PREVALENCE AND AETIOLOGICAL FACTORS OF MAXILLOFACIAL TRAUMA IN A RURAL DISTRICT HOSPITAL IN THE EASTERN CAPE

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PREVALENCE AND AETIOLOGICAL FACTORS OF MAXILLOFACIAL TRAUMA IN A RURAL DISTRICT HOSPITAL IN THE EASTERN CAPE

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

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Declaration

I Lingeswara Pillay, declare that this research report is my own work. It is being submitted for the Degree of Master of Science in Dentistry at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other University.

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L Pillay

29th day of March, 2017

To my loving wife Nisha

And

My late sister Niranjani

Acknowledgements

A warm thank you to Dr Mzubanzi Mabongo and Professor Brian Buch for the endless support and guidance. Thank you to Dr Benjamin Gaunt and Mrs Matabese for permission to conduct research at Zithulele Hospital.

Abstract

Aim: To determine the prevalence, aetiological factors and demographic data of patients presenting with maxillofacial trauma over a six month period at Zithulele Hospital. **Materials and Methods:** A retrospective, descriptive study was undertaken over a 6 month period (October 2015 – March 2016). All patients who sustained maxillofacial trauma in the study period were recorded. Data collected included demographic data (gender, age), clinical features (pattern of trauma) and the aetiology of the trauma. The radiographic records were sent to a maxillofacial surgeon and a radiologist skilled in maxillofacial interpretation for a diagnosis to be made as well as gaining a second opinion regarding the types of fractures that are seen. **Results:** A total of 239 patients sustained maxillofacial trauma. The most common aetiological factor was interpersonal violence (55%) followed by road traffic accidents (16%), falls (10%), animals (4%) and other causes (2%). The male to female ratio was 2.6:1 and the 18-24 years age group sustained the most trauma. A total of 210 (88%) patients sustained soft tissue injuries while 29 (12%) sustained hard tissue injuries. Among the soft tissue injuries, 88 sustained lacerations, 16 had hematomas and 84 patients sustained soft tissue injuries that were unspecified. There were 31 fractures diagnosed and the most frequently fractured bone was the mandible at the body. A total of 165 maxillofacial radiographs were assessed, 7% were of no diagnostic value, 56% were of poor diagnostic value and 37% were diagnostically acceptable. Cohen's Kappa inter-rater reliability test was used to assess the agreement between the two assessors. This demonstrated a Kappa (*κ)* value of 0.97 (0.81-0.99) which indicates an almost perfect agreement between the assessor. **Conclusion:** This study showed that maxillofacial trauma is prevalent in rural parts of South Africa. The findings revealed that males aged 18-24 years were more frequently injured as compared to females, with interpersonal violence as a major contributing factor in rural areas.

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Chapter 1

1. Background

Maxillofacial trauma is any injury sustained to the face, jaws and related structures and include both soft and hard tissue injuries. The maxillofacial region is composed of the following bones: frontal, nasal, ethmoid, zygomatic, maxillary bones and the mandible (Angelopoulos, 2014). It can, therefore, be divided into three parts: the upper face, midface and lower face (Angelopoulos, 2014). The lower third of the face is formed by the mandible along with its dentoalveolar arch. The middle third of the face is the area between the supraorbital margins and the occlusal plane of the upper teeth and the upper third of the face is the region above the supraorbital margins. Amongst these, the most commonly fractured is the mandible followed by factures in the nasal, zygomatic and maxillary bones (Deliverska & Rubiev, 2013).

Facial injuries are a common feature in trauma units worldwide and are known to cause significant deformity, loss of function and in severe cases, can be life-threatening (Alvi et al., 2003). The type of injuries range from soft tissue injuries to hard tissue injuries. Soft tissue injuries include burns, lacerations, bruises, avulsions and abrasions. Soft tissue injuries of the face involve injuries resulting in damage to the major salivary glands, muscles, cranial nerves, eyes and connective tissue (Hogg & Horswel, 2006). While hard tissue injuries include trauma to the dentition, dislocations of the temporomandibular joint and fractures to the bony maxillofacial complex.

A major concern with soft tissue injuries, is wound contamination and for cosmetic reasons, tissue scaring (Parashar & Sharma, 2013). The management of these injuries are carefully planned and orchestrated by a maxillofacial and plastic surgeon. The extent of maxillofacial trauma can be determined by assessing the biomechanics involved during injury which is usually obtained from a through clinical examination and correlating it with a detailed history of the traumatic event.

Biomechanics of trauma is the biological response of tissue to the mechanics of the impact (Gong et al., 2008). Depending on the object and the velocity reached when it contacts soft tissue, soft tissue injuries can range from superficial to deep penetrating wounds with significant tissue loss (Clasper, 2001). Patel et al (2005) reported an incidence of 12.6% of patients with post traumatic cranial nerve injury, the most frequently injured cranial nerve was the facial nerve followed by the oculomotor and optic nerve. It can therefore be said that maxillofacial trauma can be quite complicated.

The treatment of maxillofacial trauma is more complex and challenging than trauma elsewhere in the body. Most of the treatment modalities for trauma sustained on other parts of the body are aimed at restoring function, whereas in the maxillofacial region aesthetics are a major concern and pose difficulties for the medical personnel (Kretlow et al., 2010). Studies have shown significant psychological and functional problems that are associated with maxillofacial trauma and depression is often seen when aesthetics are a concern (Levine et al., 2005). Because of this, a comprehensive clinical examination needs to be done on the affected region (Carithers & Koch, 1997).

On completion of a comprehensive clinical examination, specific radiographs are usually requested for the diagnosis of facial fractures (Ali & Gupta, 2012). A complete radiological examination forms a crucial part in the diagnosis of hard tissue injuries and in locating foreign bodies within soft tissue. It provides valuable information on the location of the fractures, the degree of displacement and its relation to surrounding structures. Routine radiographs that are used for the diagnosis of maxillofacial trauma include: lateral cephalometric projection; submentovertex; waters view; posterior anterior skull projection; reverse Townes; mandibular lateral projection and panoramic views but conventional radiographs are becoming less popular with the availability of computer tomography and magnetic resonance imaging (Ali & Gupta, 2012).

Conventional radiographs are more readily available and easier to obtain in most parts of South Africa. Unfortunately, it is more difficult to acquire specialized images due to the shortage of resources, forcing the clinicians to make a diagnosis based on the available conventional radiographs.

Since the maxillofacial region is complex with multiple junctions, interpretation of these radiographs requires skill and experience to prevent a misdiagnosis. Furthermore the images need to be of suitable diagnostic value with no projection technique and processing errors. Also different skull projections have specific indications depending on the location of the fracture in the maxillofacial region (Ali & Gupta, 2012). It is important that the appropriate radiographs are requested for specific regions to make a diagnosis. Radiographs also play an integral part in the evaluation of healing and postsurgical outcomes. Therefore, it is vital to have accurate radiographs of diagnostic value, to be able to view various fractures and monitor the healing process after reduction in complicated cases.

Fractures occurring in the maxillofacial region can be classified anatomically into: lower third, middle third and upper third of the face (Angelopoulos, 2014). Fractures of the lower third of the face include all types of fractures on the mandible and can be classified depending on its location as condylar, subcondylar, coronoid, mandible ramus, mandible angle, mandible body, parasymphyseal or symphyseal fractures (Cornelius et al., 2014). Also the mandible is the most frequently fracture bone (Bamjee et al., 1996).

Le Fort (1901) performed research on the patterns of midfacial fractures and classified them depending on its pattern into: Le Fort I which is a horizontal fracture of the lower part of the maxilla usually at the level of the floor of the nose above the roots of the maxillary dentition; Le Fort II is a pyramidal fracture of the maxilla involving the frontonasal suture, maxillofrontal suture, infraorbital margin and the lateral wall of the maxillary sinus detaching the maxilla; Le Fort III also known as craniofacial disjunction is high level midfacial fracture involving the maxillary, zygomatic and nasal bones (Le Fort, 1901).

In the middle third of the face the nasal bones are the most commonly fractured bones (Hwang & You, 2010). This can partially be attributed to its prominence and weak structure, as it is very thin and fragile (Cormier et al., 2010). Fractures of the upper third of the face involve the frontal sinus, superior orbital rim and other parts of the frontal bone, it is not as common as fractures found in the lower and middle thirds of the face (Gerbino et al., 1999).

The pattern and nature of maxillofacial trauma depend largely on the intensity of force and the resistance offered by the maxillofacial complex (Pappachan & Alexander, 2012).The midfacial region is developed in such a way that it acts as a shock absorber when impacted with high-intensity forces thereby protecting the underlying brain by distributing the forces on more resistant parts of the facial skeleton (Pappachan & Alexander, 2012). These resistant parts are known as the facial buttress system, which is a system of bones that protect the facial skeleton by absorbing and resisting most of the forces during injury (Manson et al., 1980). The facial buttress system can be divided into vertical buttresses and horizontal buttresses (Pollock, 2013). This creates a pathway for distribution of blunt forces when it is directed to the face. Besides hard tissue injuries, there are many crucial and serious soft tissue injuries that need to be identified and treated immediately to prevent irreversible long-term complications (Lawson et al., 2016).For example injury to the orbital region is very important because complications can arise when there is damage to the extraocular muscles, optic nerve and the vasculature to the eye (Magarakis et al., 2012). Mehravaran et al (2013) reported a significant association with amaurosis and midfacial fractures.

The most common causes of maxillofacial trauma were reported to be: traffic accidents, mainly motorcycle accidents followed by physical assaults, falls and sports-related accidents (Leles, 2010). However, in South Africa the main cause was interpersonal violence as compared road traffic accidents (Mogajane et al., 2016).The major factors influencing the incidence of maxillofacial trauma are age, gender, geographic region, substance abuse, compliance to traffic legislation, domestic violence and interpersonal violence (Chrcanovic, 2012).

Around the world, these causative factors are largely influenced by differences in socio-economic status, culture and environmental factors (Lee, 2012). West et al (2002) reported a high incidence of sports-related trauma in higher socioeconomic areas, while Brasileiro and Passeri (2006) reported a high incidence of violence related trauma in lower socioeconomic areas. A number of studies indicate substance abuse to be a major contributing factor within the variable of interpersonal violence which also accounts for a significant proportion of facial injuries (O'Meara et al., 2012). In a South African study by Desai et al (2010) 65% of maxillofacial trauma

was associated with alcohol. This suggests that there is a significant correlation between alcohol consumption and interpersonal violence and maxillofacial trauma. Different geographical areas also demonstrate different patterns of cause and presentation (Jin et al., 2014).

It can be seen that all age groups are affected by maxillofacial trauma and usually range from 1 to 99 years with a median of 22 years and mean of 25.8 years (Gassner et al., 2003). In the geriatric population, studies have shown that falls were the most common cause of maxillofacial trauma and are due to age-related changes in their sensory systems (Channar et al., 2016). Similarly, studies by Jung et al (2015) reported falls to be a major cause in the paediatric population. These studies suggest that aetiologies are age related and certain age groups are more predisposed to specific aetiologies as compared to other age groups.

In studies on the gender distribution of maxillofacial trauma, Boffano et al (2015) reported a male to female ratio of 11.8:1. The male to female ratio of maxillofacial trauma was higher in rural areas than in urban areas (Batista et al., 2012) and the most commonly affected age group was between 21-30 years (Majambo et al., 2013). Similarly in a South African study on the patterns of interpersonal violence, males were mostly affected and the face was the second most common area injured (Asbury, 2011). Males are more at risk to trauma as compared to females and this can be attributed to the difference in behavioural activities that expose them to trauma (Pham-Dang et al., 2014). Studies have shown the type of injuries that males sustain are significantly more serious than those which are sustained by females, with a higher mortality and morbidity rate (Alves et al., 2014).

Furthermore, with rapid change in the socio-economic status of populations, females are driven to perform a broader range of work. This requires more physical demands on them, increasing their vulnerability to maxillofacial trauma (Olasoji et al., 2002).

A South African study showed that alcohol consumption is a greater contributing factor in males as compared to females (Peltzer et al., 2011). In 2014, the World Health Organizations global status on alcohol and health shows that alcohol is the leading risk factor for mortality in males and predisposes females to alcohol related harm (World Health Organization, 2014). Reflecting causes and associated factors, it

can be noticed that maxillofacial trauma differs depending on the geographical areas and socio-economic status of populations (Batista et al., 2012).

Since, there is no research done in the Eastern Cape on the epidemiology and aetiology of maxillofacial trauma. It is feasible to research these specific factors to gain knowledge of the maxillofacial trauma in a South African rural region. This will allow clinicians within the region to adopt specific diagnostic aids and treatment modalities. Specialised training programs can be developed from this, thus saving time and money. It will also allow for scarce resources to be allocated more effectively. This will positively influence the prevention, treatment and prognosis of maxillofacial trauma in a rural setting, as well as the cost of procedures and length of a patient's stay within the hospital setting. With the rapid socio-economic transformation and population increases in rural areas, more research is required on the epidemiology of facial trauma to better equip medical personnel with regards to the management of such cases.

In rural South Africa, the referral system in the health sector works as follows: Immediate primary care at the primary healthcare centres and community healthcare centres, intermediate or generalist care at the district hospitals and advanced diagnostic procedures and treatment at the tertiary hospital (Mojaki et al., 2011). Patients also find it difficult to access healthcare in rural South Africa due to the lack of roads and the poor availability of transport to the hospitals.

Zithulele Hospital is a 140 bed district hospital located in rural Eastern Cape. It hosts a multi-disciplinary team and services a population of 130 000. Patients who sustain maxillofacial trauma are treated within the hospital and also referred to Nelson Mandela Academic Hospital when cases are more severe. Due to Zithulele Hospital's rural positioning, its large population and multi-disciplinary team approach, Zithulele Hospital was an ideal setting for this study.

The aim of this study was to determine the prevalence, aetiological factors and demographic data of patients presenting with maxillofacial trauma over a six month period at Zithulele Hospital.

Therefore this study will help in identifying the surgical skills required by dentists working in rural district hospitals. The outcomes of the study will help in negotiating for skills upgrade in this field and identify the focus areas when planning preventive programmes. It will also allow for the identification of the patterns of trauma in rural areas.

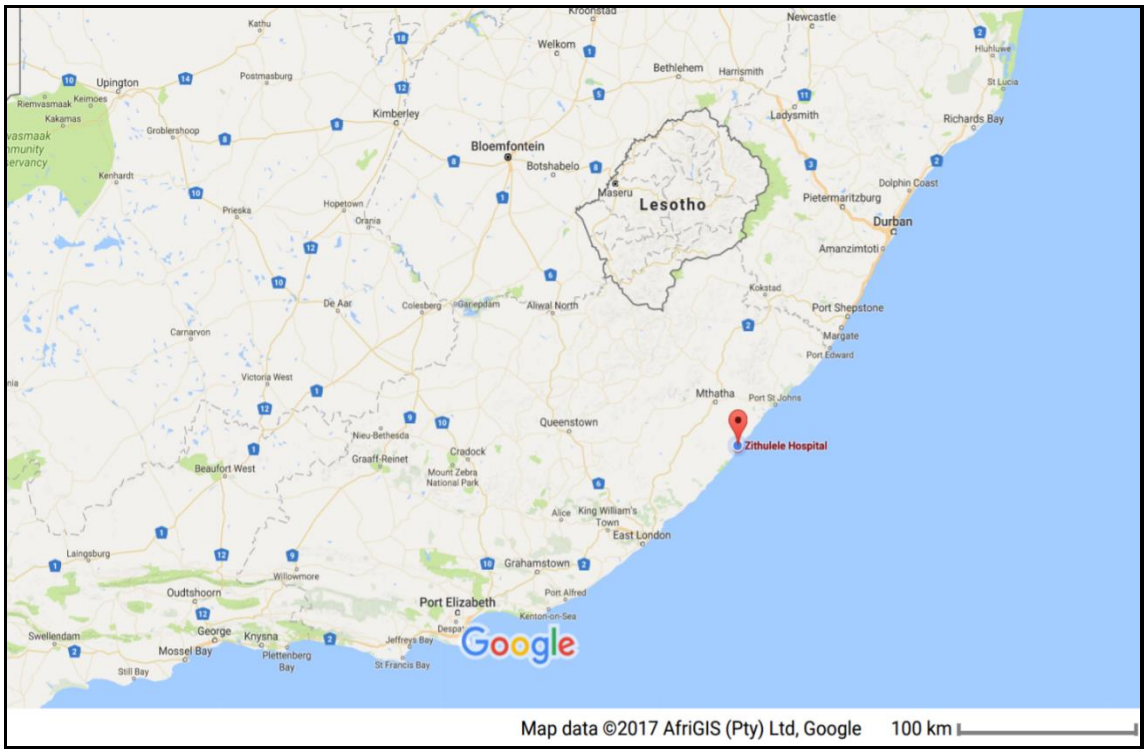


Figure 1-Location of Zithulele Hospital (Google Maps, 2017)

Chapter 2

2. Aims and Objectives

2.1. Aim

The aim of the study was to evaluate the prevalence and aetiological factors of maxillofacial trauma in rural areas/ presenting in a rural district hospital.

2.2. Objectives

2.2.1. To determine the prevalence of maxillofacial trauma over a six month period at Zithulele Hospital.

2.2.2. To determine the aetiological factors of maxillofacial trauma over a six month period at Zithulele Hospital.

2.2.3. To determine the demographic data of patients presenting with maxillofacial trauma.

Chapter 3

3. Materials and Methods

3.1. Study Design and Population

3.1.1. Study Design

A retrospective, descriptive study was undertaken to analyse the prevalence and aetiological factors of maxillofacial trauma at Zithulele Hospital, over a 6 month period (October 2015 – March 2016).

3.1.2. Study population

A convenient sampling method was used in this study to determine the total population within a specific time frame (October 2015 – March 2016). The total of 8262 patients who were triaged in casualty within the specified period were included in the study. From this total headcount, all patients who sustained maxillofacial trauma were recorded on a spreadsheet and determined. A total of 239 patients sustained maxillofacial trauma during the study period. Inclusion criteria comprised of patients in all age groups treated for maxillofacial trauma from October 2015 – March 2016. Incomplete records, missing records and any recorded trauma not within the specified period were excluded from the study.

3.2. Prevalence of maxillofacial trauma

The prevalence was calculated by taking the total number of patients (239) that sustained maxillofacial trauma for that period and dividing it by the total number of

outpatients (8262) at the hospital during that period and then multiplying it by 100 to get a percentage.

3.3. Data Collection

A data collection sheet was used to record the data by the principal investigator. Variables collected were aetiology, gender, age, diagnostic quality of radiographs, nature of injury (Soft or bone) and fractures.

3.3.1. Frequency of aetiological factors

All aetiological factors were determined and grouped as: road traffic accidents; Interpersonal violence; sports; falls; animals: unknown and other. The number of patients presenting with each aetiological factor noted in the spreadsheet was assessed and the frequency of each factor calculated.

3.3.2. Females versus males

The total number of females (66) versus the total number of males (173) with maxillofacial trauma, over the six month period was assessed and presented in a bar graph to show the difference in occurrence between males and females.

3.3.3. Age range

This data was grouped into age range categories (in decades). The age group most frequently diagnosed with maxillofacial trauma was determined and a bar graph used to demonstrate the findings.

3.3.4. Nature of injury

According to the clinical findings the nature of injuries were classified into soft and hard tissue injuries.

3.3.5. Patterns of trauma

The pattern of hard tissue trauma was classified anatomically into different types of fractures with the assistance of a maxillofacial surgeon and a radiologist skilled in maxillofacial interpretation. The soft tissue injuries were described according to the clinical records and grouped into lacerations, abrasions, bruises, burns and hematomas.

3.3.6. Diagnostic quality of radiographs

Radiographic records were retrieved from archives and were sent to a maxillofacial surgeon and a radiologist, both skilled in maxillofacial interpretation in order to assess the quality of the radiographs and their suitability for an adequate diagnosis. Furthermore, the above-mentioned clinicians were requested to offer their own diagnoses and classification of the types of fractures seen. Both observers were calibrated to assess for fractures, projection technique errors and processing errors. The radiographs were classed as: a) no diagnostic value; b) poor diagnostic value; and c) acceptable diagnostic value. The assessors' interpretation of the radiographs was captured on an excel sheet and its reliability tested with Cohen's Kappa inter-rater reliability test.

3.4. Data Analysis

The data was captured on a spread sheet using Microsoft Excel and evaluated for frequencies and percentages. Further analysis of the data was done using Microsoft Excel to determine those age ranges which presented with the highest and lowest frequencies of maxillofacial trauma; the gender having a higher occurrence of maxillofacial trauma and the most common aetiological factor in a rural setting within a specific age range and gender. Descriptive statistics were used to demonstrate the results. Tables and graphs were used to illustrate the outcomes.

3.5. Ethical Considerations

The clinical manager of Zithulele Hospital granted permission to conduct research at the institution (Appendix B) and The Human Research and Ethics Committee at the University of Witwatersrand granted ethical clearance to conduct this study (Appendix C).

3.6. Problems/Limitations

Unreliable recording of cases and misplaced records. The hospital held records were not as descriptive as a study with a predetermined format for capturing data. Since it was a retrospective study the investigator had to obtain data from archives which were captured by different data capturers. Some of the records had missing/incomplete information. The radiographs had no or poor diagnostic value making it difficult to diagnose the type of fractures seen accurately.

Chapter 4

4. Results

4.1. Prevalence of maxillofacial trauma

A total of 8262 outpatient records was assessed for the period 1st October 2015 – 31st March 2016. During this period 239 (2.89%) patients sustained maxillofacial trauma.

4.2. Frequency of aetiological factors

The most common aetiological factor of maxillofacial trauma was interpersonal violence (IPV) which accounted for 131 patients (55%), the second most common being road traffic accidents (RTA) accounting for 38 patients (16%). Falls accounted for 25 (10%) of the injuries, trauma caused by animals 9 (4%) and sports related injuries 2 (1%).Other causes (2%) included 5 patients who sustained burns to the face and one cut by a roof sheet. The aetiologies of trauma for 28 (12%) patients were unknown (Figure 2).

4.3. Females versus males

Of 239 patients, 173(72%) were male and 66(28%) female. The male to female ratio was 2.6:1. Data analysis showed that males were more prone to maxillofacial trauma than females (Figure 3).

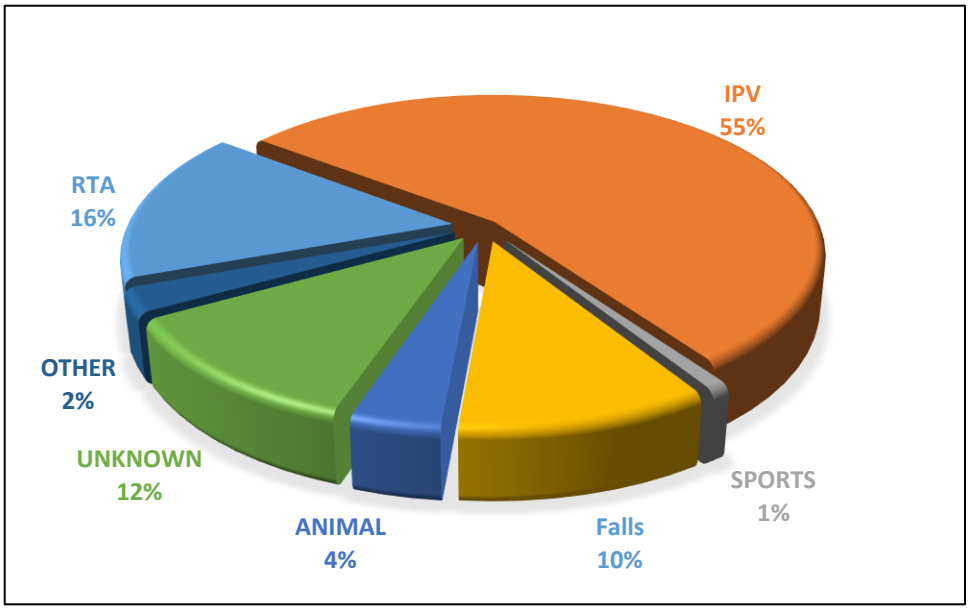


Figure 2 - Aetiology of maxillofacial trauma

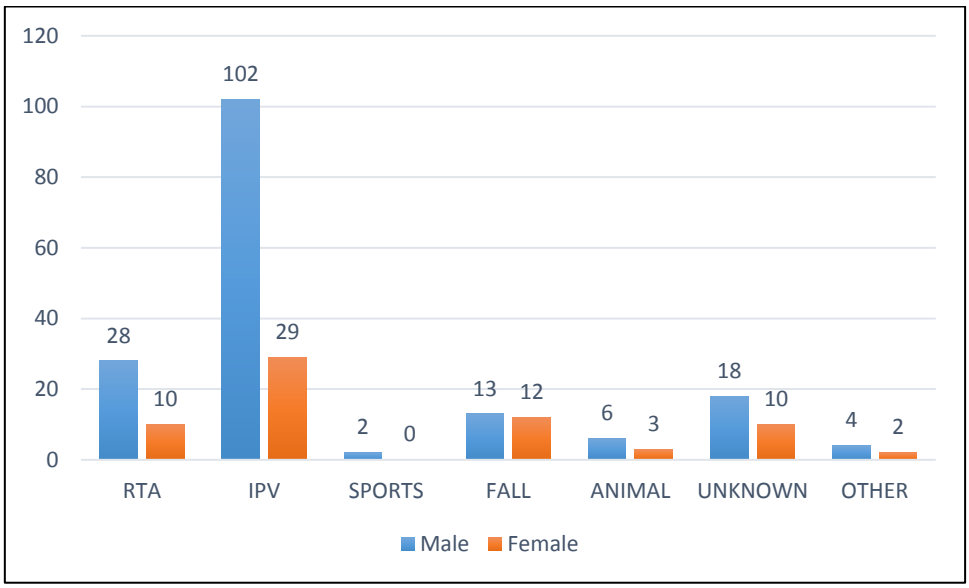


Figure 3 - Gender distribution of maxillofacial trauma

4.4. Age range

The age of patients ranged from 1 to 74 years, with a median age of 24 and a mean age of 26.3 (standard deviation: 15.4). The age group diagnosed with the most maxillofacial trauma being between 18-24 years, accounting for 27% of the patients. The second most frequent age group fell into the category of under 18 years which accounted for 24% (Figure 4).

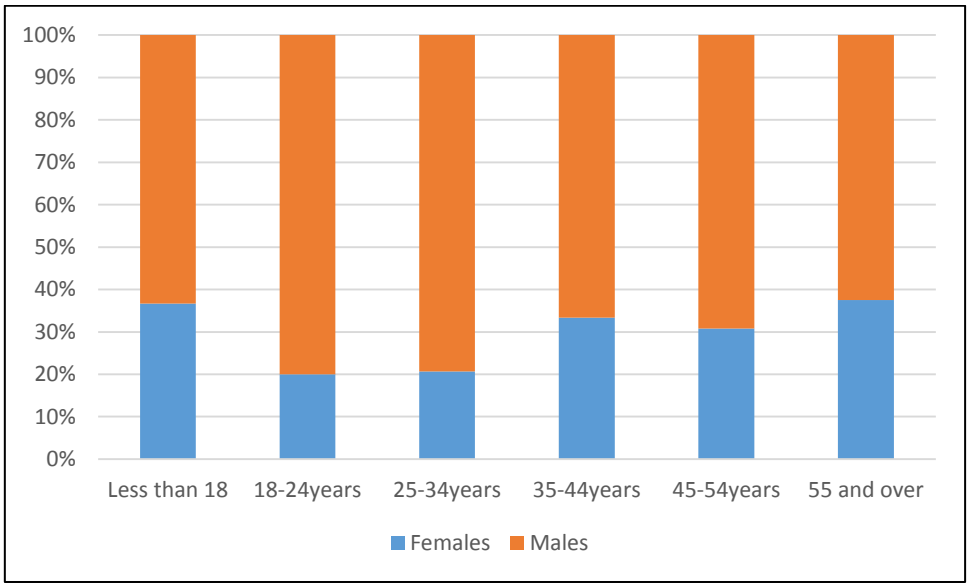


Figure 4 - Age distribution of maxillofacial trauma

4.5. Pattern of trauma

A total of 210 (88%) patients sustained soft tissue injuries while 29 (12%) sustained hard tissue injuries either unilaterally or bilaterally. Of the hard tissue injuries, there were 39 fractures diagnosed and the most frequently fractured bone was the mandible (Table 2). Mandibular fractures were either single site or multiple site fractures with the body frequently affected. Zygomatic bone fractures were the second most frequently observed fractures followed by the nasal bones and Le Fort I. Among the soft tissue injuries, 88 sustained lacerations, 16 had hematomas while 84 patients sustained soft tissue injuries that were unspecified (Table 1).

Table 1 - Patterns of Maxillofacial trauma

Hard tissue injuries	**Number of fractures**
UPPER THIRD FRACTURES	
Frontal bone	1
MIDDLE THIRD FRACTURES	
Anterior wall of maxillary sinus	1
Ethmoid bone	1
Lateral wall of the nose	1
Le Fort I	3
Le Fort II	2
Le Fort III	1
Nasal bones	3
Orbital floor	1
Zygomatic bones	4
LOWER THIRD	
Mandibular fractures	21
Soft tissue injuries	**Number of patients**
Abrasions	7
Bruises	9
Burns	6
Hematomas	16
Lacerations	88
Soft tissue injuries unspecified	84

Table 2 - Types of Mandibular fractures

Mandibular Fractures	Fractures
Alveolar	2
Angle	3
Body	8
Condyle	1
Coronoid	0
Ramus	0
Subcondylar	5
Symphysis	1
Parasymphyseal	1
Total	**21**

4.6. Diagnostic quality of radiographs

A total of 165 maxillofacial radiographs were sent to both a maxillofacial surgeon and a radiologist skilled in maxillofacial interpretation for assessment. Their findings indicated that 7% (12) were of no diagnostic value, 56% (92) were of poor diagnostic value and 37% (61) were diagnostically acceptable (Figure 5). Cohen's Kappa inter-rater reliability test was used to assess the agreement between the two assessors. This demonstrated a Kappa (*κ)* value of 0.97 (0.81-0.99) which indicates an almost perfect agreement between the assessors (Viera & Garrett, 2005).

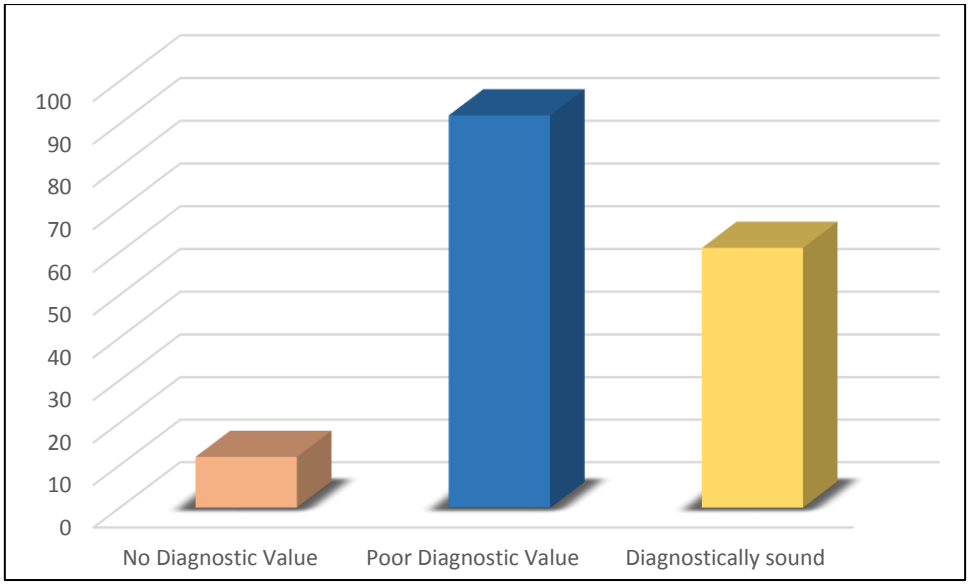


Figure 5 - Diagnostic quality of radiographs

5. Discussion

Maxillofacial trauma is still a common feature in trauma units worldwide (Alvi et al., 2003), the prevalence of maxillofacial trauma at Zithulele Hospital for the study period was 2.89 %(239 patients).

Zithulele hospital showed a lower prevalence (2.89%) of maxillofacial trauma when compared to a study in Australia (16%), this could be attributed to the difference in the socioeconomic status of the study population and their exposure to risk factors (Shahim et al., 2006).This variation of prevalence in different geographic regions could be influenced by its, urbanization, socioeconomic status, cultural differences, crime rate, period of study and environmental factors.

The most common aetiological factors were interpersonal violence in 131 patients (55%), road traffic accidents in 38 patients (16%) and falls in 25 patients (10%). This is similar to the findings in a Bulgarian study by Deliverska and Rubiev (2013) that found the main cause to be interpersonal violence followed by road traffic accidents and falls. These findings can also be closely related to a Brazilian study by Brasileiro and Passeri (2006) who reported a high incidence of violence related trauma in lower socioeconomic areas. Similarly, a study recently compared two maxillofacial units in South Africa and also found interpersonal violence to be the leading cause (Mogajane et al., 2016). In contrast, certain studies have revealed that road traffic accidents were the leading cause of maxillofacial trauma (Ajike et al., 2005; Garg et al., 2012; Alves et al., 2014).However, in this study, only 16% of the patients accounted for road traffic accidents. The difference in cause between different geographic regions could be attributed to the level of urbanization, population size, cultural differences, legislation and crime rate. In addition to this, in this study only one patient sustained maxillofacial injuries from a gunshot, whereas in other parts of South Africa maxillofacial gunshot wounds are a common finding (Tsakiris et al., 2002).

This could be due to the fact that firearms and other weapons are more easily available in urban areas where there are well established dealers and markets. Also, the Eastern Cape has a much lower crime rate when compare to Gauteng (Crime Stat, 2016).

Furthermore, trauma caused by animals are a common feature in rural areas (Batista et al., 2012) the percentage of patients that sustained trauma from animals were 4% in this study. This could be due to the fact that animals are still being used as a mode of transport and for farming in underdeveloped rural areas. In contrast to other studies (Gassner et al., 2003; Batista et al., 2012) that reported a high prevalence of sports-related trauma, the percentage of sports-related trauma was 1% in this study. This could be due to the lack of sports facilities in rural areas and its low level of development. Therefore, maxillofacial trauma differs depending on the geographical areas and socio-economic status of various populations (Batista et al., 2012).

Of 239 patients, 173 (72%) were male and 66 (28%) female. Males were more frequently injured as compared to females with a male to female ratio of 2.6:1. South African studies on maxillofacial trauma show a similar trend with males mostly affected (Beaumont et al., 1985; Tsakiris et al., 2002; Desai et al., 2010; Mogajane et al., 2016). Furthermore, the results of this study are in close agreement with findings by Batista et al (2012) which reported a higher male to female ratio in rural areas as compared to urban areas. This higher prevalence in males can be correlated with a South African study which showed that alcohol consumption is a much more significant contributing factor in males as compared to females (Peltzer et al., 2011). Desai et al (2010) found that 65% of maxillofacial trauma was associated with alcohol. Similarly, alcohol is the leading risk factor for mortality in males and predisposes females to alcohol-related harm (World Health Organization, 2014). Correlating the findings of this study, males are at a higher risk as compared to females and this can be attributed to the difference in behavioural activities that expose them to trauma.

The age group that sustained the most trauma was the 18-24 years group with males being affected the most. This is consistent with other studies in different parts

of South Africa (Tsakiris et al., 2002; Desai et al., 2010; Mogajane et al., 2016).This finding also concurs with the study by Kai Lee on the Global Trends in Maxillofacial Fractures, which showed a high prevalence of maxillofacial trauma in males aged 16 to 30 years (Lee, 2012).

The majority of hard tissue injuries were fractures in the middle third of the face, while soft tissue injuries were mainly composed of lacerations. This is consistent with studies by Gassner et al (2003) who reported a high frequency of midfacial fractures. In contrast, various South African studies have reported mandibular fractures to be the most common fractures of the face (Beaumont et al., 1985; Tsakiris et al., 2002; Mogajane et al., 2016). There was a significant change observed in the pattern of trauma with midfacial fractures being more common in the present study. This change observed in the pattern of fractures could be attributed to the size of the study population, period of study or the exposure to risk factors.

The overall quality of radiographs was poor, From the 165 maxillofacial radiographs, 7% (12) were of no diagnostic value, 56% (92) were of poor diagnostic value and only 37% (61) were diagnostically acceptable. Imaging of the maxillofacial region can be challenging in trauma patients (Prasad & Khanal, 2014) and conventional radiographs are becoming less popular with the availability of computer tomography (Goel & Gupta, 2015). In maxillofacial radiography different projection techniques are used to demonstrate different structures. The clinician first needs to evaluate the region and decide on which structures are affected, thereafter an appropriate projection is requested. Only clinicians trained in the interpretation of these radiographs and skilled in the diagnosis of maxillofacial trauma, will be able to request the appropriate radiographs. In the present study, most of the radiographic projections were inappropriate for the diagnosis of maxillofacial fractures. This could be due to the lack of training that medical doctors have in maxillofacial trauma and its radiographic interpretation.

Furthermore, with the limited research on conventional radiographs in rural hospitals and the lack of computer tomography more studies need to be conducted to improve the diagnostic quality and interpretation of these radiographs.

6. Conclusion

The prevalence of maxillofacial trauma at Zithulele Hospital for the study period was 2.89 % (239 patients). Interpersonal violence is still the leading cause of maxillofacial trauma around the world and more especially in rural areas of South Africa. This can be attributed to the low socioeconomic status, high crime rate and poor education.

Road traffic accidents were the leading cause of trauma in certain parts of the world, However in Zithulele it was the second most common cause which could be related to the fact that South Africa is still a third world country. Specialized preventive programs involving the healthcare provider, police, schools and nongovernment organizations need to be designed to reduce the crime rate.

Younger males aged 18-24 years are still common victims of trauma. This information can be useful in creating preventative programs that are designed to involve young males. Also creating youth groups and sports centres for young individuals can reduce the chances of trauma and violence amongst the youth.

Most of the identified mandibular fractures were minimally displaced indicating that it could be managed conservatively by closed reduction at rural hospitals. Dentist should receive more intense training on minor oral surgical procedures if they intend on working in rural parts of South Africa. Similarly there are very few maxillofacial surgeons that are public servants in the Eastern Cape. The department of health need to work closely with the tertiary education centres to create more supplemental posts thereby increasing the number of maxillofacial surgeons in the province.

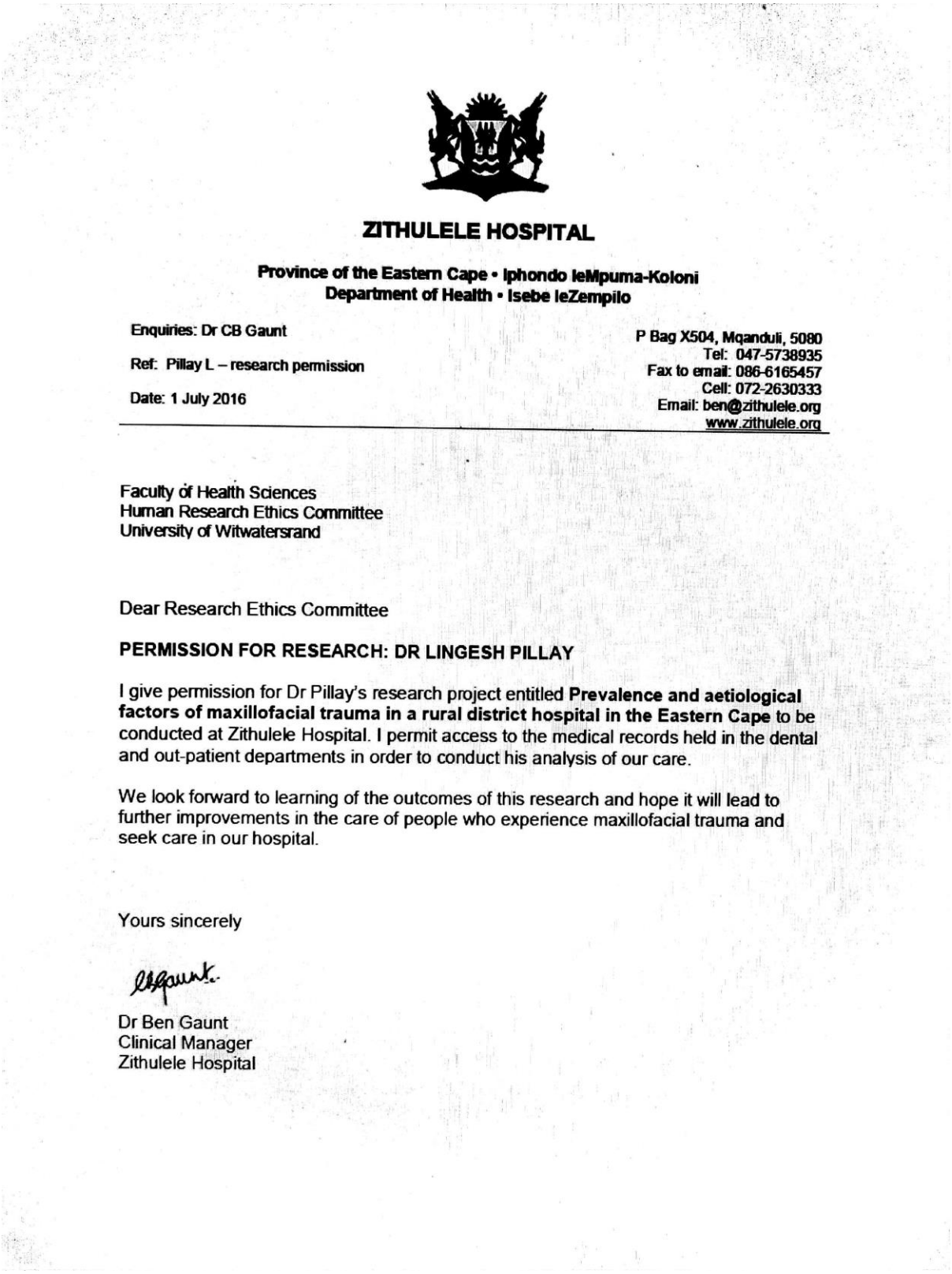
The maxillofacial region is a complex region that requires a multidisciplinary team approach with detailed imaging for the diagnosis of fractures. The radiographic findings of this study suggests that more training is required on maxillofacial imaging to improve the diagnostic quality of radiographs. Medical doctors need to be adequately trained in requesting and interpretation of maxillofacial radiographs. This can be achieve by seminars, lectures and short courses on maxillofacial trauma, which could reduce the chances of fractures being missed.

Further studies need to be done on the diagnostic aids and treatment modalities of maxillofacial trauma in South Africa as this will positively influence the prevention, treatment and prognosis of maxillofacial trauma in rural areas.

APPENDIX A.

IDENTIFICATION CODE FOR PATIENT **……**			
DATE:			
AGE:			
GENDER:	MALE:	FEMALE:	
TYPE OF MAXILLOFACIAL TRAUMA			
1)HARD TISSUE TRAUMA:			
Frontal Bone:	Nasal Bones:	Zygomatic Bones:	Maxillary Bones:
Orbital Bones:	Mandible:	Teeth:	
3)SOFT TISSUE TRAUMA:			
DESCRIPTION:			
CAUSE OF TRAUMA:			
1)ROAD TRAFFIC ACCIDENTS:			
Motor Vehicle:	Motor Cycle:	Pedestrian:	Bicycle:
2)INTERPERSONAL VIOLENCE:			
With a weapon:		Without a weapon:	
3)SPORTS:			
Soccer:	Cricket:	Rugby:	Other:
4)FALL:			
Epileptic:	Collapsed:	From a Height:	Running/walking:
5)ANIMAL:			
6)OTHER:			

APPENDIX B.



ZITHULELE HOSPITAL

Province of the Eastern Cape • Iphondo leMpuma-Koloni
Department of Health • Isebe leZempilo

Enquiries: Dr CB Gaunt

Ref: Pillay L – research permission

Date: 1 July 2016

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Faculty of Health Sciences
Human Research Ethics Committee
University of Witwatersrand

Dear Research Ethics Committee

PERMISSION FOR RESEARCH: DR LINGESH PILLAY

I give permission for Dr Pillay's research project entitled **Prevalence and aetiological factors of maxillofacial trauma in a rural district hospital in the Eastern Cape** to be conducted at Zithulele Hospital. I permit access to the medical records held in the dental and out-patient departments in order to conduct his analysis of our care.

We look forward to learning of the outcomes of this research and hope it will lead to further improvements in the care of people who experience maxillofacial trauma and seek care in our hospital.

Yours sincerely

Dr Ben Gaunt
Clinical Manager
Zithulele Hospital

APPENDIX C.

R14/49 Dr Lingeswara Pillay

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M160832

NAME: (Principal Investigator)	Dr Lingeswara Pillay
DEPARTMENT:	Oral and Maxillofacial Surgery Zithulele Hospital, Mqanduli
PROJECT TITLE:	Prevalence and Aetiological Factors of Maxillofacial Trauma in a Rural District Hospital in the Eastern Cape
DATE CONSIDERED:	26/08/2016
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Dr Mzubanzi Mabongo and Prof Brian Buch
APPROVED BY:	Professor P Cleaton-Jones, Chairperson, HREC (Medical)
DATE OF APPROVAL:	29/08/2016

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

DECLARATION OF INVESTIGATORS

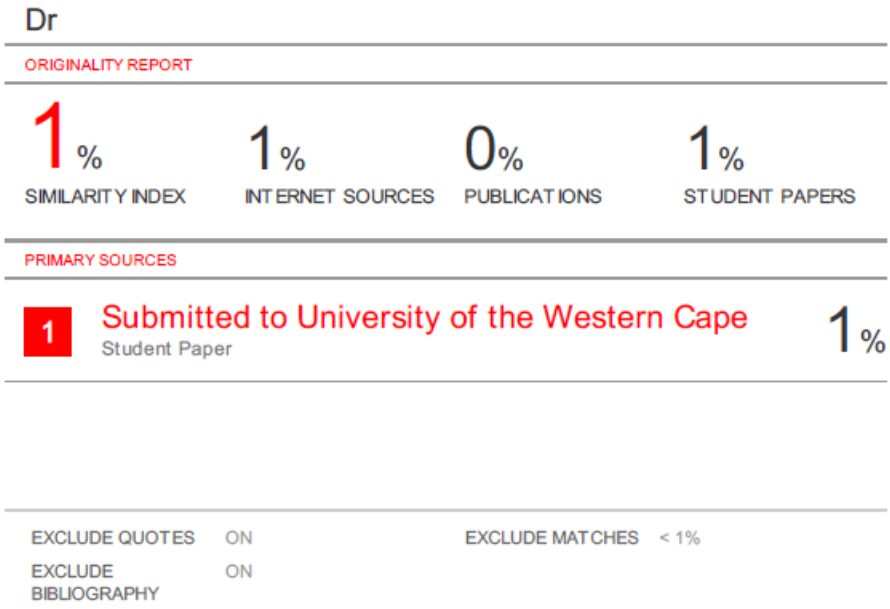
To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary in Room 10004, 10th floor, Senate House/2nd Floor, Phillip Tobias Building, Parktown, University of the Witwatersrand. I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned 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 resubmit the application to the Committee. **I agree to submit a yearly progress report**. The date for annual re-certification will be one year after the date of convened meeting where the study was initially reviewed. In this case, the study was initially reviewed in August and will therefore be due in the month of August each year.

Principal Investigator Signature

Date 29/8/16

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

APPENDIX D.



Dr

ORIGINALITY REPORT

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