Retrospective analysis of pan-facial fractures at Wits Oral Health Centre

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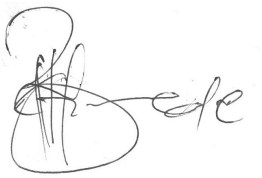
A research report submitted to the Faculty of Health Sciences, University of the Witwatersrand, in partial fulfilment of the requirements for the degree of Master of Dentistry

Johannesburg

March 2023

DECLARATION

I, Ntokozo Bhekisisa Gumede declare that this research report is my own. It is being submitted for the degree of Master of Dentistry in the Maxillofacial & Oral Surgery branch at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at another University.



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Signed: **NB Gumede**

Student Number: 9803333J

Submission: 20 March 2023

DEDICATION

This work is dedicated to my late grandmother (Ntombana Elizabeth Ndlovu) and my lovely daughter Minenhle.

ABSTRACT

Aim: This study aimed to retrospectively analyse the characteristics and treatment outcome of pan-facial fractures over five years at Wits Oral Health Centre.

Materials and methods: We designed and implemented a retrospective study composed of patients with pan-facial fractures treated at Wits Oral Health Centre. All records from January 2015 to December 2019 were analysed. Primary predictor was pan-facial fracture. Aetiology, location, type and distribution of pan-facial fractures were recorded. Perioperative variables included in the study were patient demographics, comorbidities, associated injuries and treatment outcomes.

Results: A total of 34 patients (32 M, 2 F) were included in the study. The mean age of patients was 36 years. The most common aetiology was assault (n=17) followed by road traffic accidents (n=12). Traumatic brain injury was the most common associated injury. All 34 patients had involvement of upper and lower midface fractures. 52 mandibular fractures were recorded in 34 patients. Only two of the 34 patients (6%) had complications.

Conclusion: Timing and stepwise management of pan-facial fractures in conjunction with neurosurgical team, focused on restoration of function and facial form, is required for optimal results.

ACKNOWLEDGEMENTS

I would like to thank my supervisor Prof. Ephraim Rikhotso for the guidance, knowledge, wisdom and patience he has demonstrated to me during this research project. His insight and understanding had given me the courage to persevere when I did not feel up to the task, and his good judgement helped me find solutions when I could not see them up myself.

I also like to express my utmost gratitude to Prof M Mabongo and Dr E Nokaneng.

To my fellow registrars, thank you very much for your support and camaraderie.

I would like to thank the general staff at the Maxillo-Facial and Oral Surgery units at Chris Hani Baragwanath and Charlotte Maxeke Academic Hospitals.

To Ms Rose J Ndlovu (my mother), thank you for your resolute support, encouragement and prayers.

Lastly, to God Almighty, I give all the glory.

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LIST OF ACRONYMS

AIDS	Acquired Immunodeficiency Syndrome
CEO	Chief Executive Officer
COVID-19	Coronavirus disease
CT	Computed Tomography
CSF	Cerebrospinal Fluid
HIV	Human Immunodeficiency Virus
HOD	Head of Department
HREC	Human Research and Ethics Committee
NOE	Naso-Orbito-Ethmoid
OM	Occipito-Mental
OPG	Orthopantomogram
ORIF	Open Reduction and Internal Fixation
PA	Posterior-Anterior
SMV	Sub-Mentovertex View
WITS	University of the Witwatersrand
ZMC	Zygomatico-Maxillary Complex

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION AND BACKGROUND TO THE

This chapter introduces background to problem infused with a literature review, problem statement, aim of study, objectives, research questions and significance of study.

1.1.1 Definition of Pan-Facial Fractures

Although there is no unanimity on their classification or definition, pan-facial fractures are defined as fractures of the craniomaxillofacial complex involving bones in the lower, middle, and upper thirds of the facial skeleton (Yang et al. 2012) where the lower third is made up of the mandible, middle third made up of orbit, zygoma, ethmoid, nasal, maxilla, maxillary and mandibular alveolar process and upper third made of frontal bone, fronto-orbital and sphenoid bone (Ali & Lettieri 2017) as shown in Figure 1. Follmar et al. (2007) regarded pan-facial fractures to concurrently involve all four axial segments of the facial framework: frontal, upper midface, lower midface, and mandible. These fractures often result in soft tissue destruction and damage to the facial skeleton, resulting in post-traumatic deformities and disabilities like "dish" face deformity, enophthalmos, loss of projection or facial height, malocclusion, widening of facial width (He et al. 2007; Kim et al. 2016).

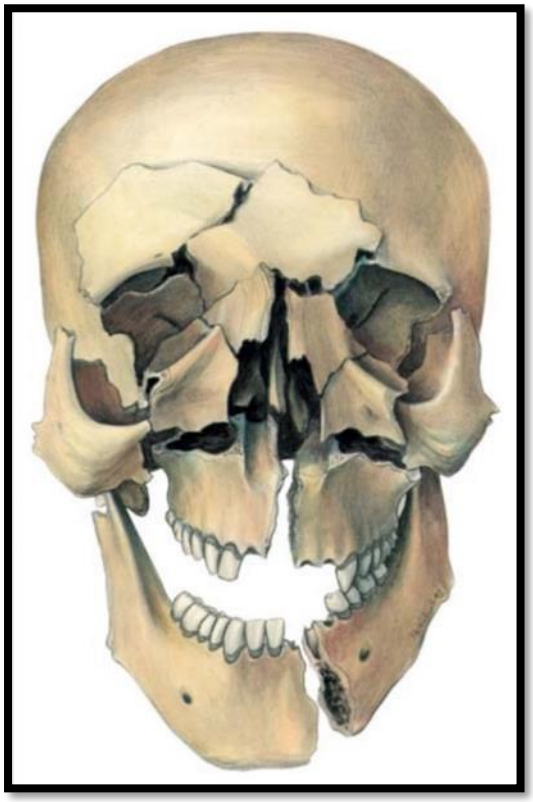

Figure 1 Pan-facial fractures (Perry & Holmes, 2014)

Fractures of the pan-facial region account for 4%-10% of all facial fractures (Kim et al. 2016). The most common fracture site in the mandible is the symphysis (33.5%), followed by condyle (31.1%) and body (17.9%) (Yang et al., 2012). According to Shah et al. (2016), unspecified mandibular fractures occurred in 73.5% of patients, while mid-face was 26.5%.

1.1.2 Characteristics of Pan-Facial Fractures

The cause, clinical features and management patterns of pan-facial fractures is mainly determined by socioeconomic factors of population studied (Mijiti et al., 2014). One study has revealed that characteristic features of pan-facial fractures differ from nation to nation, depending on each nation's socioeconomic and demographic factors (Olasoji et al., 2002).

1.1.3 Clinical Features

According to Louis et al. (2012), injury mechanism and probable energy of impact assists in identifying severity of pan-facial fractures. The clinical features of pan-facial fractures depend on the bones involved. Fractures involving the midface will present with oedema of face, bilateral periorbital oedema, bilateral subconjunctival haemorrhage, depressed nose, epistaxis, malocclusion, rhinorrhoea, diplopia, enophthalmos, anaesthesia or paraesthesia of the cheek (Patil et al. 2016). Fractures involving the mandible may present with paraesthesia of the lower lip, inability to open the mouth, facial asymmetry, step deformity, tenderness, deviation in mouth opening, bone crepitus and sublingual haematoma (Pickrell et al. 2017).

1.1.4 Aetiology

Pan-facial fractures often result from high energy forces directed at the craniomaxillofacial complex, which sometimes fractures other bones not been directly hit (Curtis & Horswell 2013). Pan-facial region have characteristics outside those that are observed in isolated fractures of the craniofacial region (Follmar et al. 2007). Such significant forces to maxillofacial region lead to contrecoup forces, which require a high index of suspicion for injuries elsewhere (Curtis & Horswell 2013).

Even though pan-facial fracture patterns are the same in many trauma units, individual factors or high energy forces responsible for such fractures depend on various countries' socioeconomic factors (Blumer et al. 2018). Some authors have reported road traffic accidents, interpersonal violence, and falls from heights as major causes of pan-facial factors (Erdmann et al. 2008). Similarly, Ramanujan et al. (2013) reported road traffic accidents, interpersonal violence, sports-related accidents, gunshot wounds and industrial accidents as plausible causes of these fractures.

1.1.5 Epidemiology / Incidences

In a study conducted in Bulgaria, the most common traumatic cause for pan-facial fractures was assault (42.6%), followed by car accident (23.1%), falls (16.2%), sports (5%), occupational (2%), and gunshot wound (0.9%) (Rubiev, 2012). Shah et al. (2016) reported that pan-facial fractures in low- to middle-income countries mainly occurred between ages of 20 and 40 years; this corroborated in a study by Mohan et al. (2022). It was also found to be more common in males when compared to females (Shah et al. 2016; Mohan et al. 2022). Road traffic accidents were responsible for 42.2% of pan-facial fractures in a study by Shah et al. (2016) and 82% in a study Mohan et al. (2022), followed by falls (37.2%) and assault (11.8%). Falls were higher in females when compared to road traffic accidents. Mijiti et al. (2014) reported road-traffic accidents (42.2%) as a major cause of pan-facial fractures, followed by interpersonal violence (17.6%) and falls (15.0%). Mohan et al. (2022) associated high incidence of pan-facial fractures with risky behaviour, such as not wearing protective devices and consumption of alcohol before driving. Road traffic accident remains the leading cause of pan-facial fractures in low-to-middle-income countries (LMIC) (Shah et al. 2016; Mohan et al. 2022; Curtis & Horswell 2013), followed by gunshot injuries (Curtis & Horswell 2013).

1.1.6 Management of Pan-Facial Fractures

Management of pan-facial fractures has advanced in the last few decades (Pasha et al. 2022). Previously repair of pan-facial fractures was performed with wire and various fixation techniques, which resulted in flattened and widened faces (Gadre, Kumar & Gadre 2021). However, since the emergence of rigid fixation in the1960s, principles for reconstructing structural relationships between skull base and occlusal surface and accurately narrowing the midface have significantly changed (Manson et al. 1995). Soft tissue repair techniques that result in satisfactory outcomes have emerged (Manson, 1986). Reconstructing pan-facial region fractures can be a challenging endeavour with many pitfalls. Poor anatomic reduction and fixation can result in problems with height, facial projection, and width. Pan-facial fractures usually accompany injuries in cranium and other serious injuries. As such, the maxillofacial surgeon must stage treatment considering priority status.

1.1.6.1 Principles of Buttress Repair

The key to stepwise fashion in managing fractures in the pan-facial region is understanding the principles of buttress repair (Manson et al. 1999). The facial buttresses represent vertical and horizontal struts between the occlusal region and the base of the skull. Buttresses make up areas of thick, dense bone that transmit chewing forces to the supporting regions of the skull. The buttresses provide quality bone that guides internal fixation and reconstruction of facial height, width, and projection (Grass & Mackinnon 1986; Gruss & Phillips 1989).

Reduction and fixation of facial buttresses form the basis for oral and maxillofacial reconstruction. Zygomaticomaxillary, pterygomaxillary, and nasomaxillary buttresses constitute the vertical buttresses, as shown in Figure 2.

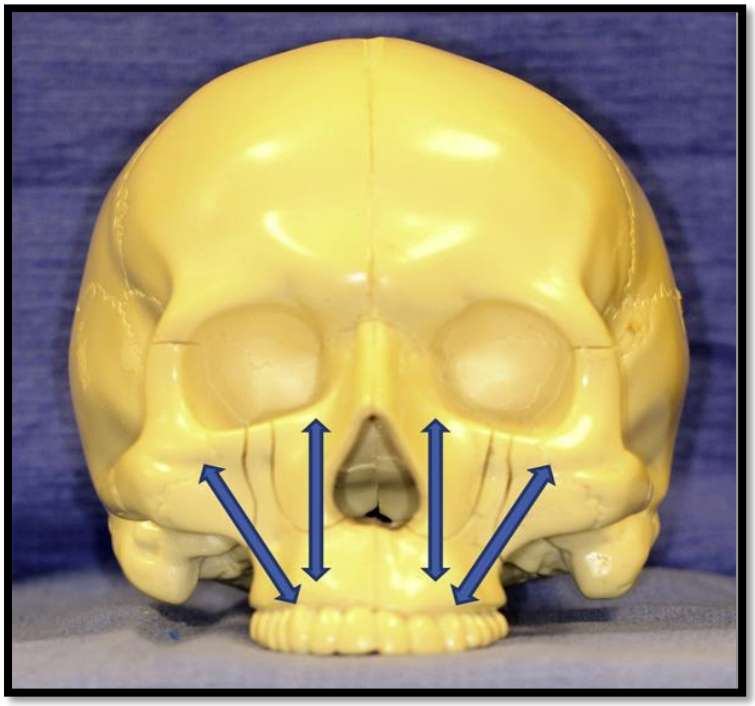

Figure 2 The vertical buttresses of midface (Gentile et al., 2013).

Horizontal buttresses, which include the superior orbital rims, infra-orbital rims /zygomatic arch and maxillary alveolus, play a critical role in facial width restoration, as illustrated in Figure 3 below (Curtis & Hoswell 2013). Apart from providing anatomical landmarks during maxillofacial reconstruction, buttresses provide a framework for protecting soft organs such as the brain and eyes.

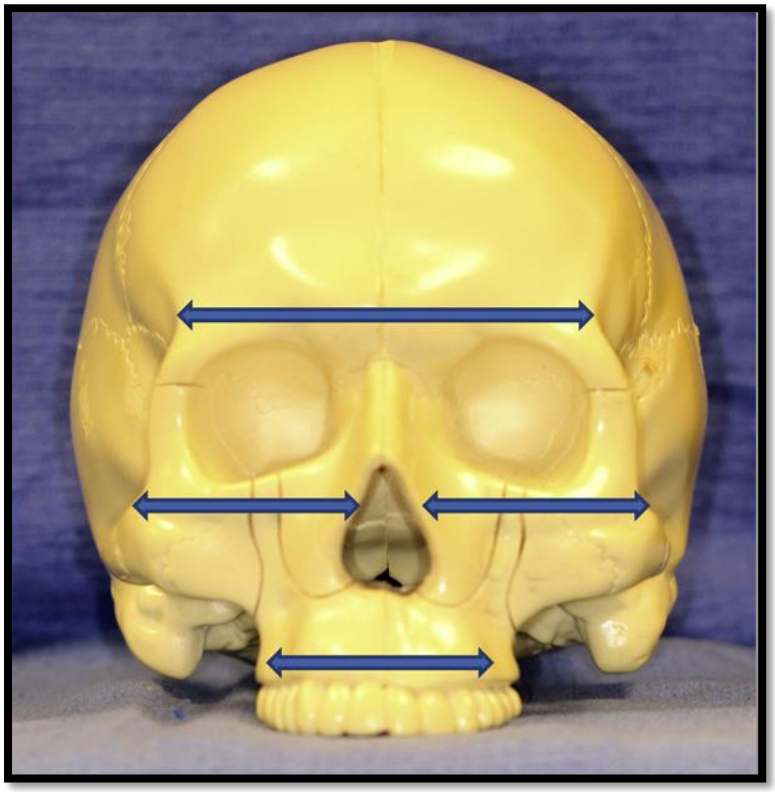

Figure 3 The horizontal buttresses of the midface (Gentile et al., 2013)

1.1.6.2 Management /Treatment Goals

Management of pan-facial fractures is usually delayed as they often occur in conjunction with complex life-threatening injuries to areas such as the cranium (He et al. 2007). However, suppose management is not done soon after the injury, the fractured bones usually mal-unite. In that case, contraction of soft tissues ensues, and scarring develops, all of which make late treatment very challenging. The treatment goals for pan-facial region's fractures are function restoration and pre-injury 3-dimensional facial contours without delay (Ramanujan et al., 2013). Nevertheless, a treating surgeon's most challenging part is deciding the correct stepwise sequencing of complex pan-facial fractures (Kim et al. 2016).

1.1.6.3 Management Sequences

Different schemes of management sequences have been proposed, including "bottom to top", "top to bottom"," "inside-out"/medial to lateral, or "outside-in"/lateral to medial (Gruss and Phillips, 1989; Koraitim 2020). The various sequences are detailed in the next subsection.

Bottom-to-top sequence

Bottom- to- top sequence begins with repair of the mandible, which determines the height of the lower third of the face. A correctly reconstructed mandible will re-establish posterior facial height and lower facial width and projection (Wening et al. 1991). The occlusion is then established, followed by repair of the zygomaticomaxillary complex, frontal sinus fractures, naso-orbit ethmoid (NOE) fractures and the maxilla is repaired last. However, Gruss and Phillips suggested reconstruction of the zygomatic arch and malar projections as an initial step in management to restore the "outer facial frame" and provide projection and upper facial width before NOE, maxillary and mandibular reconstruction (Gruss & Phillips 1989).

Top-to-bottom sequence

The top-to-bottom approach starts with repair of the frontal sinus fractures. Repair of zygomaticomaxillary complex fractures, NOE, Le Fort fractures, and r mandibular fractures follows. Merville agreed that stepwise fixation should start from "top-to-bottom" if the NOE region is part of the pan-facial fractures (Merville, 1974). Currently, no management sequence is established for pan-facial fractures treated late when the ends of bone fragments are mal-united. In such instances, controlling the facial projection, width, and height can be extremely difficult.

Inside-out/ medial to lateral, or outside-in/ lateral to medial

Many studies have compared combinations of these management approaches (Degala et al. 2015; Markowitz et al. 1989; Ramakrishnan et al. 2021). Degala et al. (2015) compared the top-to-bottom and outside-in sequences with the bottom-to-top and inside-out sequences. In both groups, patients achieved satisfactory occlusion. As the two sequences give similar clinical outcomes, deciding which approach to use depends on the surgeon's fracture pattern and preference. Markowitz et al. (1989) reported that the "bottom-to-top and outside-in"/lateral

to medial sequence is primarily widely utilised method in the treatment of pan-facial fractures because it has excellent advantages in reconstructing the outer facial frame and projection. Nevertheless, some surgeons prefer a "top-to-bottom" approach and achieve favourable results, provided the occlusion has been established. A recent review of the literature on the use of various sequencing techniques has found good and satisfactory outcomes achieved in "Bottom-top and outside-in"/ lateral to medial sequence compared with other sequence pattern (Ramakrishnan et al. 2021). The decision on which sequence to use depends on the pattern of facial fractures concerning the "immobile to mobile" and "simple to complicated" principles.

Surgical approaches and exposure

Surgical approaches to the face through incision allow extensive exposure of fractured bony fragments, resulting in adequate anatomic reduction, as illustrated in Figure 4. Fracture severity dictates the amount of exposure. Most trauma units prefer the bicoronal approach for surgical exposure (Zhuang et al. 2015; Zhang et al. 2006; Singh & Dhungel 2019). This is because it allows broad surface exposure to the upper and middle facial regions (Howarth, Pflibsen & Beals, 2021). The bicoronal approach is the preferred surgical technique within the University of the Witwatersrand Maxillofacial and Oral Surgery Department.

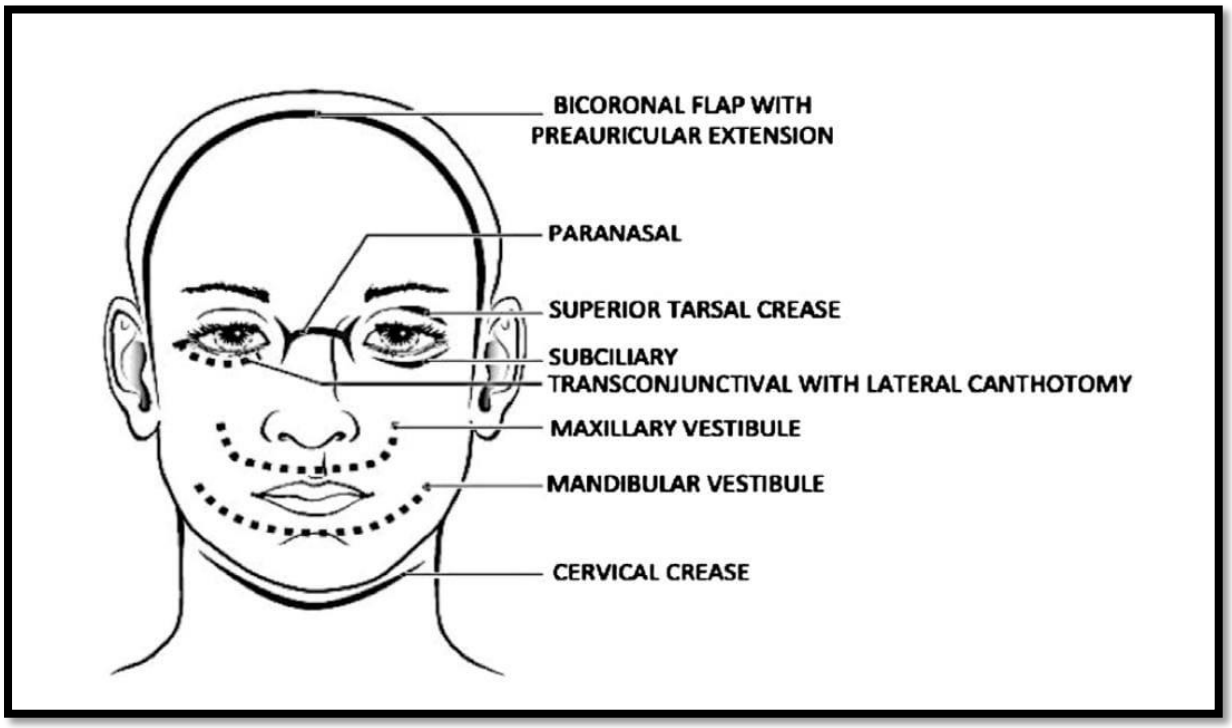

Figure 4: Surgical approaches to the facial skeleton. (Louis et al., 2012).

1.1.6.4 Complications Associated with Management of Pan-Facial Fractures

The extent of injuries around the face, severity of bone fragmentation, and location of fractures contribute to complications. Zachariades et al. (1993) reported a pan-facial fracture complication rate between 11% and 12.8%. However, a recently accepted complication rate for management of pan-facial fractures is around 17% (Politis, Kluyskens & Dormaar 2017; Bicsák et al. 2021; Casale et al. 2017; Cabalag et al. 2014).

The surgical management of pan-facial fractures is often associated with sequelae of inadequate correction, including increased facial width, enophthalmos, facial retrusion, and malocclusion (Massenburg & Lang 2021). A study by Lin et al. (2021) has suggested that of all the patients they have reviewed, 97.8% complained of postinjury complications. The most common complication was malocclusion (83.7%), followed by limited mouth opening (67.4%), infraorbital nerve palsy (45.8%), and hypoplasia/blindness (31.7%).

1.2 PROBLEM STATEMENT

South Africa is well known for its elevated levels of trauma emanating from road traffic accidents and violent crimes such as gunshots and stabbings (Lutge et al. 2016; Navsaria et al. 2021). These kinds of trauma are primarily responsible for facial injuries and pan-facial fractures that the Maxillofacial and Oral Surgery Departments manage in conjunction with other surgical disciplines. The Wits Oral Health Centre is one of four facilities in South Africa training Maxillofacial and Oral Surgeon. Despite considerable number of facial fractures treated at Wits Oral Health Centre, no study has been conducted to describe pan-facial fractures' patterns, distribution and treatment outcomes. Against this background, this study was undertaken to document the characteristics and treatment outcomes of pan-facial fractures seen within the Wits Oral Health Centres jurisdiction in the past five years.

1.3 AIM OF THE STUDY

To retrospectively analyse the characteristics and treatment outcome of pan-facial fractures at Wits Oral Health Centre in Johannesburg, Gauteng Province.

1.4 OBJECTIVES OF THE STUDY

- To determine the aetiology of pan-facial fractures among patients treated at Wits Oral Health Centre
- To determine the location of pan-facial fractures at Wits Oral Health Centre
- To describe how pan-facial fractures were managed among patients treated at Wits Oral Health Centre
- To identify factors which predict treatment outcome.

1.5 RESEARCH QUESTIONS

- What is the aetiology of pan-facial fractures among patients treated at Wits Oral Health Centre?
- What are the locations of pan-facial fractures treated at Wits Oral Health Centre?
- How were pan-facial fractures managed among patients treated at Wits Oral Health Centre?
- What are the factors that may predict treatment outcome of patients presenting with pan-facial fractures?

1.6 SIGNIFICANCE OF THE STUDY

The findings of this study will likely add to the body of knowledge in the management of pan-facial fractures within South African context. It was also envisaged that the findings will assist the Gauteng Provincial Department of Health in allocating appropriate resources to manage pan-facial fractures and reviewing policies linked to this project's outcome.

CHAPTER 2

RESEARCH METHODOLOGY

2.1 STUDY LOCATION

The study was conducted at Wits Oral Health Centre, Johannesburg, Gauteng Province, South Africa. Wits Oral Health Centre is affiliated with the University of the Witwatersrand's School of Oral Health Sciences, one of four institutions of higher learning training Dentists and Dental Specialists in South Africa. Data were collected from the Department of Maxillo-facial and Oral Surgery at Charlotte Maxeke Johannesburg Academic Hospital and Chris Hani Baragwanath Academic Hospital, which are part of the primary teaching facilities for Wits Oral Health Centre. Charlotte Maxeke Johannesburg Academic and Chris Hani Baragwanath Academic Hospitals are referred to as central hospitals being the most advanced of all public health facilities in the country. According to *Regulations Relating to Categories of Hospitals* of 2012, central hospitals should have a bed capacity of about 1200, be attached to a medical school and offer subspecialised services.

2.2 STUDY DESIGN

To answer the research question, a five-year retrospective case-control design (Hess 2004) was followed on patients who presented with pan-facial fractures at the Department of Maxillo-facial and Oral Surgery of Charlotte Maxeke Johannesburg Academic Hospital and Chris Hani Baragwanath Academic Hospital (Wits Oral Health Centre) between 01 January 2015 and 31 December 2019. A Retrospective case-control design is exploratory in that it is likely to identify little-known phenomena, such as identifying specific risks associated with the matter under investigation (Hess 2004; McMillan & Schumacher 2006). A retrospective design utilises existing data collected for purposes other than for research, such as medical records (Hess 2004). This design was chosen due to its advantages. Data were readily available (Hess 2004).

2.3 TARGET POPULATION

A target population is a group of elements or cases that conform to a particular criterion to which the results are intended to be generalised (McMillan & Schumacher (2006:119). The

target population for this study were patients who presented to the Department of Maxillo-facial and Oral Surgery at Charlotte Maxeke Johannesburg Academic Hospital and Chris Hani Baragwanath Hospital with pan-facial fractures between 2015 and 2019.

2.4 SAMPLING

A non-probability and purposive sample (Etikan, Musa & Alkassim 2016) of patients who presented to the Department of Maxillo-facial and Oral Surgery at Charlotte Maxeke Johannesburg Academic Hospital and Chris Hani Baragwanath Hospital with pan-facial fractures between 2015 and 2019 was retrospectively selected. Purposive sampling is 'used to select respondents most likely to yield appropriate and useful information' (Kelly, 2010:317). In the case of this study, data from patients who sustained pan-facial fractures were used.

2.4.1 Inclusion Criteria

To be included in the study, patients must have met the following inclusion criteria:

- Any gender
- Above the age of 18 (not to be considered as a child)
- Had pan-facial fractures.
- Treated at the Department of Maxillo-facial and Oral Surgery at Charlotte Maxeke Johannesburg Academic Hospital and Chris Hani Baragwanath Hospital between 01 January 2015 to December 2019

2.5 RESEARCH INSTRUMENT

The researcher developed a data collection tool/questionnaire (see ANNEXURE A) based on available literature and in line with the study's objectives. The tool/questionnaire has closed-ended and open-ended questions (McMillan & Schumacher 2006), eliciting both quantitative and qualitative data. The tool comprises two sections collecting a patient's demographic and clinical information.

The **demographic information** includes age; gender; occupation; social history, including alcohol and tobacco use. On the other hand, **clinical information** included medical history or comorbidities, including diabetes mellitus, hypertension and other conditions. Medical history

was followed by aetiology of fracture; distribution of fracture; associated injuries; treatment, and date of treatment. Radiological records or images such as orthopantomogram (OPG); Occipito-Mental (OM); Posteroanterior (PA) view of mandible; Skull submentovertex (SMV), and computerised tomography (CT) scan were used to determine site, type, location and number of fractures sustained which had to do with fracture distribution and associated injuries. The last aspect of data collection tool was treatment outcome, including complications.

2.6 DATA COLLECTION TECHNIQUES

Data collection commenced as soon as the researcher obtained all the necessary permissions from the authorities (Charlotte Maxeke Johannesburg Academic Hospital and Chris Hani Baragwanath Hospital) (ANNEXUREs E and F). The researcher collected all necessary documentation (patient records including radiographic images) from Charlotte Maxeke Johannesburg Academic Hospital and Chris Hani Baragwanath Hospital , perused it and completed the questionnaire (ANNEXURE A).

2.7 DATA ANALYSIS

Data were captured into a Microsoft Excel® spreadsheet for statistical analysis. The exploratory study described the aetiology, fracture location, treatment and outcome. Descriptive statistics in the form of mean, frequencies, percentages and range (McMillan & Schumacher 2006) was used to address the first three objectives of the study. As for the last objective, which was to identify factors which predict treatment outcome, multiple regression was required (McMillan & Schumacher 2006) but was not done. Failure to do multiple regression became a limitation of study.

2.8 ETHICAL CONSIDERATIONS

Research involving human subjects should observe the following ethical principles, autonomy, beneficence, non-maleficence and justice (Speziale & Carpenter 2007). Autonomy deals with informed consent, voluntary participation and permission to conduct research (Speziale & Carpenter 2007:62). Beneficence is not harming participants. In contrast, non-maleficence is about doing good (Speziale & Carpenter 2007:62). Justice ensures that participants are treated with dignity and respect, with their anonymity and confidentiality maintained.

The four ethical principles were applied as follows:

- The study was approved by Human Research Ethics Committee (HREC) of the University of the Witwatersrand (reference number M200845) (ANNEXURE B)
- Permission was obtained from (ANNEXURE B-F):
  (a) Head of School of Oral Sciences,
  (b) Head of Maxillo-facial and Oral Surgery
  (c) CEO of Charlotte Maxeke Johannesburg Academic Hospital
  (d) CEO of Chris Hani Baragwanath Hospital.
- All patients were assigned identification numbers.

CHAPTER 3

RESULTS

3.1 INTRODUCTION

In Chapter 3, results of the study are presented, starting with demographic characteristics of participants (age, gender, occupation, and social history) and ending with clinical information (Comorbidities, aetiology, associated injuries, pan-facial injuries distribution, treatment and outcome).

3.2 DEMOGRAPHIC CHARACTERISTICS OF PARTICIPANTS

The clinical records of 34 patients who presented with pan-facial fractures at the Maxillofacial and oral surgery departments of the two Wits Oral Health Facilities between 01 January 2015 and 31 December 2019 formed part of this study.

3.2.1 Age

Participants' age ranged from 19 to 65, with a mean of 36 and a standard deviation of 9.66 years. The median was 35.5, with a mode of 36. The various age ranges of patients with frequencies and percentages are presented in Table 1.

Table 1 Participants' Age

Age range (Years)	**Frequency**	**Percentage**
10-19	1	2.9%
20-29	8	23.5%
30-39	16	47.1%
40-49	6	17.6%
50-59	2	5.9%
60-69	1	2.9%
Total	**34**	**100%**

3.2.2 Gender

There were (*n*=32) 94.1% males and (*n*=2) 5.9% females, as depicted in Figure 5.

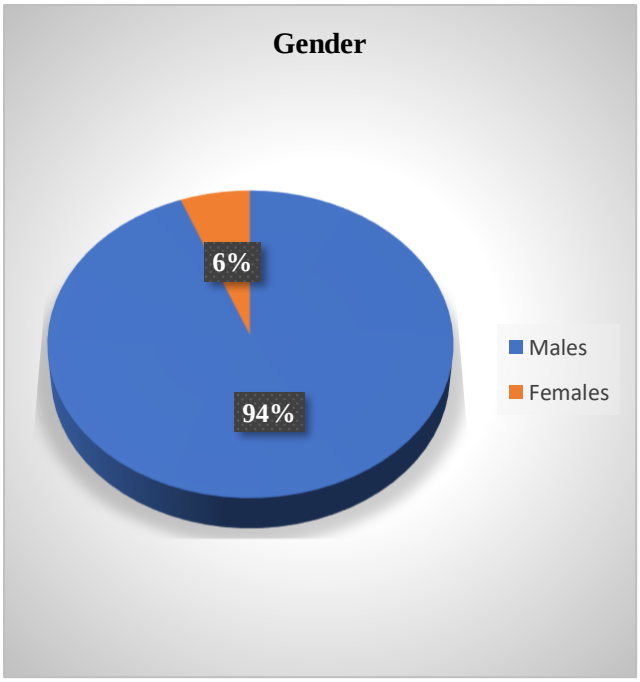

Figure 5 Gender Distribution

3.2.3 Occupation

Most patients were unemployed (*n*=20, including inmates) 58.9%, followed by students (*n*=4) 11.8% and security guards. A summary of each occupation group with its frequency and percentage is presented in Table 2.

Table 2 Summary of Participants' Occupation

Occupation	Frequency	Percentage
Domestic workers	1	2.9%
Drivers	2	5.9%
General workers	2	5.9%
Hawkers	1	2.9%
Pensioners	1	2.9%
Inmates	2	5.9%
Security guards	3	8.8%
Students	4	11.8%
Unemployed	18	53.0%
Total	**34**	**100%**

3.2.4 Social History

Most participants consumed alcohol (*n*=30) 88%, as shown in Figure 6. About (*n*=23) 68% of all patients were tobacco smokers, as depicted in Figure 7.

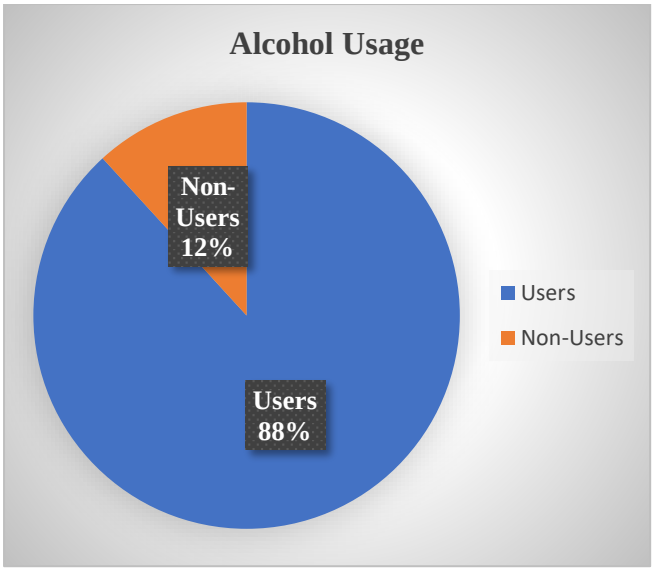

Figure 6 Social History – Alcohol Usage

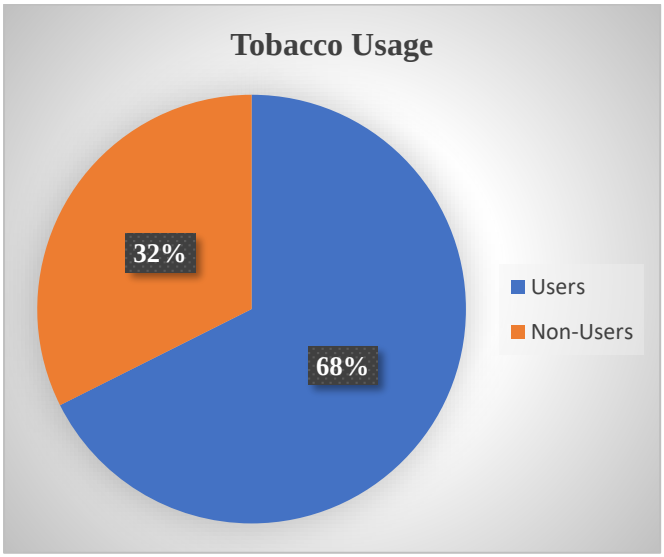

Figure 7 Social History – Tobacco Usage

3.3 CLINICAL INFORMATION

3.3.1 Medical History/Comorbidities

Majority of participants (*n*=18) 53.0%, had other medical conditions or comorbidities. A summary of reported comorbidities is shown in Table 3.

Table 3 Summary of Comorbidities

Comorbidities	**Frequency**	**Percentage**
HIV	4	11.8%
Diabetes Mellitus	2	5.9%
Hypertension	5	14.7%
Other conditions	7	20.6%
Not Reported	16	47.0%
Total	**34**	**100%**

3.3.2 Aetiology of Pan-Facial Fractures

The most common aetiology was assault (*n*=17) 50.0%, followed by road traffic accident (*n*=12) 35.0% and gunshot (*n*=3) 8.8%. A summary of aetiology of pan-facial fractures is presented in Table 4.

Table 4 Aetiology of Pan-Facial Fractures

Aetiology	Frequency	Percentage
Assault	17	50.0%
Motor Vehicle Accident	8	23.5%
Pedestrian Vehicle Accident	4	11.8%
Gunshot (face)	3	8.8%
Fall from height	2	5.9%%
Total	**34**	**100%**

3.3.3 Associated Injuries Distribution

The majority of participants (*n*=29) 85.0%, did not have any associated injuries. About 15% (*n*=5) reported associated injuries. Traumatic brain injuries (*n*=3) 9% were leading, followed by epidural haematoma and pneumothorax (*n*=1) 3% as well as anterior & middle cranial fossa fracture (*n*=1) 3%. A summary of associated injuries in frequencies and percentages is presented in Table 5.

Table 5 Associated Injuries Distribution

Associated Injury	Frequency	Percentage
Traumatic Brain Injury	3	9.0%
Epidural haematoma & pneumothorax	1	3.0%
Anterior & middle cranial fossa fracture	1	3.0%
Not Reported	29	85.0%
Total	**34**	**100%**

3.3.4 Pan-Facial Fractures Distribution

Pan-facial fractures were observed on face's frontal, upper midface, lower midface, upper & lower midface, and mandibular areas. A summary of all fractures is shown in Table 6.

3.3.4.1 Frontal Area

Only three patients (9%) in the frontal area presented with frontal sinus fractures.

3.3.4.2 Upper Midface Area

Three participants (9%) presented with Naso-Orbito-Ethmoid fracture (NOE). Another three (9%) had bilateral nasal fractures, followed by one patient each (3%) with bilateral, right and left orbital floor fractures.

3.3.4.3 Lower Midface Area

Only (*n*=6) 18% of patients sustained fractures at lower midface area. Two patients 6%, had palatal split, and two others (6%) had bilateral LeFort 1 fractures. The last two (6%) had left LeFort 1 fractures.

3.3.4.4 Upper and Lower Midface Area

All patients (*n*=34) 100% had a fracture(s) of varying degrees at upper and lower midface area. Most participants (*n*=13) 37% had left Zygomaticomaxillary (ZMC) fractures, followed by right ZMC (*n*=5) 15%. One patient (3%) had bilateral ZMC. Total unilateral ZMC were at 53 % (*n*=18). Therefore, majority of patients (*n*=19) 56%, had ZMC fractures. Almost 24% (*n*=8) of patients LeFort 3 fractures of varying sides, followed by 21% (*n*=7) LeFort 2 fractures.

3.3.4.5 Mandibular Area

A total of 52 mandibular fractures were recorded in all 34 patients (100%). These fractures manifested in 16 locations which can be further categorised into nine. Left angle fracture was the most common at 18% (*n*=6), followed by the Left angle + right body at 12% (*n*=4), as well as left condyle also at 12% (*n*=4).

Table 6 Pan-facial Fracture Distribution

Patient N	Age	Sex	Frontal	Upper Midface	Lower Midface	Upper and Lower Midface	Mandibular
1	32	M			Palatal split	R LeFort 3	R condyle + L body
2	27	M				L ZMC	Symphysis
3	23	M				B/L LeFort 2	B/L condyle + symphysis
4	19	M				R ZMC	L angle + R body
5	45	M	Frontal sinus			L ZMC	L condyle
6	34	M				L LeFort 3	L parasymphysis
7	47	M		B/L orbital floor		B/L LeFort 3	R parasymphysis
8	35	F				R LeFort 2	R angle + L body
9	42	M				L LeFort 2	L angle + R body
10	36	M			L LeFort 1	L ZMC	L angle
11	31	M		B/L nasal		R ZMC	B/L angle
12	28	M				B/L LeFort 3	R angle + L body
13	33	M				L ZMC	B/L condyle
14	36	M				L ZMC	L angle
15	65	M	Frontal sinus	NOE	B/L LeFort 1	B/L ZMC	R angle + B/L body
16	42	M				B/L LeFort 2	L condyle
17	34	M				L ZMC	L angle + symphysis
18	35	M				L ZMC	R condyle
19	37	M				L LeFort 2	B/L condyle
20	24	M				R ZMC	symphysis
21	56	M				B/L LeFort 3	L angle
22	43	M		B/L nasal		L ZMC	L condyle
23	29	F			Palatal split	L ZMC	B/L condyle
24	38	M				B/L LeFort 2	R condyle + L body
25	42	M		NOE		R ZMC	L angle
26	36	M	Frontal sinus			R LeFort 3	L angle + R body
27	39	M				L ZMC	B/L body
28	38	M		R orbital floor		L ZMC	L parasymphysis
29	23	M				B/L LeFort 2	L angle
30	32	M			B/L LeFort 1	R ZMC	L condyle
31	36	M		L orbital floor	L LeFort 1	L ZMC	L angle
32	26	M		B/L nasal		B/L LeFort 3	R angle
33	52	M				L ZMC	B/L body
34	28	M		NOE		B/L LeFort 2	L angle + R body

M= Male; F= Female; L= Left; R= Right; BL= Bilateral; NOE= Naso-Orbito-Ethmoid; ZMC= Zygomaticomaxillary

3.3.5 Treatment

The range of days between injury and maxillofacial surgery was two (2) to five (5), with an average of three (3) days. Majority of patients (*n*=32) 94.0%, had open reduction and internal fixation (ORIF). Two participants (*n*=2) 6%, had debridement plus ORIF, as depicted in Figure 8.

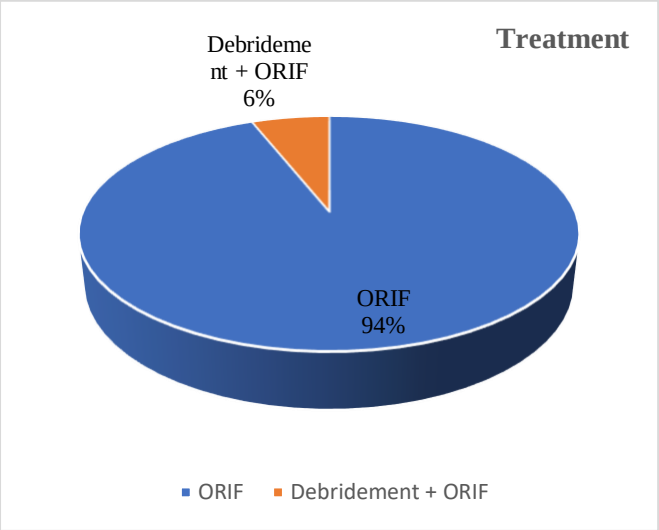

Figure 8 Types of Treatment

3.3.6 Outcome

No intra-operative complications were seen in any of the patients. Instead, occlusion was found to be acceptable in all patients postoperatively. Overall, the outcome was satisfactory in 32 (94.0%) patients. Two patients (6%) developed complications, and one (3%) eventually died of traumatic brain injury. The said patient's profile is shown in Figure 9. The other patient had septic hardware removed and ORIF redone (see Figure 10).

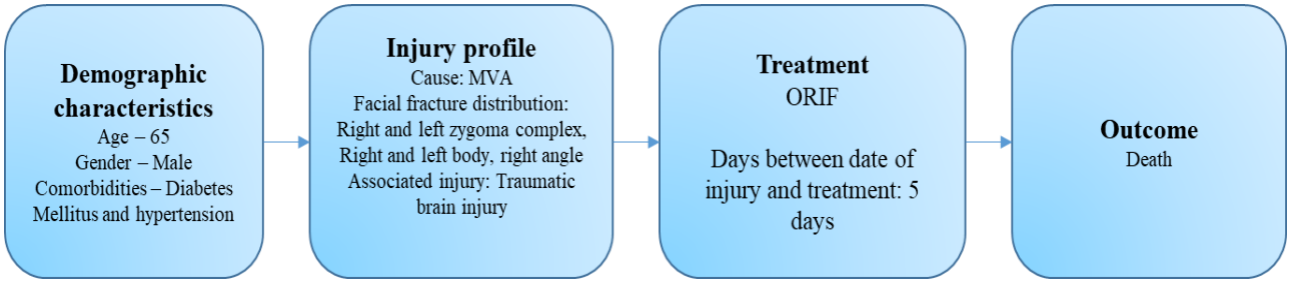

Figure 9 Profile of Patient who Died.

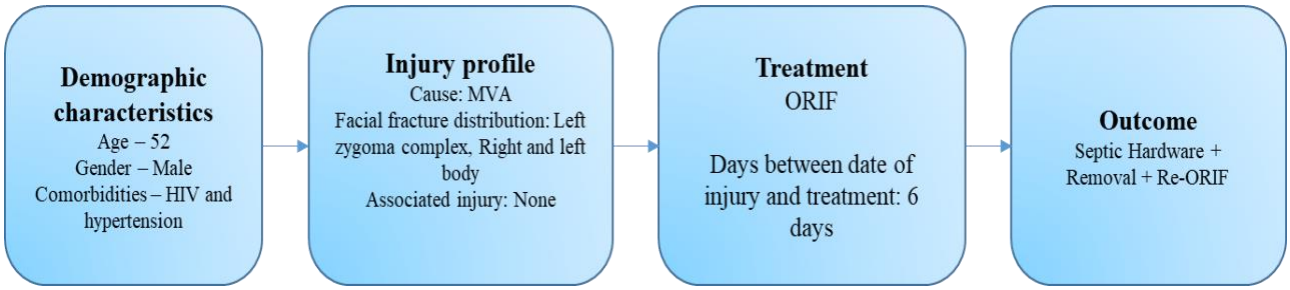

Figure 10 Profile of a Patient with Septic Hardware

CHAPTER 4

DISCUSSIONS

4.2 DEMOGRAPHIC INFORMATION

4.2.1 Age and Gender

In recent studies involving pan-facial fractures and their management, the age of patients varied slightly. A study by Murakami et al. (2022) had a mean age of 51.3 years, and Cynthia et al. (2023) had a much younger mean age of 28.6. In contrast, Mohan et al. (2022) had the majority (61%) in the 18-40 age group, slightly less than in the current study, where the 18-40 group were 74% of the total participant. The findings of the current study, as supported by others (Cynthia et al. 2023; Mohan et al. 2022), are in line with earlier findings by Shah et al. (2016), who suggested that pan-facial fractures are much more common between the ages of 20-40 years. However, neither the current study nor previous studies on pan-facial fracture have provided reasons why the 20-40 group is vulnerable to these injuries. Mohan et al. (2022) have linked risky behaviours as reasons leading to pan-facial fracture but fell short of linking such with age or gender of patients.

It is also interesting that the current study and other studies had over 93% of patients being males (Cynthia et al. 2023; Mohan et 2022). Rogers et al. (2010) have suggested that males tend to engage in riskier and more dangerous behaviour than their counterparts, which could be the reason more males present with these fractures. Similarly, Johnson et al. (2002) have associated youthful age with risky and dangerous behaviour.

4.2.2 Alcohol and Tobacco Use

Most patients 88% in the current study, consumed alcohol. The collection of drinking habits in the study did not imply that patients were intoxicated or had taken alcohol before the accident that landed them in the emergency department. However, a study by Mohan et al. (2022) found that 64% of all patients who presented with pan-facial fractures in the emergency department were intoxicated. It is also well known and generally accepted in society that alcohol consumption is likely to increase one's chance of engaging in risky and dangerous behaviour such as drunk driving and jaywalking. Patients who are under the influence of alcohol are said to be at risk of sustaining falls and assault-related pan-facial fractures (Jin et al, 2018). In similar studies investigating pan-facial fractures, Murakami et al. (2022) reported only 4% of their participants compared with 68% in the current study. However, no association has been made between tobacco use and pan-facial fractures. Tobacco contains many toxins, carcinogenic agents, and nicotine, a known neurotoxin (Talhout et al. 2011). Unlike alcohol intake, which directly affects one's immediate risky and dangerous behaviour, tobacco tends to be a risk for chronic disease (Alkam & Nabeshima 2019), which is likely to predispose patients with pan-facial fractures to complications.

4.2.3 Occupation of Participants

Most patients (59%) were unemployed in the current study, in keeping with the situation in South Africa. As an example, Statistics South Africa [STATSSA] has reported a 34.9% unemployment rate in the third quarter of 2021, of which 66.5% were young people [STATSSA 2021], making it one of the highest by any world standards (Maskaeva & Msafiri 2021).

4.3 CLINICAL INFORMATION

Comorbidities, aetiology, associated injuries, pan-facial distribution, treatment, outcome and complications are discussed in the following sub-section.

4.3.1 Comorbidities

Most participants, 53% in the current study, had different comorbidities. At times, comorbidities have a bearing on the aetiology of a condition as well as the treatment outcome of such a condition. People living with HIV have been reported to have reduced bone mineral density making them more susceptible to fractures and reduced healing (Chang et al. 2021;

Martinez et al. 2022). On the other hand, diabetes mellitus has been found to affect bone fragility and reduce bone mineral density (Romero-Díaz et al. 2021). In addition, the condition is said to result in a poor prognosis due to delayed healing (Hernandez et al. 2012). It makes patients susceptible to infections (Humphers et al. 2014).

One Korean study has suggested that postoperative outcome of patients with hip fractures was compromised due to hypertension (Yoon et al. 2021). Even though that study did not focus on pan-facial fractures, there seems to be a relationship between fracture healing and hypertension. Similarly, other chronic conditions, such as chronic kidney disease (Wakasugi et al. 2022), have been associated with bone fragility and reduction in bone mineral density. Like alcohol and tobacco smoking habits, comorbidities also affect the cause and outcome of pan-facial fractures.

4.3.2 Aetiology

South Africa has one of the highest interpersonal violence in the world (Prinsloo et al. 2022). It is not surprising that 50% of the participants in the current study sustained injuries or pan-facial fractures due to an assault. Besides assaults, 9% of the patient's injuries resulted from gun violence. The numbers of gun-related injuries are higher in South Africa. For example, there were 127000 cases in 2005 (Allard & Burch 2005) which decreased to about 55000 in 2012 (Martin et al. 2017). In agreement with the current study, other studies also cited assault as the commonest aetiology of these fractures in countries such as Jordan (16%) and Canada (41%) (Czerwinski et al., 2008). Other low to middle-income countries such as Nigeria (13%), Brazil (22.5%), and Zimbabwe are said to be reporting assault-related aetiology (Schon et al. 2001).

Contrary to the high numbers of violence-related causes of pan-facial fractures in South Africa, other countries have reported road traffic-related accidents to be the leading aetiology for these fractures (Ramanujam et al. 2013; Mijiti et al. 2014; Blumer et al. 2018; Mohan et al. 2022; Cynthia et al. 2022). Road traffic accidents were the second commonest aetiology for pan-facial fractures (35%) in the present study. In some recent studies where road traffic accidents were the most common, they reported exceedingly high numbers compared to the current study. Cynthia et al. (2023) reported 95.4%, with Mohan et al. (2022) and Murakami et al. (2022) reporting 82% and 60%, respectively.

Only 6% of the current study sustained fractures from falls. A study by Lin et al. (2021) has reported that pan-facial fractures from falls are related to industrial or occupational accidents. The numbers were low in the current study due to the high number of unemployed patients.

4.3.3 Associated Injuries

Concomitant injuries are frequent among patients with pan-facial fractures. Jang et al. (2020) study reported that as much as 89% of patients with pan-facial fractures had concomitant injuries. Yang et al. (2012) had concomitant injuries in 41.1% of their patients, while Mijiti et al. (2014) reported 48.3%.

Some of the most common concomitant injuries associated with these fractures are upper or lower limb injury, cervical spine injury, thorax injury, craniocerebral injury, and abdomen injury (Lin et al. 2021). Of the 34 patients in the present study, 15% presented with associated injuries, including traumatic brain injury, anterior and middle cranial fossa fracture, epidural haematoma and pneumothorax. However, associated injuries were not as high as reported in other studies (Yang et al. 2012; Mijiti et al. 2014; Jang et al. 2020).

4.3.4 Pan-Facial Fracture Distribution

This study observed about 34 combinations of pan-facial fractures out of 34 patients when compared with 69 combinations from 227 patients in a study by Lin et al. (2021). The most common fracture sites were on the mandible (100%), zygomaticomaxillary (56%), LeFort 3 (24%), and LeFort 2 (21%), followed by Naso-Orbito-Ethmoid and frontal sinus at 9% each. The distribution of pan-facial fractures in Lin et al. (2021) study was 92% maxillary sinus wall, 82.8% mandibular, 75.3% zygomatic arch, 74.9% lateral orbital wall and 69.6% nasal bone. Our findings align with a Saudi Arabia study that reported mandibular and Le Fort 2 & 3 as the most common fracture distribution (Daniels et al. 2020).

4.3.5 Treatment

It took an average of three (3) days between injury and surgical management of patients in this study. The time it took to manage pan-facial fractures does not significantly differ from other studies. For example, it took 4.7 days with a standard deviation 3.9 in Murakami et al. (2022).

In the present study, all 34 patients were treated using ORIF under general anaesthesia. This contrasts with other studies (Al Ahmed et al. 2004; Barkadjiev et al. 2007), in which conservative treatment or closed reduction was often used.
All patients had CT scans and 3D CT reconstructions before surgery to analyse the characteristics of their fractures. A neurosurgical and ophthalmological evaluation was obtained for some patients. The pre-anaesthetic consult was done if needed. Bi-coronal or hemi-coronal, lateral brow, pre-auricular, infraorbital, subciliary, transconjunctival or through pre-existing scar as per merit of the case was used. The neck incision was used to access various parts of the mandible. The infraorbital approach was used on the orbital floor. Intraoral access was done via maxillary and mandibular vestibular approaches.

Submental intubation was used in six patients. This intubation is an effective and safe method for securing the airway in managing patients with fractures of the pan-facial region when a wide surgical exposure and restoration of occlusion is needed (Ramanujam et al. 2013). Tracheostomy was performed in two patients who required long-term intubation postoperatively. Maxillomandibular fixation was used and removed at four weeks postoperative in all but two patients.

Other studies on fractures of pan-facial region revealed that two approaches of treatment had been recognised as "top-to-bottom" (Grus et al. 1992) and 'bottom-to-top" (Yang et al. 2012; Wening et al. 1991; Markowitz et al. 1989). There are different philosophies about these two approaches. The bottom-to-top approach entails fixing maxilla-mandibular unit as the initial step. This would allow the occlusal relationship to be reconstructed and "built out" accordingly. The top-to-bottom approach involves reconstructing the outer facial frame and addressing the interfacial frame (Curtis & Horswell 2013).

The key to stepwise fashion in managing fractures of pan-facial region is to understand the principles of buttress repair (Manson et al. 1999). The damage to essential areas critical for anatomical alignment also disrupts the midface. Marciani et al. (2009) recommends restoring alveolar ridge continuity and alignment by reconstructing the rest of mandibular fractures. This is followed by restoring vertical heights of the mandibular condyles and ramus. They recommend exposing all midface and upper face structures to allow good visualisation of fractured segments. Next, zygomatic arches are used as a guide to re-establish width of the

face. Then the vertical buttresses are reduced, aligned and repaired in order to restore the vertical height of the face. NOE fractures are usually the last to be repaired.

At Wits Oral Health Facilities, fractures are exposed, mobilised and debrided first, then repaired in a stepwise fashion. All patients are managed using a "bottom-up and outside-in" sequence. The mandible is first repaired with the maxilla guided into the repaired mandible. Intermaxillary fixation is done to bring the maxilla and mandible in occlusion. Then, the "Outside-in" concept is used to reduce, align and repair fractures of the midface in the following order: ZMC, infraorbital rims, and maxilla (Le Fort 1 level). Midface impaction is corrected with disimpaction using Rowe forceps. The anatomic reduction was accomplished, and fractures were repaired stepwise. The ZMC fracture is first repaired, followed by the zygomatic arch lifted into position if warranted. The infra-orbital rims are repaired only if required. NOE, if present was repaired last. Then, osteosynthesis of the Le Fort 1 fractures was done.

4.3.6 Outcome and Complications

The outcome was satisfactory in 32 out of the 34 patients who participated in this study. One patient had septic hardware, and another one died. Complications are possible in almost all cases but can be avoided by "definitive treatment planning and stepwise management" (Ramakrishnan et al 2021). Early treatment of the fractures together with the stepwise “bottom-up and outside-in” approach may have contributed to the decreased complication rate observed in the present study.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.2.1 AETIOLOGY OF PAN-FACIAL FRACTURES

Considering the history of violence in South Africa (Prinsloo et al. 2022, Allard & Burch 2005; Martin et al. 2017), the most common aetiology was violence related (59%) made up of assault (50%) and a gunshot to the head (9%). Males between ages of 19-39 years, who happened to consume alcohol were in the majority. The intake of alcohol could have influenced the interpersonal violence that happened, especially in assault injuries. The second common aetiology was a road traffic accident (35%) made of motor vehicle accidents (23.5%) and Pedestrian vehicle accidents (11.8%). These road traffic accidents are also likely exacerbated by drunk driving and walking.

5.2.4 FACTORS WHICH PREDICT TREATMENT OUTCOMES

Ideally, this objective should be answered through a predictive study where predictor variables are tested against criterion variables using multiple regression (McMillan & Schumacher 2006:224). The said statistical analysis was not performed as part of this study, which is part of the limitation of the project. Nonetheless, there are factors identified from the current study and corroborated with literature suggesting some associations with treatment outcomes. Based on the current study, patient characteristics and clinical information will likely influence treatment outcomes.

The use of alcohol tends to encourage risky and dangerous behaviours resulting in (1) unnecessary fights and assaults, (2) road traffic accidents due to drunk driving/walking and (3) exposure to HIV/AIDS, amongst others. The presence of comorbidities in patients who have sustained pan-facial fractures directly impacts treatment outcome. For example, HIV and Diabetes Mellitus are likely to predispose patients to infections as a complication following maxillofacial management.

5.3 LIMITATIONS OF THE STUDY

The study had methodological limitations in that retrospective studies depend on recorded information that was not necessarily collected for research purposes. The information collected was part of patients' records, which are not written in a standardised format. As such, the information is presented differently from one patient's file to another. The sample size was smaller, with patients having similar demographic characteristics. Size and demographic characteristics also affected statistical analysis in the sense that multiple regression could not be done in order to address the last objective of the study. There was no patient follow-up beyond six weeks. As such, effectiveness of treatment and presence of complications beyond that point could not be established. The data collection tool was not piloted before use. Trustworthiness or rigour of the findings is questionable, considering a weaker methodological approach.

5.4 RECOMMENDATIONS

It is also recommended that future studies should establish whether participants had alcohol before the incident that led them to the hospital and not only reports whether they consumed alcohol or not. In addition, it would be beneficial to the policymakers and hospital management if the exact days and times of the incidents were recorded to enable them to sufficiently plan and provide appropriate resources for those "busy" times. Besides provision of resources, policies such as liquor licenses and permits could be reviewed if found to be contributing to time, causes and nature of accidents.

5.5 CONCLUSION

Even though this study had a methodological weakness, its findings may be used as a baseline for future studies following application of suggested recommendations. Timing and stepwise management of pan-facial fractures in conjunction with a neurosurgical team focused on restoration of function, and facial form is required for optimal results.

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ANNEXURES

ANNEXURE A: Data Collection Tool/Questionnaire

Patient no	
Age	
Sex	Male / Female
Occupation	
Social History	Alcohol / Tobacco / Other
Medical History	Diabetes mellitus / Hypertension / HIV / Other
Aetiology	
Pan-facial Distribution	
Associated Injuries	
Date of injury	
Date of treatment	
Treatment	
Outcome	

ANNEXURE B: Ethical Clearance

UNIVERSITY OF THE WITWATERSRAND JOHANNESBURG

R14/49 Dr N Gumede

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
CLEARANCE CERTIFICATE NO. M200845

NAME: (Principal Investigator)	Dr N Gumede
DEPARTMENT:	School of Oral Health Sciences Department of Maxillofacial and Oral Surgery Dental School University
PROJECT TITLE:	Retrospective analysis and literature review of panfacial fractures at Wits Oral Health Centre
DATE CONSIDERED:	28/08/2020
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Professor R Rikhotso
APPROVED BY:	Dr CB Penny, Chairperson, HREC (Medical)
DATE OF APPROVAL:	2020/09/23

This clearance certificate is valid for 5 years from the date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary on the 3rd Floor, Phillip Tobias Building, Parktown, University of the Witwatersrand, Johannesburg.
I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to submit details to the Committee. **I agree to submit a yearly progress report**. When a funder requires annual re-certification, the application date will be one year after the date when the study was initially reviewed. In this case, the study was initially reviewed in **August** and will therefore reports and re-certification will be due early in the month of **August** each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

Principal Investigator Signature _____ Date _____

ANNEXURE C: Permission Letter- School of Oral Health Sciences

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

FACULTY OF HEALTH SCIENCES

School of Oral Health Science

Department of Oral Biological Sciences, 7 York Road, Parktown, 2193. Tel: 011 717 2045 Fax: 086 553 3800 Email: Aditha.Molepo@wits.ac.za

30 May 2022

Dr N. Gumede
Maxillofacial Surgery Department
Faculty of Health Sciences
University of the Witwatersrand
Johannesburg

RE: PERMISSION TO CONDUCT RESEARCH

REFERENCE: HRRC/May/08/2022

It is my pleasure to grant final approval to conduct your research at Wits Oral Health Centre titled "Retrospective analysis and literature review of panfacial fractures at Wits Oral Health Centre".

The Hospital Research and Risk Committee allocated a unique reference number to this application – Kindly quote this reference number in all future correspondence regarding this research.

Please note that the Hospital Research and Risk Committee should be informed of the estimated date the research will commence, as well as regular status reports until the research has been concluded. Within a month after conclusion of the research project, a written report must be submitted to the Head of School/CEO, summarizing the final result/outcome as well as the recommendations made based on the research concluded.

Regards,

Jay Shackleton

Prof J. Shackleton
Acting Head of School
Date:

Dr P. M Molokomme
Acting CEO
Date: 31.5.2022.

ANNEXURE D: Permission Letter- HOD Maxillo-Facial and Oral Surgery

7 York Road, Parktown, 2193 South Africa ◻Telegrams "Witsmed" ◻Telephone (011) 717-2000 ◻Fax (011) 484-2717

Department of Maxillofacial and Oral Surgery
Telephone 0117172130
Fax: 0867654436
E-Mail: liza.huygen@wits.ac.za

08 June 2020

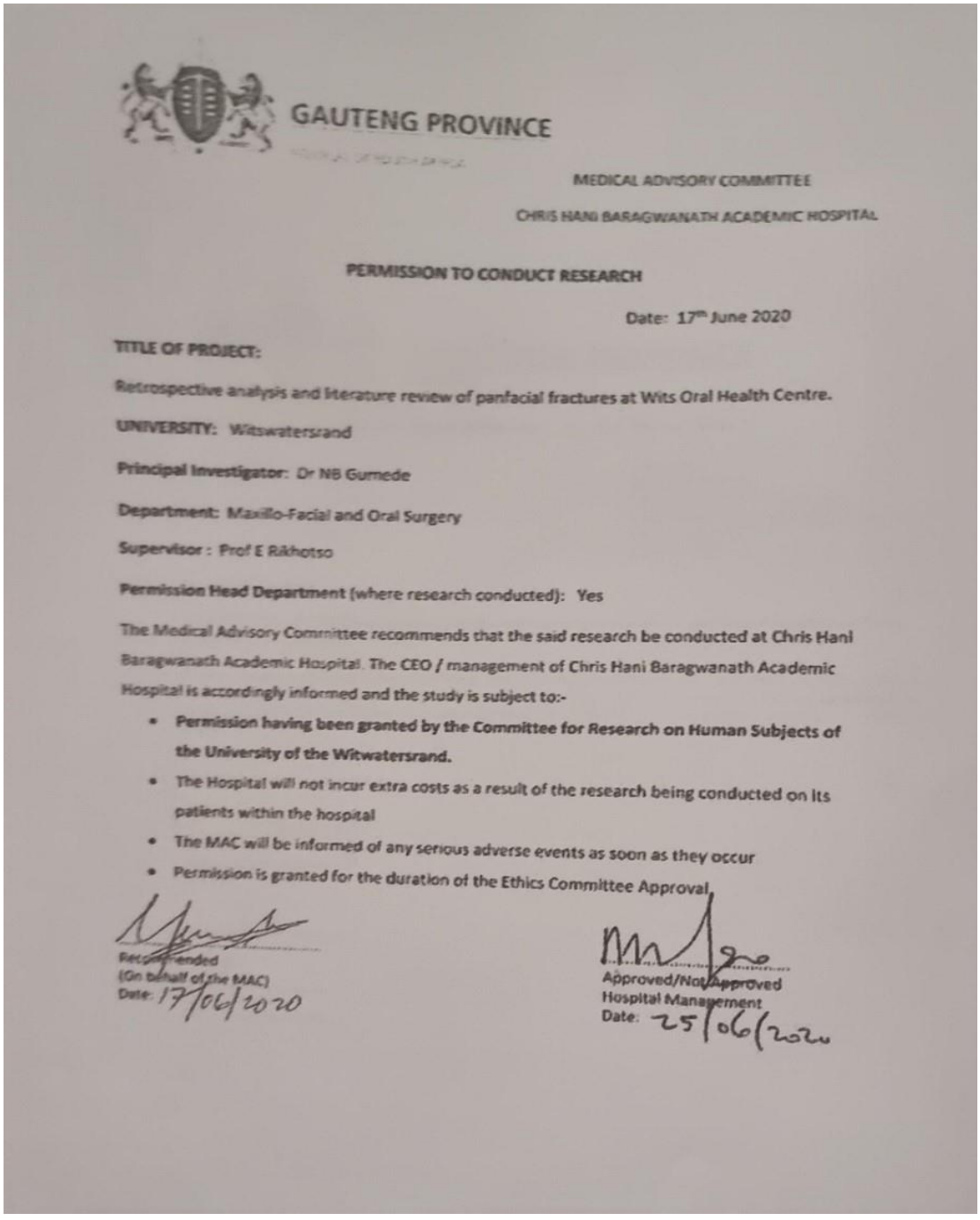
Dear Dr. N Gumede

As per your request for your study entitled "***Retrospective analysis and literature review of panfacial fractures at Wits Oral Health Centre***," approval is hereby granted for you to access records of patients who were treated for panfacial fractures.

Although these patients have given consent for treatment at Wits Oral Health Centre, their privacy and confidentiality however need to be respected at all times and at no stage should these patients be identified by their names in the ultimate collection and analysis of the data.

Yours sincerely

ANNEXURE E: Permission Letter- CEO Christ Hani Baragwanath Academic Hospital



GAUTENG PROVINCE

MEDICAL ADVISORY COMMITTEE

CHRIS HANI BARAGWANATH ACADEMIC HOSPITAL

PERMISSION TO CONDUCT RESEARCH

Date: 17th June 2020

TITLE OF PROJECT:

Retrospective analysis and literature review of panfacial fractures at Wits Oral Health Centre.

UNIVERSITY: Witswatersrand

Principal Investigator: Dr NB Gumede

Department: Maxillo-Facial and Oral Surgery

Supervisor : Prof E Rikhotso

Permission Head Department (where research conducted): Yes

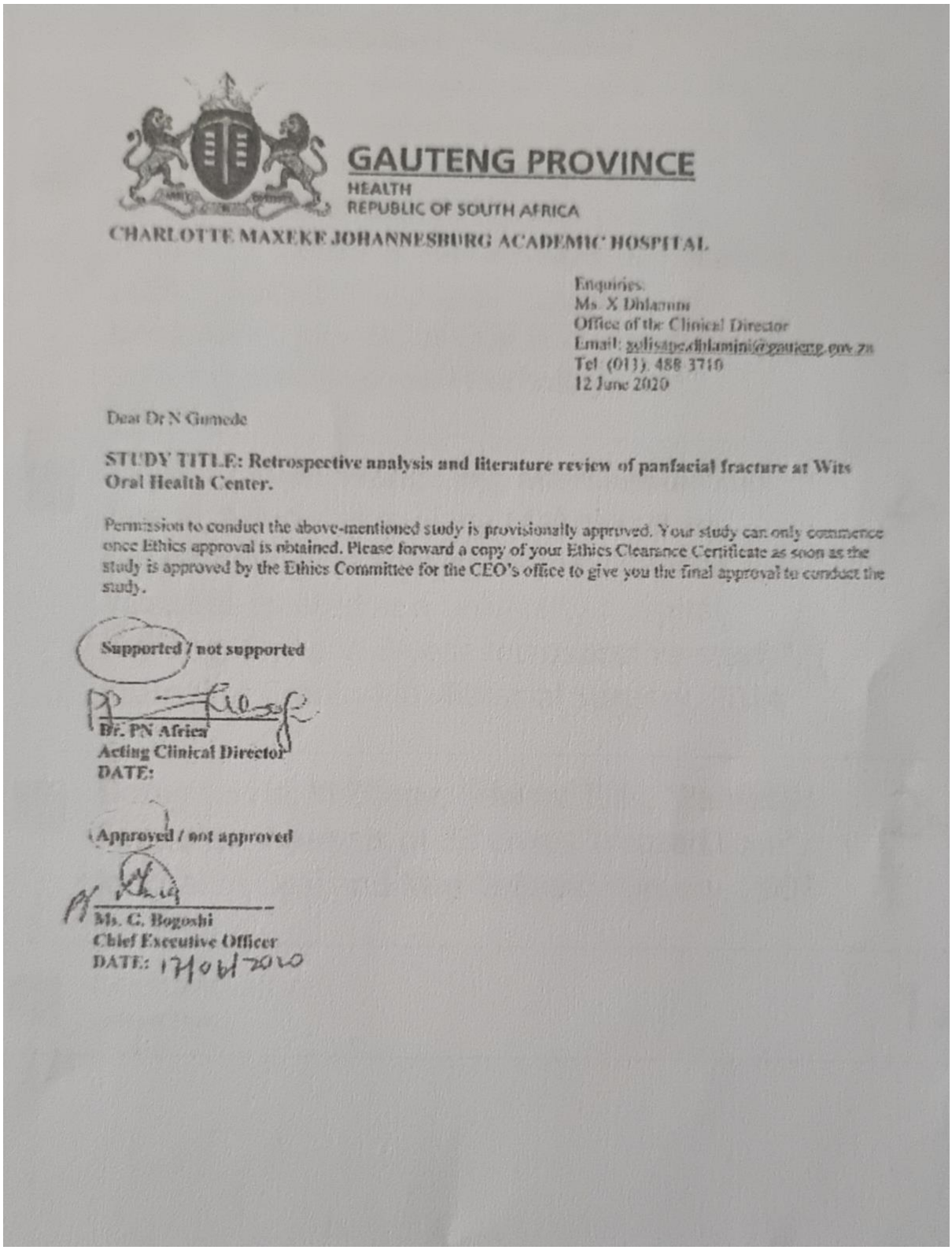
The Medical Advisory Committee recommends that the said research be conducted at Chris Hani Baragwanath Academic Hospital. The CEO / management of Chris Hani Baragwanath Academic Hospital is accordingly informed and the study is subject to:-

- **Permission having been granted by the Committee for Research on Human Subjects of the University of the Witwatersrand.**
- The Hospital will not incur extra costs as a result of the research being conducted on its patients within the hospital
- The MAC will be informed of any serious adverse events as soon as they occur
- Permission is granted for the duration of the Ethics Committee Approval.

Recommended
(On behalf of the MAC)
Date: 17/06/2020

Approved/Not Approved
Hospital Management
Date: 25/06/2020

ANNEXURE F: CEO Charlotte Maxeke Academic Johannesburg Hospital



GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

CHARLOTTE MAXEKE JOHANNESBURG ACADEMIC HOSPITAL

Enquiries:
Ms. X Dhlamini
Office of the Clinical Director
Email: xolisaxe.dhlamini@gauteng.gov.za
Tel: (011). 488 3710
12 June 2020

Dear Dr N Gumede

STUDY TITLE: Retrospective analysis and literature review of panfacial fracture at Wits Oral Health Center.

Permission to conduct the above-mentioned study is provisionally approved. Your study can only commence once Ethics approval is obtained. Please forward a copy of your Ethics Clearance Certificate as soon as the study is approved by the Ethics Committee for the CEO's office to give you the final approval to conduct the study.

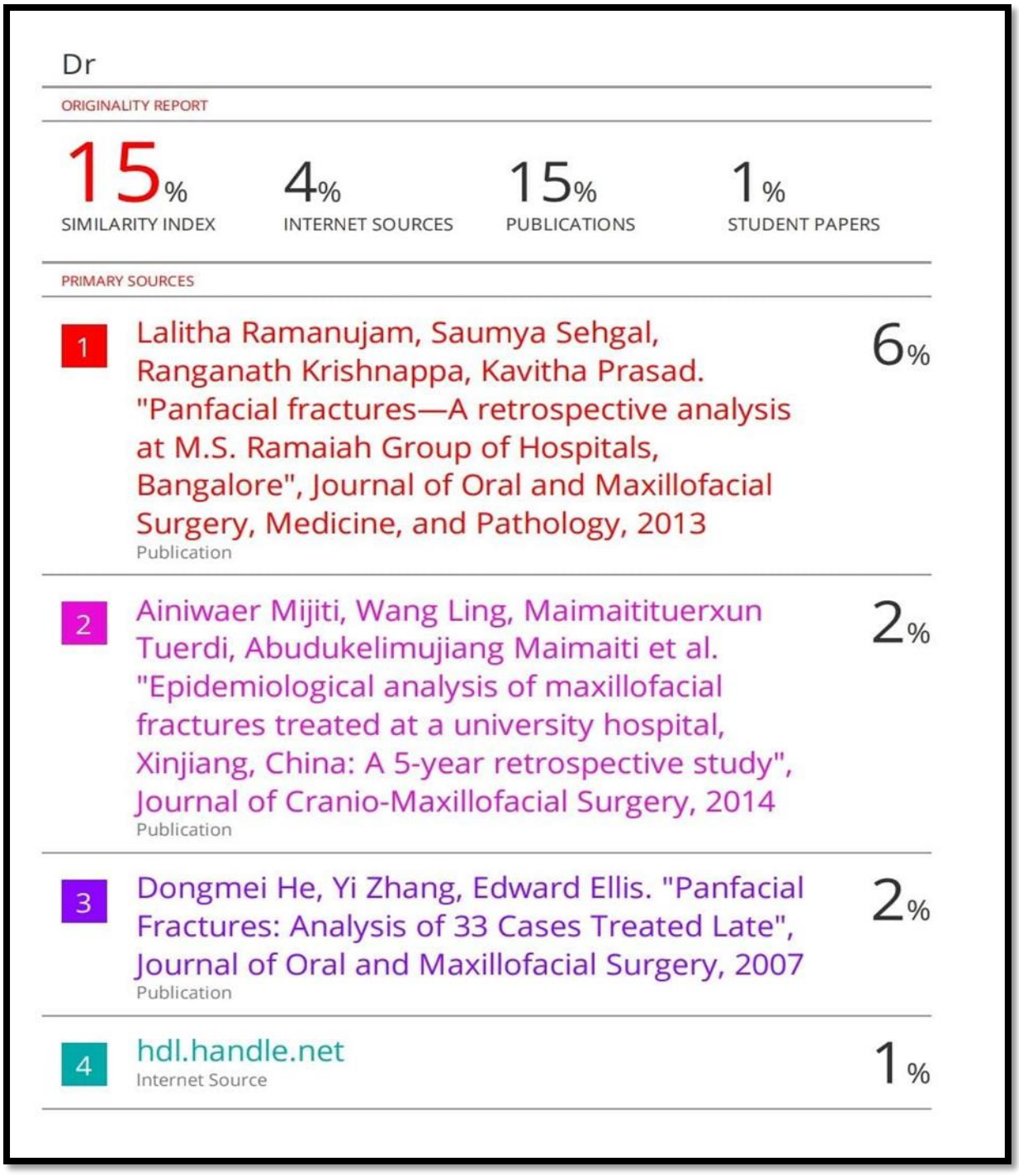
Supported / not supported

Dr. PN Africa
Acting Clinical Director
DATE:

Approved / not approved

Ms. G. Bogoshi
Chief Executive Officer
DATE: 17/06/2020

ANNEXURE G: 2022 Turnitin Report



Dr

ORIGINALITY REPORT

15%	4%	15%	1%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Lalitha Ramanujam, Saumya Sehgal, Ranganath Krishnappa, Kavitha Prasad. "Panfacial fractures—A retrospective analysis at M.S. Ramaiah Group of Hospitals, Bangalore", Journal of Oral and Maxillofacial Surgery, Medicine, and Pathology, 2013 Publication	6%
2	Ainiwaer Mijiti, Wang Ling, Maimaitituerxun Tuerdi, Abudukelimujiang Maimaiti et al. "Epidemiological analysis of maxillofacial fractures treated at a university hospital, Xinjiang, China: A 5-year retrospective study", Journal of Cranio-Maxillofacial Surgery, 2014 Publication	2%
3	Dongmei He, Yi Zhang, Edward Ellis. "Panfacial Fractures: Analysis of 33 Cases Treated Late", Journal of Oral and Maxillofacial Surgery, 2007 Publication	2%
4	hdl.handle.net Internet Source	1%