middle 1/3 facial fractures | Males most commonly affected<br>Blacks – interpersonal violence<br>Whites – motor vehicle accidents |
| Duvenhage (1979) | 4426 cases<br>Pretoria | Facial skeleton | 86% of cases in blacks<br>fracture incidence similar to Snijman (1963) |
| Beaumont (1985) | 389 cases<br>Johannesburg | Facial skeleton | Intentional violence most common etiology<br>Mandible (body and angle) most commonly fractured |
| Bamjee (1993) | 4192 cases<br>Johannesburg | Facial skeleton | Patients < 18 examined<br>Mandibular fractures most common<br>Interpersonal violence most common etiology |

Snijman (1963) performed a statistical analysis of facial skeleton fractures in 1699 patients treated in the Department of Maxillofacial and Oral Surgery of the University of Pretoria. He showed that 83% of cases occurred in the black group, the remainder in the white group. Mandibular fractures were the most common followed by isolated zygomatic complex fractures. In the black group, intentional violence was the most common cause of injury while road traffic accidents accounted for this in the white group. As far as anatomical site of the fracture was concerned, the body of the mandible was the most common site in both ethnic groups. Condylar neck fractures were more prevalent in the white group possibly because of the anatomically thinner bone according to a theory proposed by the author.

In 1977, Muller and Schoeman analysed 1233 patients in the Division of Maxillofacial and Oral Surgery, University of Pretoria South Africa with fractures of the zygomatico-maxillary complex, including all middle third fractures. The authors noted that motor vehicle accidents were the most common cause in the white group while intentional violence accounted for the majority of cases in the black group.

Duvenhage (1979) reviewed 4426 cases of facial fractures treated in the Maxillofacial and Oral Surgery unit of the University of Pretoria and compared the incidence of fractures over a six year period in two population groups. Furthermore, he related the sites of fracture to various ethnic groups. The annual incidence of 700-750 cases was similar over the six year period, the majority of cases (86%) occurring in the black population. An analysis of the etiology revealed a

prevalence similar to that found by Snijman (1963). Most of the fractures found involved the mandible.

Beaumont, et al (1985) analysed fractures of the facial skeleton in three ethnic groups in the greater Johannesburg area. In all categories, intentional violence was the commonest etiological factor, except in middle third facial fractures in the white group which were generally the result of motor vehicle accidents. Assaults were more common in the black group, less common in the coloured and Asian groups and least common in the white group. In all groups, the mandible was the facial bone most commonly fractured, while fractures of the middle third of the facial skeleton and combined fractures were less common. Analysis of the mandibular fractures revealed that the regions most commonly involved were the body and angle. Condylar neck fractures were more common in the white ethnic group.

Bamjee (1993) designed his study to focus on the prevalence of maxillofacial injuries in South African children aged 18 or younger. Of the 4192 patients of all ages treated for facial injuries over a 5 year period in the division of Maxillofacial and Oral Surgery at the University of the Witwatersrand, 326 (8%) were younger than 14 years of age. Mandibular fractures were the most common followed by maxillomandibular fractures. Violence was the most common etiological factor.

Trends in types of facial fractures, etiology and age distribution have also been described in publications outside South Africa. Two examples during the current study decade are:

Torgersen and Tornes (1992) reviewed the records of 169 patients treated at Haukeland Hospital, Bergen, Norway between 1989 and 1991. Socio-etiologic aspects, frequency and localization of jaw fractures, treatment and complications were analysed. Interpersonal violence was the most prevalent cause of injury. Mandibular fractures were 4.8 times more frequent than maxillary fractures, and reduction and fixation with mini plate osteosynthesis was the preferred treatment in most patients.

Vetter et al (1991), in a 3 year retrospective survey in Connecticut USA of 311 patients who had 564 facial fractures in a medium sized metropolitan area compared etiology, distribution and treatment of these injuries to previous studies. They confirmed a trend away from motor vehicle accidents as the primary etiology of maxillofacial fractures to interpersonal violence. Mandibular and maxillary fractures were equally prevalent.

A clear similarity is present between those studies done abroad and those done in South Africa in the same decade. A clear trend is evident in which the number of maxillofacial injuries due to interpersonal violence is increasing compared to those injuries resulting from road traffic and sport-related accidents.

## 1.5 The need for the current study

The last clinical audit study undertaken in the Division of Maxillofacial and Oral Surgery, University of the Witwatersrand was that by Bamjee (1993) who analyzed facial fractures only in the paediatric population. Before this Beaumont (1985) described facial fractures in three different ethnic groups. Both these studies researched specific aspects of the maxillofacial and oral surgical population in Johannesburg. No study in Johannesburg or elsewhere in South Africa has analyzed the entire patient population of a specific maxillofacial and oral surgical unit. This is important in order to determine the overall scope and variety of maxillofacial and oral surgical patients treated and for planning of future services.

The Human Immunodeficiency virus (HIV) and Aquired Immunodeficiency Syndrome (AIDS) has had a crippling effect socio-economically on the entire Southern African subcontinent. No study exists in the maxillofacial and oral surgical literature where rate of HIV positivity was determined, let alone its impact on the various types of injuries and length of hospitalization.
Similarly, while previous studies have shown the types of injuries, ages and ethnic groups of the patients, little is known of the length of hospitalization or the treatment rendered.

## 1.6 The objective of the study.

The objective of the study is to analyse the spectrum of cases treated in an academic maxillofacial and oral surgical unit in an inner city hospital in Johannesburg using the following parameters: Hospital number, age, sex, Human Immunodeficiency Virus status, length of hospitalisation, mode of presentation, cause of injury, type of injury, sepsis, pathology, other, treatment rendered.

## CHAPTER 2

## MATERIALS AND METHODS

2.0. The research material.

The data were collected while I was a maxillofacial and oral surgical registrar at Hillbrow Hospital from 01 January 1995 to 31 May 1995 inclusive, a period embracing both winter and summer months and thus reasonably reflecting a representative number of cases experienced throughout the year. All the 244 cases included in this study were examined and treated by myself aided by two consultants and senior house officer in the Div' 'on of Maxillofacial and Oral Surgery, Hillbrow Hospital, Johannesburg, South Africa. At the time of data collection, this hospital was one of the five academic teaching hospitals in which a maxillofacial and oral surgical service was rendered. The Hillbrow Hospital unit typically treated 600 surgical inpatients and 5000 outpatients per annum with a staff of two consultants, one registrar and one surgical house officer. The hospital was chosen because it represented the widest spectrum of maxillofacial and oral surgery in the greater Johannesburg area draining a population of approximately 2 000 000 people. The hospital also received referral cases from smaller peripheral hospitals within the Gauteng province where specialist maxillofacial and oral surgical services were unavailable. From October 1997, a rationalisation process within the Gauteng provincial hospital administration closed the in-patient section of Hillbrow Hospital. maxillofacial and oral surgical services were amalgamated with the unit at Johannnesburg Hospital. Currently in 2000, maxillofacial and oral surgical services

are concentrated in two academic hospitals namely Johannesburg Hospital in the north of the city and Chris Hani Baragwanath Hospital in the south of the city. Patients who would have previously attended Hillbrow Hospital now mostly go to Johannesburg Hospital.

## 2.1. Data Collection.

Data were collected from the inpatient and outpatient clinical files and surgical theatre record book at Hillbrow Hospital for the 6 month period 01 January 1995 to 31 May 1995. The record list was complete because during the study period the name and hospital number of every patient admitted were recorded for future use. Access to these records was approved by the Committee for Research on Human Subjects (Medical) of the University of the Witwatersrand. [clearance number M980229].

A treatment survey chart (Fig 1) was compiled to record the following:

a. Hospital number, age, sex.

b. Human Immunodeficiency Virus status.

c. Length of hospitalisation.

d. Mode of presentation.

e. Cause of injury

f. Type of injury, sepsis, pathology, other.

g. Treatment rendered.

As each record was examined the relevant section on the survey chart was marked.

MARK NISSENBAUM (MDent)

MFOS TREATMENT SURVEY

Hospital number: Age: Gender: HIV Status: Hospital stay:

Mode of presentation: emergency in hours 07h00-16h00
emergency after hours16h00-07h00
outpatient in hours 07h00-16h00

Cause of injury: interpersonal violence gunshot wound
motor vehicle accident sepsis
motor cycle accident pedestrian accident
dental pathology
other

Type of injury:

| leFort 1 | leFort 2 | leFort 3 |
|---|---|---|
| # orbit left | # orbit right | # orbit both |
| # zygoma left | # zygoma right | # zygoma both |
| # arch left | # arch right | # arch both |
| # maxilla left | # maxilla right | |
| # dentoalveolar maxilla | # dentoalveolar mandible | |
| # condyle left | # condyle right | # condyle both |
| # asc. ramus left | # asc. ramus right | # asc. ramus both |
| # angle left | # angle right | # angle both |
| # body left | # body right | # body both |
| # parasymphysis left | # parasymphysis right | # symphysis |
| # parasymphysis both | | |

Sepsis:

submandibular abscess left submandibular abscess right
buccal space abscess left buccal space abscess right
canine fossa abscess left canine fossa right
submental abscess ludwigs angina
acute suppurative osteomyelitis chronic suppurative osteomyelitis
osteoradionecrosis

Pathology

decayed teeth impacted teeth oro-antral communication
ameloblastoma dentigerous cyst sebacious/dermoid cyst
fibrous dysplasia neurofibroma ossifying fibroma
odontogenic keratocyst nasopalatine duct cyst
adenomatoid odontogenic tumor peripheral ossifying fibroma
cemento osseous dysplasia

Other:

| | |
|---|---|
| dislocation of the mandible | osteotomy |
| removal bone plates/screws/wires | soft tissue lacerations |

Treatment rendered:

| | |
|---|---|
| extra-oral open reduction | intra-oral open reduction |
| closed reduction | bone plate osteosynthesis |
| wire osteosynthesis | incisional biopsy |
| excisional biopsy | enucleation biopsy |
| suturing soft tissue | relocation mandible |
| reconstruction mandible | reconstruction mandible |
| (rib, titanium mesh, iliac crest) | (rib, iliac crest) |
| Gillie's lift | hook lift |
| debridment wound | incision and drainage |
| surgical removal of teeth | antral packing |
| orbital floor reconstruction | dental extraction |
| DXT clearance | circumzygomatic suspension |
| decortication and sequestrectomy | |

**Figure 1:** Example of treatment survey chart.

The data were analysed with SAS for Windows V6.12 (SAS Institute Inc, Cary NC,USA) and Instat Version 3 (GraphPad Software, San Diego, California, USA). The statistics used were descriptive statistics, the Pearson correlation coefficient, the Chi – squared test [When the Chi – squared test showed statistically significant results, pair – wise comparisons were done using the Fisher exact test.] and a linear logistic analysis. The level of statistical significance was set at $P<0,05$.

## CHAPTER 3

## RESULTS

### 3.0. Reliability of data recorded.

All information for each patient was recorded prospectively, by myself as the patients presented to the maxillofacial and oral surgical unit at Hillbrow hospital. The data were stored on a personal computer. This method of data retrieval removed the need to use hospital archives and filing systems which have proved unreliable in past studies by others. No followup data were needed for this study. These two factors ensured that no patients were omitted. The data therefore truly record information for the test period.

### 3.1. Statistical analysis.

The dependant variable of interest in this investigation was the length of hospitalization. After preliminary analysis it was felt most appropriate to categorize this rather than use the information as a continuous variable. Based on clinical experience two hospital stay groups were defined - a stay of up to 3 days, or 4 days or more. Etiology, HIV status, jaw injured, sepsis, reduction, age, and gender were the independent variables studied, these were also categorized as will be seen from the subsequent tables. When the Chi-squared test indicated statistically significant differences between three independent variable groupings, pair-wise comparisons

of the variable were made with the Fisher Exact test using Instat version 3 (GraphPad Software, San Diego, California, USA).

3.2. Hospital stay by etiology

**TABLE 2:** Hospital stay by etiology

| | *Interpersonal violence Gunshot injuries* | | *Road traffic accidents* | | *Sepsis , Pathology, Dental* | | *TOTAL* | |
|---|---|---|---|---|---|---|---|---|
| | *N* | *%* | *N* | *%* | *N* | *%* | *N* | *%* |
| Number of days | | | | | | | | |
| 0 –3 days | 146 | 76 | 7 | 4 | 38 | 20 | 191 | 100 |
| ≥ 4 days | 18 | 41 | 6 | 14 | 20 | 45 | 44 | 100 |

**$\chi^2 = 22.36$, df = 2, P = 0.001**

The etiology of the patient's maxillofacial and oral surgical problem was divided into 3 groups:

1. interpersonal violence and gunshot injuries
2. road traffic accidents
3. sepsis, pathology and dental.

For the purposes of the study, sepsis only included those patients who presented with fascial space infections of either the maxilla or mandible. Acute periapical dental sepsis was excluded here.

In the three etiological groups, most (81%) patients required hospitalization of 3 days or less (Table 2). Of the 19% of patients who required longer periods of hospitalization, those who presented with violent injuries including gunshot

wounds (41%) and those who had severe facial sepsis (45%) required more intensive treatment and longer hospitalization. Patients involved in road traffic accidents did not show any significant difference regarding the length of hospital stay however those remaining in hospital for ≥4 days had severe polytrauma and the injuries other than those of maxillofacial and oral origin were responsible for this. In this particular table, 9 patients refused hospital treatment and were released from hospital care. Pairwise comparisons with the Fisher exact test showed that hospital stay was significantly lower for interpersonal violence compared to road traffic accidents (P=0.003), but hospital-stay for sepsis (P=0.001) was significantly longer than for interpersonal violence. No significant differences were found between hospital stay for road traffic accidents and sepsis.

3.3 Hospital stay by HIV Status.

**TABLE 3:** Hospital stay by HIV status.

| *HIV STATUS* | *HIV NEGATIVE* | | *HIV POSITIVE* | | *TOTAL* | |
|---|---|---|---|---|---|---|
| | *N* | *%* | *N* | *%* | *N* | *%* |
| Number of days | | | | | | |
| 0 –3 days | 182 | 92 | 15 | 8 | 197 | 100 |
| ≥ 4 days | 37 | 79 | 10 | 21 | 47 | 100 |

**Fishers exact test P = 0.01**

Ninety-two percent of the patients who were hospitalized for 0 – 3 days were HIV negative while 8% were HIV positive. 21% of the 47 patients requiring hospitalization longer than 4 days were HIV positive (Table 3).

The Fisher exact test showed that HIV positivity is a statistically significant factor in hospital stay but this could be a confounding variable masking the effects of other variables such as etiology, gender and jaw involved. To elaborate on this, a linear logistic analysis (Proc Catmod) was done with hospital group as the dependant variable and etiology, HIV status and jaw as independent variables. The results showed that etiology ($\chi^2$ =14.23, df = 2, P =0.008) had a significant effect but HIV status ($\chi^2$ = 1.83, df = 1, P =0.18), jaw ($\chi^2$ = 3.48, df = 2, P =0.18) and gender ($\chi^2$ = 0.01, df = 2 and P =0.18) did not have significant effects when the multivariate analysis was done.

3.4 Hospital stay by jaw injured.

**TABLE 4:** Hospital stay by jaw injured.

| | *Combined Midface/ Mandible injuries* | | *Mandibular injuries* | | *Midface injuries* | | *TOTAL* | |
|---|---|---|---|---|---|---|---|---|
| | *N* | *%* | *N* | *%* | *N* | *%* | *N* | *%* |
| Number of days | | | | | | | | |
| 0 –3 days | 6 | 3 | 132 | 83 | 21 | 14 | 159 | 100 |
| > 4 days | 5 | 16 | 18 | 60 | 7 | 23 | 30 | 100 |

**$\chi^2$ = 10.64 df = 2 P =0.005**

There was a statistically significant effect of the anatomical site of the injury on hospital stay. Overall 84% of patients were hospitalized for less than 3 days while 16% remained in hospital for a longer period (Table 4). Five out of 11(45%) combined midface/mandibular and isolated midface injuries required hospitalization of > 4days compared to 18 out of 150 (12%) of isolated mandibular fractures, a statistically significant difference, (Fishers exact test P=0.01) indicating the seriousness of the combined injury.

3.5 Hospital stay by sepsis.

**TABLE 5:** Hospital stay by sepsis.

| | *Mandibular sepsis* | | *Maxillary sepsis* | | *TOTAL* | |
|---|---|---|---|---|---|---|
| | *N* | *%* | *N* | *%* | *N* | *%* |
| Number of days | | | | | | |
| 0 –3 days | 9 | 82 | 2 | 18 | 11 | 100 |
| > 4 days | 11 | 73 | 4 | 27 | 15 | 100 |

**Fishers exact test P = 1.00**

Sepsis of the maxillofacial and oral region was present at admission in 26 patients and did not significantly effect the length of hospitalization (Table5). Sepsis in this study was regarded as those patients suffering from fascial space infection only. Mandibular sepsis was three times more common than maxillary sepsis.

3.6 Hospital stay by fracture reduction.

**TABLE 6:** Hospital stay by method of fracture reduction.

| | *Closed reduction* | | *Open reduction* | | *TOTAL* | |
|---|---|---|---|---|---|---|
| | *N* | *%* | *N* | *%* | *N* | *%* |
| Number of days | | | | | | |
| 0 –3 days | 98 | 60 | 41 | 25 | 139 | 85 |
| > 4 days | 16 | 10 | 7 | 5 | 23 | 15 |

**Fishers exact test P = 1.00**

The method of fracture reduction did not have significant effects on the length of hospitalization (Table 6). While it might be expected that open reduction of a facial fracture might require longer hospitalization, an equal proportion (15%) of closed and open reduced fractures required hospitalization of greater than 4 days; 85% of all the fractures treated required hospitalization less than 3 days.

3.7 Hospital stay by age in decades.

**TABLE 7:** Hospital stay by age in decades.

| *AGE* | *10 –20* | | *21 –30* | | *31 –40* | | *41 –50* | | *51 - >* | | *TOTAL* | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *N* | *%* | *N* | *%* | *N* | *%* | *N* | *%* | *N* | *%* | *N* | *%* |
| Number of Days | | | | | | | | | | | | |
| 0 – 3 days | 11 | 5 | 73 | 30 | 67 | 27 | 33 | 14 | 13 | 5 | 197 | 81 |
| > 4 days | 1 | 0.5 | 23 | 9 | 12 | 5 | 8 | 3 | 3 | 1.5 | 47 | 19 |

$\chi^2 = 3.90$, **df = 5, P = 0.56**

No children under the age of 10 years of age were treated at Hillbrow Hospital because the hospital did not provide a pediatric service. In all the age groups, patients were generally hospitalized for 3 days or less. Figure 2, illustrates a unimodal distribution skewed to the third decade with the majority of patients being hospitalized in the 2nd to 5th decades. A similar distribution was noted in the group hospitalized for ≥ 4days. There was no statistically significant effect of age on hospital stay.

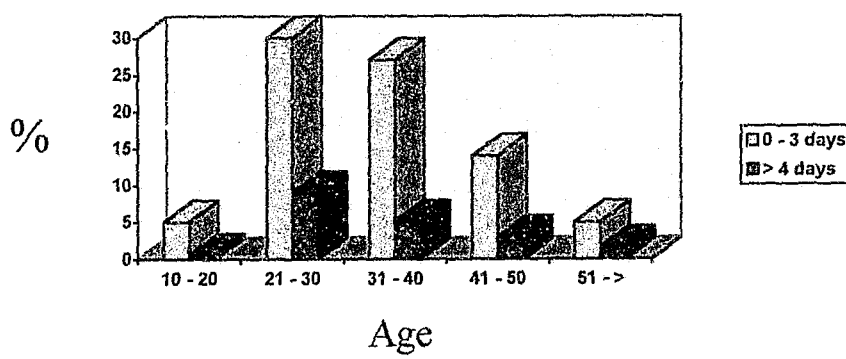



Figure 2: Bar chart of hospital stay by age in decades

3.8 Hospital stay by gender.

**TABLE 8:** Hospital stay by gender.

| *SEX* | *MALE* | | *FEMALE* | | *TOTAL* | |
|---|---|---|---|---|---|---|
| | *N* | *%* | *N* | *%* | *N* | *%* |
| Number of days | | | | | | |
| 0 –3 days | 155 | 79 | 42 | 21 | 197 | 100 |
| ≥ 4 days | 30 | 64 | 17 | 36 | 47 | 100 |

**Fishers exact test P = 0.04**

Table 8 shows that gender was significantly associated with hospital stay. While 64% of the male patients were hospitalized for 4 days or more, more females required longer hospitalization possibly due to the greater degree of facial sepsis and pathology in the female group requiring more intensive treatment and longer hospitalization.

Because etiology of the injury remains such an important variable, it was compared to two further variables ie. gender and HIV status presented in Tables 9 and 10 respectively.

3.9 Gender by etiology.

**TABLE 9:** Gender by etiology.

| | *Interpersonal violence gunshot injuries* | | *Road traffic accidents* | | *Sepsis , pathology, Dental* | | *TOTAL* | |
|---|---|---|---|---|---|---|---|---|
| | *N* | *%* | *N* | *%* | *N* | *%* | *N* | *%* |
| SEX | | | | | | | | |
| MALE | 143 | 79 | 10 | 5 | 29 | 16 | 182 | 100 |
| FEMALE | 21 | 40 | 3 | 1 | 29 | 59 | 53 | 100 |

$\chi^2 = 33.94$ **df = 2 P = 0,001**

In the male group of 182 patients, 79% of the injuries were due to interpersonal violence and gunshot injuries (Table 9); 5% and 16% were involved in road traffic accidents and sepsis/pathology/dental causes, respectively. A different trend predominated in the female group where 59% of females presented with facial sepsis, pathology or dental causes. A further 40% and 1% of females were involved in interpersonal violence or gunshot injuries and road traffic accidents, respectively. Interpersonal violence and gunshot injuries predominated in both the male and females groups. Pairwise comparisons showed significantly more interpersonal violence among males compared to sepsis (Fishers exact test P=0.0001) but no other significant differences.

3.10 HIV status by etiology.

**TABLE 10:** HIV status by etiology.

| *HIV STATUS* | *Interpersonal violence gunshot injuries* | | *Road traffic accidents* | | *Sepsis , pathology, Dental* | | *TOTAL* | |
|---|---|---|---|---|---|---|---|---|
| | *N* | *%* | *N* | *%* | *N* | *%* | *N* | *%* |
| HIV NEGATIVE | 147 | 63 | 13 | 6 | 51 | 21 | 211 | 90 |
| HIV POSITIVE | 17 | 7 | 0 | 0 | 8 | 4 | 25 | 11 |

**$\chi^2 = 1.70$ df = 2 P = 0.43**

No significant effect was seen for HIV status and the etiology of the maxillofacial and oral surgical problem (Table 10).

## CHAPTER 4

## DISCUSSION

4.0 Hospital stay by etiology.

The etiology of maxillofacial injuries has changed over the last three decades. The main causes of injuries to the maxillofacial region in all countries are road accidents, interpersonal violence, falls and sporting injuries. Road accidents have been the predominant etiological factor of maxillofacial injuries in the past. This has been illustrated in studies done in both developed and third world countries such as the United States (Haug et al,1992) and Nigeria (Adelkey 1980). A decline has been seen in the proportion of vehicle related injuries due predominantly to changes in legislation that have made the use of seat belts in vehicles compulsory and the introduction of severe criminal penalties for driving under the influence of alcohol. Rutherford et al (1985) found a 25% decrease in hospital admissions of patients injured in motor vehicle accidents in the United Kingdom due to seat belt legislation.
Similarly, Telfer et al (1991) found a 34% decrease in the number of patients injured in road accidents in the United Kingdom.

In this study, irrespective of the length of hospitalization, 70% of the patients treated, sustained injuries as a result of interpersonal violence or gunshots. 6% were involved in road traffic accidents and 24% presented as a result of dento-facial sepsis or pathology. It is thus mostly the treatment of facial fractures that take up the bulk of the maxillofacial and oral surgery service at this hospital and this is where the emphasis of this study is directed. Because of its location, Hillbrow Hospital rendered services mostly to the black population. In this study and in

previous South African studies the statistic of increased interpersonal violence especially amongst the black population is again seen.

Although no statistically significant difference was seen in the length of hospitalization for patients injured in road traffic accidents in this study, those who were hospitalized for more than 4 days generally suffered severe polytrauma in addition to their maxillofacial injuries requiring admission to high and intensive care facilities and a multidisciplinary surgical approach.

While a significant decrease in road traffic accidents and injuries has been noted, a marked increase has been seen in maxillofacial fractures arising from assaults and interpersonal violence. Telfer et al (1991) showed a 47% increase in the number of patients injured due to assault in Bristol, England. Two factors have been consistently implicated in the etiology of facial bone fractures due to interpersonal violence: alcohol and unemployment.
Numerous studies have showed that a strong correlation exists between poor socio-economic conditions and unemployment with interpersonal violence.
Shepherd et al (1986) showed a highly significant difference in assault rates between unemployed males and the rest of the Bristol population in the United Kingdom.

Similarly a strong correlation exists between alcohol abuse and interpersonal violence. Shepherd (1989) in his review on the surgical, socio-economic and forensic aspects of assault clearly showed the strong correlation between alcohol abuse and innercity violence. Interpersonal violence and gunshot injuries predominated both hospital stay variables. Athough most of the injuries sustained were simple fractures and required less than 3 days of hospitalization, those requiring longer hospitalization were mostly gunshot injuries and pan facial trauma requiring extensive surgery and airway management. In South Africa, a similar

trend exists where interpersonal violence plays a significant part in the etiology of maxillofacial injuries. Beaumont et al (1985) showed that assaults were the most common cause of injuries to the facial skeleton. Similarly, Bamjee et al (1994) showed that in the paediatric and adolescent population, 48% of the injuries sustained were as a result of interpersonal violence. Tsakiris (1997) showed that the trend was changing in South Africa and gunshot injuries were becoming more common.

Sepsis and dental pathology in this study also showed significantly increased lengths of hospitalization. Because of the increased amounts of mandibular sepsis with associated airway compromise longer periods of hospitalization and convalescence were required.

## 4.1 Hospital stay by HIV status.

With prior patient consent, The HIV status was determined for each patient to determine the extent of infectivity amongst patients with maxillofacial injuries and what if any impact this would have on the length of hospitalization. 10.3% of all the patients in the study were HIV positive. None of these patients showed signs of Aquired Immuno-Deficiency Syndrome related complex or Aquired Immuno-Deficiency Syndrome. Similar studies done in South Africa largely on female patients in antenatal clinics showed 14.17% of all women were HIV positive in 1996. Since then, the Department of Health, South Africa, has shown an exponential increase in HIV positivity amongst females attending antenatal clinics throughout the country and in 1998, 22.8% of females were HIV positive. This study has shown no significant effect of HIV status on hospital stay; rather the primary pathology dictated this. The results, however, indicate that in the trauma and resuscitation setting HIV exposure is a potential hazard to all health care

workers and that HIV risk factors alone are not reliable in identifying the HIV positive patient. While in this study 10,3% of patients with maxillofacial and oral injuries were HIV positive, Sloan et al (1995) showed similar results in the general trauma setting where 4.3% of patients admitted to an urban level 1 trauma centre in North America were HIV positive.

4.2 Hospital stay by jaw injured.

The evaluation of the anatomic site of injury as a factor influencing the length of hospitalization illustrated that 81% of all the injuries incurred required hospitalization for three days or less. In the maxillofacial region, it is essentially the need to protect a threatened airway either by conservative or surgical means, or sepsis that would necessitate longer hospitalization. The majority of injuries requiring four or more days in hospital were mandibular injuries. Two patterns were noticed here:

The first included a group of patients who generally had a delayed presentation from their peripheral referral hospital to Hillbrow Hospital. In this group the most common presenting variable was fascial space sepsis in addition to their mandibular injury. This required incision and drainage of the abscess as well as reduction and immobilization of the fracture site.

The second group of patients included those with acute injuries associated with severe swelling of the perimandibular tissues and floor of the mouth that needed emergency airway management. It is these complicated mandibular injuries that require longer periods of hospitalization. It was these patients who accounted for 60% of those requiring hospitalization greater than four days. The remainder of the patients included those with isolated midfacial injuries and those with combined midfacial and mandibular injuries, the severity of these accounting for longer hospitalization.

4.3 Hospital stay by sepsis.

Fascial space infections of the maxillofacial and oral region for this study were divided into 2 main groups:

a. Those spaces surrounding the mandible ie. submandibular, submental, submasseteric, medial pterygoid and sublingual spaces.
b. Those spaces surrounding the maxilla and periorbita ie. canine fossa, infratemporal fossa and buccal spaces.

No statistical significance was noted in the comparison between types of sepsis and length of hospitalization. Although mandibular sepsis was more common and 73% of cases required hospitalization longer than 4 days, it was mainly the seriousness of the sepsis and threat to maintaining an adequate airway that determined the length of hospitalization. In the group of patients with maxillary sepsis, only 27% required longer hospitalization possibly due to the severe bacteraemia or bacterial antibiotic resistance.

4.4 Hospital stay by fracture reduction.

The methods of reduction and immobilization of facial fractures has evolved over the past few decades. In the mid-face, the trend today is almost to avoid the use of external fixation devices, eg. Halo frames. Other than in severe bony comminution, there is a multitude of titanium mini plating systems which are used to reduce and stabilize midfacial injuries. A similar tendency exists with mandibular fractures, where rigid fixation according to Champy's principles predominates with titanium bone plates. Although these methods have distinct advantages of decreased time of intermaxillary fixation, accurate reduction and direct bony alignment of fracture

sites to facilitate healing, the length of the surgical procedure and cost of the material may preclude surgeons from using this modality of treatment in poorer developing countries.

In this study, no significant effect was noted between the type of fracture reduction and the length of hospitalization. The determining factors on which type of reduction is used is based on the patient load and staffing and surgical capacity of the hospital.

4.5 Hospital stay by age in decades.

There were no statistically significant effects of age on the length of hospitalization. The hospital did not provide a pediatric service and no children under the age of 10 years were seen but rather transferred to Johannesburg Hospital.

A unimodal distribution of age was noted where the majority of patients admitted to hospital were in the 2nd to 5th decades, the peak incidence being in the 3rd decade. This age distribution pattern seems to be common in most world centers. In studies by Torgersen and Tornes (1992), involving 169 patients in Norway and Ugboko et al (1998), involving 442 cases in Nigeria, similar results was noted.

4.6 Hospital stay by gender.

A significant effect was seen when comparing hospital stay to gender. While most male patients staying longer than 4 days had sustained severe trauma to the maxillofacial region, females in this category had mostly severe fascial space sepsis or pathology rather than traumatic injuries.

This trend is noted throughout the developed world where considerably less females sustain facial fractures as a result of interpersonal violence. In his study,

Vetter et al (1991), showed facial fractures occurring three times more commonly in males than in females. This was consistent with other international studies.

4.7 Gender by etiology.

In this study, 75% of the patients presenting to hospital were males compared to females. 79% of these patients sustained injuries as a result of interpersonal violence and gunshot wounds and only 5% and 16% were involved in road traffic accidents and sepsis/pathology/dental causes respectively. A different trend was noted in the female group where interpersonal violence played a lesser etiological role compared to road traffic accidents and sepsis/pathology/dental causes. Throughout the world, males appear to be more commonly involved in maxillofacial trauma. Both Telfer et al (1991) and Koorey et al (1992), showed that almost 75% of patients with facial fractures were males.

A trend exists, in recent years, in which the etiology of maxillofacial injuries has moved away from road traffic accidents towards interpersonal violence. Kahn et al (1988) showed that 81.6% of facial fractures in Zimbabwe were as a result of assaults. Vetter et al (1991), showed, in his study in Hartford USA, a marked increase in facial fractures (37%) as a result of assaults compared to a similar study by Luce et al(1979) a decade prior to this where 35% of facial fractures occurred as a results assaults, falls and sport related injuries.
The decline in road traffic accidents may be as result of more stringent road safety rules and severe penalties for drunken driving. The coincidental rise in interpersonal violence reflects the dramatic rise in socio-economic strife especially in urban settlements. Although alcohol comsumption was not documented in this study, it appeared to play a major role in the etiology of most of the injuries.

Shepherd 1989, showed that although some of the injuries as a result of interpersonal violence may be minor compared to those from other causes, they are often important sign of underlying severe social pathology. It is therefore incumbent upon maxillofacial and oral surgeons to understand the etiology and social background of racial and domestic violence particularly in relation to alcohol and unemployment.

4.8 HIV status by etiology.

No significant effect was seen comparing HIV status to etiology.
In this study, 10.2% of all the patients were HIV positive. In his study, Sloan et al (1995), showed that 4,3% of patients treated at a level 1 trauma unit in Chicago USA in 1988 were HIV positive. Rudolph et al (1993) showed 3,5% of trauma patients admitted to hospital were HIV positive. Both these studies c[illegible]ed the major etiology as intravenous drug related abuse. Only 3% of the patients admitted to high risk sexual partners or homosexual activities.
In our study, it appeared that high risk sexual activity was the most predominant etiology of seropositivity. This trend seems to be more prominent especially in South Africa and developing African countries.
Both American studies above reiterated the importance of adequate precautions being taken by health care workers especially in the trauma setting and the establishment of HIV primary care facilities for both testing and counselling.

## CHAPTER 5

## CONCLUSION.

The statistics shown in this study again show the marked prevalence of facial injuries sustained as a result of trauma. Interpersonal violence in the form of assaults and gunshot injuries still remain the major etiological factor in facial fractures in South Africa. While common assaults still play the higher role in facial trauma, a marked increase has been seen in gunshot injuries to the head and face. This is largely attributed to the lack of effective firearm control and legislation as well as the marked increase in car hijacking in South Africa.

Despite this increase in violence related injuries, the lengths of hospitalization for the treatment of these injuries is still relatively short. The major factor for this is the early diagnosis and treatment of these injuries. At the present time, due largely to financial constraints, many academic hospitals, including Hillbrow Hospital, have been closed and this will have a significant effect on the remaining hospital's staffing establishment and facilities. The length of time taken to adequately diagnose and then treat these patients will be longer resulting in the need for more complicated surgical procedures and hence longer periods of hospitalization. In addition, as the workload increases the utilization of more sophisticated treatment modalities to treat maxillofacial injuries will become less. For example open reduction and plating of fractured mandibles may become too costly and time consuming resulting in the more frequent use of intermaxillary fixation.

Unfortunately, most of the population of South Africa is solely reliant on the public government run health care system and as it becomes more impeded by financial constraints and inadequate staff so the treatment load increases. A minority of the population in South Africa is able to afford private health care and it is largely in this sector where current trends and practices predominate.

A further far reaching effect is that of academic teaching. As the burden of trauma increases and financial resources decrease, a definite decrease in the amount of elective surgery and teaching of current trends is seen. One aspect of maxillofacial and oral surgery which has definitely been affected by this is the teaching of osseointegrated implantology where this is no longer affordable in the public sector.
It may therefore depend on maxillofacial and oral surgeons in the private sector to render teaching to registrars in these aspects of maxillofacial and oral surgery.

Recent trends in Southern Africa suggest a severe epidemic with regards to the Human immunodeficiency virus. While the statistics in this study showed a rate of approximately 10% in 1995, the prevalence of HIV infection amongst females attending antenatal clinics throughout the country has dramatically increased.
Floyd in 1996, showed that 2.4 million adults in South Africa were infected with the HIV virus
According to the statistics from the Gauteng Department of Health (1998), unlinked anonymous testing of females attending antenatal clinics throughout South Africa has shown 22.8% HIV positive.
Anyone working in state hospitals is aware of the high HIV positivity rate which is much higher than when the current study was done. The study needs to be repeated to see if the current observations of HIV status and maxillofacial injuries have changed.

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