

https://dspace.org/

The relationship between pericoronitis and the positioning of impacted mandibular third molars

Bhikha, Vishal

2020
https://hdl.handle.net/10539/31720

Downloaded from a DSpace repository. https://dspace.org/

THE RELATIONSHIP BETWEEN PERICORONITIS AND THE POSITIONING OF IMPACTED MANDIBULAR THIRD MOLARS

Vishal Bhikha

A Research Report submitted to the Faculty of Health Science, University of Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree of

Masters of Dentistry, in the Department of Maxillofacial and Oral Surgery.

School of Oral Health Sciences,

Faculty of Health Sciences

University of the Witwatersrand,

Johannesburg

2020

DECLARATION

I, **Vishal Bhikha** (student no: **351127**), declare that this research report is my own, unaided work. It is being submitted for the degree of Master of Science in Dentistry, in the Department of Maxillofacial and Oral Surgery at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in any other University.

.....

.....day of 2020

DEDICATION

I dedicate this work to:

My beloved Guru, Babaji, for His divine grace and unconditional love.

I thank my dear parents Sapna and Kishore, and my siblings Shivam, Puja and Reyna for their constant support, guidance, love and motivation.

Bless you!

“Seek and it shall be given to the seeker”

-Dr Avdhoot Shivanand

ABSTRACT

Introduction: Impacted mandibular third molars may lead to a variety of conditions. Pericoronitis is an inflammatory condition of the gingival soft tissue surrounding the impacted or partially erupted tooth (mandibular third molar). Pericoronitis may result in varied pain, swelling, halitosis, abscess formation. Angulation and position of the mandibular third molar may be a contributing factor towards the development of pericoronitis.

Aim: To investigate the relationship between pericoronitis and the positioning of impacted mandibular third molars.

Methodology: This study is a retrospective study based on the records (clinical records and panoramic radiographs) of 201 patients who presented for surgical extraction of symptomatic impacted mandibular third molars diagnosed with pericoronitis. Data collection was done using a designed questionnaire. The Pell and Gregory, and Winter's classifications were used to assess position and angulation respectively.

Results: Pericoronitis was seen mostly in female patients (53.2%). The most predominant mandibular third molar angulation associated with pericoronitis was vertical (51.7%), followed by mesioangular (43.2%) and horizontal (3%). The most predominant position was IA (36.3%), followed by IIB (28.8%) and thirdly was IB (15.9%). The most common combination was a IA position with vertical angulation (36%). There was a statistically significant association observed between combination of classifications and pericoronitis (P= 0.01*).

Conclusion: Pericoronitis is a condition that may be seen mostly between the ages of 20-29 years, affecting predominantly females. Pericoronitis occurrence is highly associated with vertically angulated mandibular third molars and/or mostly present in positions of class I/II ramus relation and class A depth. Patients presenting with unfavourable angulations, positions and patterns of mandibular third molars should be aware of the possibility of developing a pericoronal infection and symptoms thereof. It is advisable to consider some form of assistance or treatment modality.

ACKNOWLEDGEMENTS

I would like to acknowledge and express my heartfelt gratitude to both my supervisors, Prof Mzubanzi Mabongo and Dr Maphefo Thekiso, for their constant dedication, encouragement and drive towards the research progress.

TABLE OF CONTENTS

DECLARATION ii

DEDICATION iii

ABSTRACT iv

ACKNOWLEDGEMENTS vi

TABLE OF CONTENTS vii

CHAPTER 1: INTRODUCTION 1

CHAPTER 2: LITERATURE REVIEW 3

AIM AND OBJECTIVES OF THE STUDY 14

AIM 14

HYPOTHESIS 14

OBJECTIVES 14

CHAPTER 3: METHODOLOGY 15

3.1 Study Design 15

3.2 Data Collection 15

3.3 Inclusion Criteria 15

3.4 Exclusion Criteria 15

3.5 Sample size 15

3.6 Realiability 16

3.7 Data Analysis 16

3.8 Ethical Considerations 16

3.9 Data collection Limitations 17

CHAPTER 4: RESULTS 18
4.1 Results 18
4.2 Graphs and Tables 21

CHAPTER 5: DISCUSSION AND CONCLUSION 28
5.1 Discussion 28
5.2 Conclusion 33
5.3 Future recommendations 34

REFERENCES 35

APPENDICES 38
APPENDIX I: Plagiarism Declaration 39
APPENDIX II: Turnitin Report 40
APPENDIX III: Ethics Clearance 43
APPENDIX IV: CEO Permission Letter 44
APPENDIX V: Data Collection Sheet 45

CHAPTER 1: INTRODUCTION

Third molars, commonly known as wisdom teeth, have always brought about much concern and debate regarding their purpose and treatment, especially, when the tooth and its surroundings become symptomatic (Knutsson *et al*., 1996). Third molars are the last teeth to erupt in the dental arch, and eruption usually occurs between 17 and 24 years of age (Indira *et al*., 2013). Third molars have a high rate of impaction, furthermore mandibular third molars (followed by maxillary third molars) present with the greatest impaction prevalence (Ali *et al*., 2014; Kazemian *et al*., 2015).

The failure of third molars to erupt completely, in the lower jaw, is commonly associated with a lack of space between the second molar and the ascending ramus. This occurrence is frequently seen as one of the main causes of mandibular third molar impaction. Other causes of impaction include; an aberrant path of eruption, premature loss of primary dentition and pathological lesions. (Bjork, 1956; Ali *et al*., 2014).

Impacted third molars may lead to a variety of conditions that include, dental caries of the second and/or third molars as a result of food/debris traps, pericoronitis and root resorption (Hazza'a *et al*., 2009). A common condition associated with impacted mandibular third molars is pericoronitis, which can be described as an inflammatory process that occurs within the soft tissue surrounding the crown of a partially erupted or impacted tooth (Indira *et al*. 2013; Friedman, 2007). Other risk factors for pericoronitis are presence of periodontal pockets adjacent to the erupting tooth, poor oral hygiene, trauma to gingiva caused by occlusion of the opposing tooth and a previous history of pericoronitis (Dhonge *et al.*, 2015)

The appearance of pericoronitis is generally that of an erythematous gingival swelling. Symptoms may include varied pain (which may become severe), malaise, restricted jaw opening and difficulty upon closing, halitosis, regional lymphadenopathy, abscess formation and trauma to gingiva often caused by occlusion of the opposing maxillary third molar (Langlais and Miller, 2009).

The management of pericoronitis should aim to restore individual health by alleviating symptoms and signs such as pain, inflammation and infection. Treatment options may entail a course of antibiotics to treat possible infection, analgesics and non-steroidal anti-inflammatory drugs to alleviate pain and swelling and the use of saline solution for flushing of the affected area. Other treatment options, depending on the cause of the pericoronitis, may include an operculectomy of gingival tissue at the affected site or an extraction of the opposing (maxillary) molar (Kamuda *et al*, 2014). Education on effective oral hygiene practices should also be advocated to the patient (Dhonge *et al.*, 2015).

In many cases the recurrence of pericoronitis is a common phenomenon. Episodes of pericoronitis may persist until a more definite treatment modality is carried out, this treatment option often includes the extraction of the partially erupted or impacted tooth. (Langlais and Miller, 2009; Kamuda *et al*, 2014). Even though pericoronitis appears as a minor condition at the initial stages, it should not be ignored and the appropriate treatment interventions should be carried out in order to prevent further complications and even life-threatening conditions (Dhonge *et al.*, 2015).

CHAPTER 2: LITERATURE REVIEW

Pericoronitis can be described as an inflammatory process that occurs within the soft tissue surrounding the crown of a partially erupted or impacted tooth. The most common initiation of the inflammatory process is, when food debris and plaque deposits become trapped under the operculum of the overlying tooth crown (Neville *et al.*, 2010; Dhonge *et al.*, 2015). This area becomes an ideal environment for bacterial species such Streptococcus, Actinomyces and Propionibacterium to manifest (Dhonge *et al.*, 2015). The mucosal area is more prone to developing infection due to the break in the continuity of the mucosa, as well as difficulty of access to the region in order to maintain satisfactory oral hygiene (Langlais and Miller, 2009). Another factor that may predispose a break in continuity of the gingival mucosa is the continual trauma caused by the occlusion of the opposing third molar (maxillary third molar) upon the mandibular gingival mucosa. (Kamuda *et al*, 2014). Yamlik and Bozkaya (2008) reported that the occurrence of an impinging maxillary dentition did not have a statistically significant impact on presence of pericoronitis ($p = 0.075$).

Pericoronitis is a condition that can be labelled as inflammation of the surrounding gingiva in relation to an erupting or impacted tooth (mandibular third molar) and is considered to be the most common pathological condition associated with third molars (Indira *et al*. 2013). A number of studies and articles from various countries such as United States of America ($p>0.05$), Pakistan ($p>0.05$), India ($p>0.05$) and Nigeria ($p<0.05$) respectively have shown a positive association between pericoronitis and the presence of an impacted or partially erupted mandibular third molar (Friedman, 2007; Shahzad *et al*., 2016; Indira *et al*. 2013, Akpata, 2007). Hazza'a *et al*. (2009) who conducted a study in Jordan substantiated that the pericoronitis condition is strongly related to the angulation of mandibular third molars and

furthermore reported that there was a statistically significant association between radiographic changes and the angulation of the tooth ($p<0.002$). Nazir *et al.* (2014) shared a similar finding through a study conducted in Pakistan whereby he expressed that third molars with unfavourable angulations are more likely to result in associated pathologies, whereby one of many pathologies being pericoronitis. It was reported that pericoronitis was the second most common (29.36 %) condition after dental caries associated with impacted/angular mandibular third molars (Nazir *et al.*, 2014).

Studies on pericoronitis often depict the association and relationship of the impacted mandibular third molar and progression towards the development of the condition (Indira *et al*., 2013; Almendros-Marques *et al*., 2006; Shira *et al*., 1986). Yamlik and Bozkaya (2008) from Turkey highlighted the impact of positional, anatomical and structural characteristics of third molars together with their surroundings and its correlation towards the development of pericoronitis. Impactions may be a result of lack of space in the dental arches, abnormal path of eruption, dense overlying bone or soft tissue (Shahzad *et al*., 2016). The frequency of impactions of the mandibular third molar is higher compared to impactions of the maxillary third molar (Shahzad *et al*., 2016). According to a study carried out by Hashemipour *et al.*, (2013) in India, the prevalence of third molar impaction ranges from 16.7% to 68.6% (3-10). Ali *et al* (2014) from Pakistan reported that frequency of third molar impactions in mandible is threefold compared to impactions of the maxilla. Pillai *et al.* (2014) from India expressed that maxillary third molars impactions represented only 20.8% prevalence as compared to mandibular third molar impactions with prevalence of 79.1%. Impacted third molars often lead to a variety of conditions that include, dental caries of second and third molars as a result of longstanding food trap formation together with poor oral hygiene maintenance,

pericoronitis and occasionally root resorption which is the wear of the root surface due to the intimate proximity of the second and third molars (Hazza'a *et al*., 2009).

With the purpose of evaluating the type of angulation and degree of impaction, Indira *et al*. (2013) carried out clinical examinations and radiographic assessments in Bengaluru, India, in order to discover the status of an impacted third molar that may be prone to the development of a pericoronal infective process and its potential complications, of which possible signs and symptoms may include pain, swelling and masticatory difficulty. With the nature of pericoronitis being an inflammatory condition associated with the soft tissue/gingiva surrounding the third molar, Knutsson *et al*. (1996) therefore, carried out a study in Sweden whereby he described the categories of soft tissue coverage and the likelihood of pericoronitis. Among the categories of soft tissue coverage i.e. Fully erupted, Partially covered by soft tissue and Completely covered by soft tissue; it can be emphasised that pericoronitis is the most frequent disease occurring among molars in the category of partially covered by soft tissue. This occurrence is often associated with bacterial invasion and/or inadequate oral hygiene practices at the soft tissue site. (Knutsson *et al*. 1996). Pericoronitis may develop from the moment that the crown of an erupting third molar comes into contact with the oral cavity. Once the infective process has developed as a result of continuous inadequate hygiene practices, interproximal debris traps, and bacterial ingress, it has the potential to become chronic and recur intermittently until the tooth is fully erupted (Almendros-Marques *et al*. 2006). However, Shira *et al* (1986) reported in a study done in Boston, USA, that the tooth that is at the highest risk for developing acute pericoronitis is the fully erupted mandibular third molar which is vertically positioned, this finding resulted in an 84% prevalence. Often these teeth are partially encapsulated by soft tissue and are at the most compromised angulation for developing a pericoronal infection due to bacterial ingress. Even

though the vertical position was said to be a higher risk factor, the finding was not statistically significant ($p>0.05$) (Shira *et al.* 1986).

In 2006 in Spain, Almendros-Marques *et al*. reported, through his study on prophylactic removal of impacted mandibular third molars, that this type of complication (pericoronitis) was related to more than just a series of anatomical parameters associated with the impacted third molars but to consider age and sex as secondary factors as well. Furthermore, Knutsson *et al*. (1996) from Sweden suggested the occurrence of pericoronitis as a pathology is considered to be of a multi-factorial origin with associated risk factors such as age, gender, poor oral hygiene, caries and other pathology such as cysts and tumours. A pair of authors from Canada showed that there was a higher occurrence of pericoronitis among the age group of 20-29 (Mercier and Precious, 1992), these findings were similar to those of Dhonge *et al*. (2015) from India. Another two authors, one from Thailand and other from Pakistan respectively, reported that pericoronitis seems to usually occur in the third decade of one's life, however these findings were not statistically significant ($p>0.05$) (Punwutikorn *et al*., 1999; Nazir *et al*, 2014). Hazza'a *et al*. (2009) from Jordan reported an association between pericoronitis and the age group of 17-25 year-old, with the average age being 24.8 years, furthermore, it was expressed that there was statistical significance between pericoronitis and age of the subjects ($P=0.004$).

There have also been differences in the findings with regard to the gender and its association with pericoronitis. Various studies from counties that include Thailand, Pakistan and Turkey reported a higher association of females and the occurrence of pericoronitis (Punwutikorn *et al*., 1999; Shahzad *et al*., 2016; Yamlik and Bozkaya, 2008). Even though Yamlik and Bozkaya (2008) from Turkey reported a higher female association with the presence of

pericoronitis ($p<0.05$), they reported that gender did not have a significant impact on the third molar angulation type ($P>0.05$). Some authors, from Pakistan and Turkey respectively, gathered that males showed a higher association with pericoronitis (Ali *et al*., 2014; Yilmaz *et al.*, 2015). Yilmaz *et al.* (2015) from Turkey reported that the male/female difference was not statistically significant ($p=0.187$). Akpata (2007) from Nigeria suggested that there was no sex difference in his study and elucidated that sex differences are not important in the development of a pericoronal flap infection. Even though another author found a higher association between females and the occurrence of pericoronitis, it was further stated that there was no statistically significant association between gender and the type of impaction ($p>0.05$) (Shahzad *et al*., 2016).

The positioning of an impacted mandibular third molar may be clinically assessed through visual assessment; however, such assessment may have limitations. More accurate categorisation can be done with the help of radiographs through which the anterior-posterior, superior-inferior as well as the position with regard to the long axis relations may be assessed (Shahzad *et al*., 2016). Impacted mandibular third molars are commonly classified according to Pell and Gregory, which is used to assess pattern and position and the Winter's classification describes angulations (Akpata, 2007; Ali *et al*. 2014).

The Pell and Gregory classification is used to assess the ramus (horizontal) and occlusal (vertical) position of mandibular third molar in relation to anterior border of ramus and distal aspect of second molar. The pattern and position of impacted third molars is viewed according to Pell and Gregory classification as follows: If space between anterior border of ramus and distal surface of second molar is sufficient, it is labelled Class I. If space is less than mesio-distal diameter of impacted tooth, it is termed Class II. A tooth completely into

ramus is assigned Class III. A third molar with its highest part at level of occlusal plane of second molar is assigned position A. In position B, impacted tooth is between occlusal plane and cervical margin of second molar while a tooth below cervical margin is labelled position C (Ali *et al*. 2014).

Winter's classification is used to assess angulations of mandibular third molars in relation to the long axis of mandibular second and third molar (Indira *et al*. 2013). Winter's Classification describes the impaction as: Distoangular, Mesioangular, Vertical and Horizontal (Akpata, 2007).

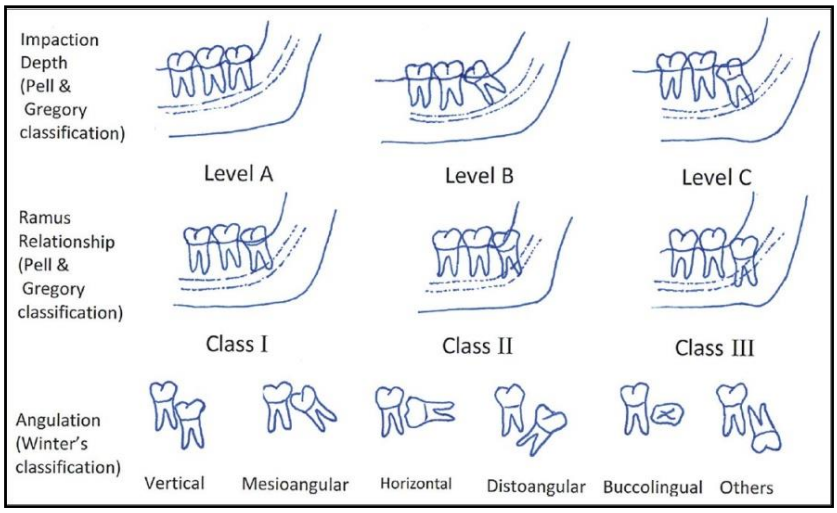


Figure 1: Diagrammatic illustrations of mandibular third molar classifications i.e. Pell & Gregory and Winter's.

In a study, conducted by Akpata (2007) in Nigeria, to determine the relationship of acute pericoronitis to the position of the mandibular third molars, it showed that the highest risk of pericoronitis was associated with vertically positioned mandibular third molars at 57.4% followed by 25.9% and 14.8% of distoangular impactions and mesioangular impactions respectively. It was observed that majority of the vertically impacted teeth were either at the

same occlusal level or slightly above. However, another author described that third molars that are in the vertical position or slightly distoangular which present with partial mucosal and bony coverage are the presentations most likely to cause pericoronitis (Almendros-Marques *et al*. 2006). Hazza'a *et al.* (2009) reported that the vertical angulation (50.0%) was most associated with pericoronitis prevalence and also found statistical significance between the pericoronitis and the angular position ($p<0.002$). Punwutikorn *et al*. (1999) had shared similar findings to Hazza'a *et al.* (2009) with regard to the most prevalent angulations associated with pericoronitis i.e. vertical angulation (40.6%) followed by distal angulation (42.0%). These findings were also found to be statistically significant ($P<0.05$). On the other hand, some authors reported that there was an intimate relationship between the mesioangular position and the appearance of pericoronitis and that mesioangular impactions presented with highest prevalence i.e. 30%, 37.6% and 45,55% respectively (Knutsson *et al*., 1996; Ali *et al*. 2014; Shahzad *et al*., 2016). However, these findings did not have any statistical significance between the pericoronitis and mesioangular impactions ($p>0.05$). Nazir et al. (2014) had found that disto-angular impactions were commonly associated with pericoronitis 46.8% ($p>0.05$).

A study conducted in Pakistan (using Pell and Gregory classification) showed that the occurrence of pericoronitis was seen in 29.36% of patients of which most were associated with distoangular impaction and position A and B, Class II (Ali *et al*. 2014). Similar results were found by Almendros-Marques (2008) i.e. class IIB was closely associated with the appearance of pericoronal infection. The outcomes of another study found that the predominant position was 1A and angulation was vertical in cases of pericoronitis (Indira *et al*. 2013). Hazza'a *et al.* (2009) reported that position A (80.2%) followed by position B (19.8%) were most associated with pericoronitis prevalence but found no statistical

significance between the pericoronitis and depth of impaction (p=0.063). Hazza'a *et al.* (2009) reported no cases of position depth C (0%) associated with pericoronitis. Shahzad *et al*. (2016) had similar findings to Hazza'a *et al*. in which position A depth (54,71%) was the most commonly associated with third molar pathologies, furthermore there was no statistically significant relationship of any pathology and the angulation depth or ramus relation (p>0.05). Yilmaz *et al*. (2015) reported that a level C was the most common type of impaction but level A (44%) category impactions were predominantly associated with pericoronitis (p<0.01).

Through studies, carried out by Steed (2014), Mercier and Precious (1992), Punwutikorn *et al*. (1999), the authors showed that pericoronitis was the most common indication for the removal of mandibular third molars. It was reported that there is a higher indication for extraction in cases of pericoronitis and accounted for 40% of all mandibular third molar extractions (Mercier and Precious, 1992). Some reports suggested that dental caries was the main cause for third molar extraction followed by pericoronitis (Shahzad *et al*., 2016; Knutsson *et al*. 1996). Another group of authors reported that prophylactic removal i.e. the removal of an asymptomatic tooth, was the primary reason for removal of mandibular third molars and was closely followed by pericoronitis (Lysell and Rohlin, 1988). Other indications for the removal of mandibular third molars include preparation for orthodontic treatment, periodontitis, cyst formation and malocclusion (Lysell and Rohlin, 1988).

Symptomatic impacted third molars can affect the quality of one's life due to varied pain, swelling, associated fever and headaches and often the most common treatment offered is a dental extraction. Conversely there has always been controversy and debate regarding the prophylactic removal of impacted mandibular third molars (Friedman, 2007). Many

controversial topics are brought about surrounding the prophylactic removal of mandibular third molars. One of the most common controversial substantiations given by general dentists to their patients in this regard is; the prevention of future problems such as pathology, decay and discomfort at later stages according to Cunha-Cruz *et al*. (2014) whose reports were based on practices in the Pacific Northwest region of USA. Other common controversial topics discussed on the prophylactic removal of third molars are; early removal is less traumatic, high incidence of pathology associated with third molars, crowding of anterior teeth due to pressure of erupting third molars, development of pathological risk in third molars increases with age and there is little risk of harm caused by removal of third molars (Friedman, 2007). On the economical point of view, prophylactic removal of third molars in high numbers carried out in state hospitals and clinics resulted in very hefty expenses causing a financial burden on the state (Renton *et al*, 2012). Furthermore, in a South African setting, large numbers of patients attending state hospitals are from low income earning households (i.e. R1-R19 200 per annum) (Lehohla, 2015). Increased number of people from low and middle socio-economic status (SES) backgrounds attend state primary healthcare facilities as compared to high (Myburgh et al, 2005). Young (2016) expressed that the current public healthcare system is based on socioeconomic status and elaborates that the attempts to reform the health system have not gone far enough to bring about the adequate equity in healthcare.

Prophylactic removal of impacted mandibular third molars was recommended to reduce the incidence of complications secondary to impaction, and to reduce the morbidity associated with extractions when performed in elderly patients with regard to surgical wound healing and bone formation (Almendros-Marques *et al*. 2008). A study showed that 80% of the conditions, such pericoronitis, tooth decay and unfavourable eruption, associated with mandibular third molar impactions were recorded in the age group of between 16 and 30

years of age. The distribution of the patient sample by ages shows a marked tendency toward early extraction of impacted third molars, hence prophylactic management is considered to be beneficial for patients under 25 to 30 years old, due to the maintenance of favourable bone levels with minimum bone loss after extraction (Almendros-Marques *et al*. 2006).

"The decision whether or not to remove the third molars should take the overall benefit to the patient's oral status and general health into account." (Van der Linden *et al*., 1993:239)

In the year 2000, the National Institute of Clinical Excellence (NICE) of the United Kingdom released guidelines regarding the management of third molars. These guidelines suggested that the practice of prophylactic removal of pathology-free impacted third molars should be discontinued. Surgical removal of impacted third molars should be limited to patients with evidence of pathology which include unrestorable caries, subsequent episodes of pericoronitis, non-treatable pulpal and/or periapical pathology, cellulitis, abscess, osteomyelitis and tumour (Renton *et al*, 2012; NICE guidelines, 2000). The NICE guidelines elaborated that every procedure associated with the removal of an impacted third molar carries a risk for the patient, including temporary or permanent nerve damage, alveolar osteitis, infection and haemorrhage as well as temporary local swelling, pain and restricted mouth opening. There are also risks associated with the need for general anaesthesia in some of these procedures and therefore patients are being exposed to the risk of undertaking a surgical procedure unnecessarily (NICE guidelines, 2000).

"Specific attention is drawn to plaque formation and pericoronitis. Plaque formation is a risk factor but is not in itself an indication for surgery. The degree to which the severity or recurrence rate of pericoronitis should influence the decision for surgical removal of a third

molar remains unclear. The evidence suggests that a first episode of pericoronitis, unless particularly severe, should not be considered an indication for surgery. Second or subsequent episodes should be considered the appropriate indication for surgery." (NICE guidelines, 2000)

Since the implementation of the NICE guidelines there has been a marked decrease in the number of prophylactic third molar surgical activity (Renton *et al*, 2012). This decrease has been seen at both state and private healthcare facilities. There is no dependable evidence to support a health benefit to patients from the prophylactic removal of pathology-free teeth (Renton *et al*, 2012). Almendros-Marques (2008) explained that the treatment decision has become an intuitive and somewhat an arbitrary process that is subject to the individual criterion of each professional and is based on three fundamental aspects: (1) patient information (such as health status, age, gender etc.), (2) the characteristics of dental impaction (severity of impaction, angulation and positioning of the impaction) and (3) information based on the existing clinical and scientific evidence (international guidelines and criteria e.g. NICE guidelines). In addition whereby non-extraction strategy is adopted, long-term clinical and radiographic follow ups should be maintained, so that surgical intervention can be instituted if some pathology starts to develop (Ali *et al*, 2014).

In an objective to obtain predictive criteria for pericoronitis, it is essential to first investigate mandibular third molars that are most likely to become symptomatic. Subsequent analysis of eruption patterns of these teeth may lead to early prediction. The purpose of this study is to describe the characteristics of the mandibular third molars at highest risk for acute pericoronitis.

AIM AND OBJECTIVES

AIM

To investigate the relationship between pericoronitis and the positioning of impacted mandibular third molars.

HYPOTHESIS

There is no relationship between the positioning of the impacted mandibular third molar and pericoronitis.

OBJECTIVES

1) To identify the common pattern and position of mandibular third molar impactions.

2) To determine whether demographic factors are associated with pericoronitis.

3) To determine the position and pattern of impacted mandibular third molars that are associated with pericoronitis.

CHAPTER 3: METHODOLOGY

3.1 **Study design**

This study is a retrospective study based on the records (clinical records and panoramic radiographs) of 201 patients who presented for surgical extraction of symptomatic impacted mandibular third molars diagnosed with pericoronitis. The study was carried out in the Department of Maxillofacial and Oral Surgery at Wits Oral Health Centre (WOHC), in Johannesburg. Patients who presented from January 2016 to June 2016 were included.

3.2 **Data collection**

Data collection was done using a designed questionnaire (Appendix V).

3.3 **Inclusion criteria**

All patients aged 18 and above.

3.4 **Exclusion criteria**

Patients with asymptomatic mandibular third molars i.e. patients who did not present with any signs of pericoronitis.

Patients presented with pathology such cyst formation and tumour associated with the mandibular third molars.

Patient's files with missing clinical records and radiographs were also excluded.

3.5 **Sample size calculation**

The appropriate sample size of 201 patients was determined using the Raosoft sample size calculation. The estimated population of patients presenting with symptomatic mandibular

third molars at the Department of MFOS was 420 (Departmental Annual Records) at a marginal error of 5% and response distribution of 50% at a 95% Confidence Interval (CI). Data collection was done using a designed questionnaire (Appendix V).

3.6 **Reliability**

The researcher and one qualified radiologist were calibrated to standardize the radiographic criteria on analysing the panoramic radiographs using the Pell and Gregory classification and Winter's classification. The intra and inter-examiner reliability agreement was assessed using the Cohen Kappa Statistic, with the overall score of 0.95 and 0.93 respectively.

3.7 **Data analysis**

Data was captured using the designed questionnaire and then analysed using the statistical package for social sciences- STATA (Stata Corp, 2017). Descriptive statistics of the trends were captured and then presented in data tables and graphs. The odds ratio was used to determine the strength of the association. Bivariate logistic regression models were also used to analyse data. The statistical significance level was set at $p<0.05$ and estimates were reported at the 95% confidence interval.

3.8 **Ethical considerations/Issues**

An application for ethical clearance was sought from the Human Research Ethics Committee (HREC) of the Universty of the Witwaterand. A permission letter was obtained from the CEO/Head of Wits Oral Health Centre granting the researcher to conduct the study (Appendix IV).

3.9 **Data collection limitations**

- Poor record keeping.
- Insufficient information or details recorded in patient files.
- Poor quality of radiographs (e.g. faded paper printed radiographs).

CHAPTER 4: RESULTS

4.1 Results

The sample size in this study consisted of 201 patients (files) with a history of pericoronitis. Male patients represented a figure of 94 (46.7%), while 107 (53.2%) patients were female (Figure 2). The age of the patients ranged from 18-58 years with the mean age being 29.6 years and the median interquartile range (IQR) 28(22.50-35). The association between pericoronitis and gender was found to be significant when Chi-square tests were applied ($P< 0.05$) (Table 2.1).

The age group with the highest occurrences of pericoronitis was the age group between 26-35 years i.e. n=82 (40.6%), followed by the age group of 18-25 years i.e. n=75 (37%). The age group 36-45 years had a total of 40 patients (20%). The age group older than 45 years was the group representing the lowest numbers of pericoronitis occurrences i.e. n=4 (2%) (Figure 3). Although the age group of 26-35 years showed higher association with pericoronitis, there was no statistical significance between the occurrence of pericoronitis and the age group category ($P> 0.005$) (Table 2.1).

In terms of socio-economic status/patient tariffs; the most common classification (Table 1) of patient in this sample was H1 with 103 patients (51.2%), followed by H2 with 58 patients (28.8%) and thirdly H3 with 37 patients (18.4%). The least number of patients were from classification H0 with 3 patients (1.5%). The socio-economic status association with pericoronitis showed statistical significance whereby $P<0.05$.

Table 1: Table showing the means test descriptors and percentage represented by each classification in this study.

Classification	Single income	Household income	% Represented in this study (Total n= 201)
H1	R0 to R70 000 per annum	R0 to R100 000 per annum	51.2% (n=103)
H2	R70 000 to R250 000 per annum	R100 001 to R350 000 per annum	28.8% (n=58)
H3	>R250 000 per annum	>R350 000 per annum	18.4% (n=37)
H0	Exempted	Exempted	1.5% (n=3)

One hundred and twenty-nine patients (64.1%) suffered from pericoronitis at the left mandibular third molar and 72 (35.8%) patients reported pericoronitis at the right mandibular third molar. Twenty-eight patients reported pericoronitis on the left and right mandibular third molars (13.9%).

According to the Pell and Gregory classification the class most affected by pericoronitis was IA with 73 (36.3%) cases, followed by IIB representing 58 (28.8%) cases. The third most common class affected by pericoronitis was IB with a number of 32 (15.9%) cases. There were no cases representing the following classes IIIA, IIIB and IIIC (Figure 4). The Pell and Gregory classification representing position and its association with pericoronitis was not found to be statistically significant.

Through a bivariate logistic regression model,it was found that there was significance between females and position IIA, therefore suggested that males are less likely by 67% to have this classification (p=0.038) (Table 2.2). It was also found that patients represented by socio-economic status of H2 classification commonly presented with Pell and Gregory classification position IA (P= 0.046) (Table 4).

According to the Winter's classification the angulation most prone to pericoronitis was a vertically positioned mandibular third molar represented by 104 (51.7%) patients, followed by 87 (43.2%) patients with mesioangular. Horizontal angulations was represented with a number of 7 (3%). In this sample the most uncommon angulation was a distioangular mandibular third molar representing only 3 cases (1.5%) (Figure 5). Although vertical angulation was associated with pericoronitis there was no statistical significance found with regard to the Winter's classification.

With the use of a Pearson Chi-Square test it was found that there was significance between Winters classification and gender (P=0.00) (Table 2.1). It was shown that there was significance between Winter's classification and socio-economic status (P=0.014).

With regard to the combination of Pell and Gregory and Winter's classifications respectively and the prevalence of pericoronitis; the most common combination was a IA position and vertical angulation which was seen in 72 (35.8%) patients. The second most common combination was IIB and mesioangular angulation seen in 43 (21.3%) patients. The third highest combination was IB and mesioangular angulation seen in 25 (12.4%) patients (Table 5). The association between the pericoronitis and the combination of classifications i.e. Pell and Gregory and Winter's was found to show statistical significance (P= 0.000) (Table 5).

4.2 Graphs and Tables

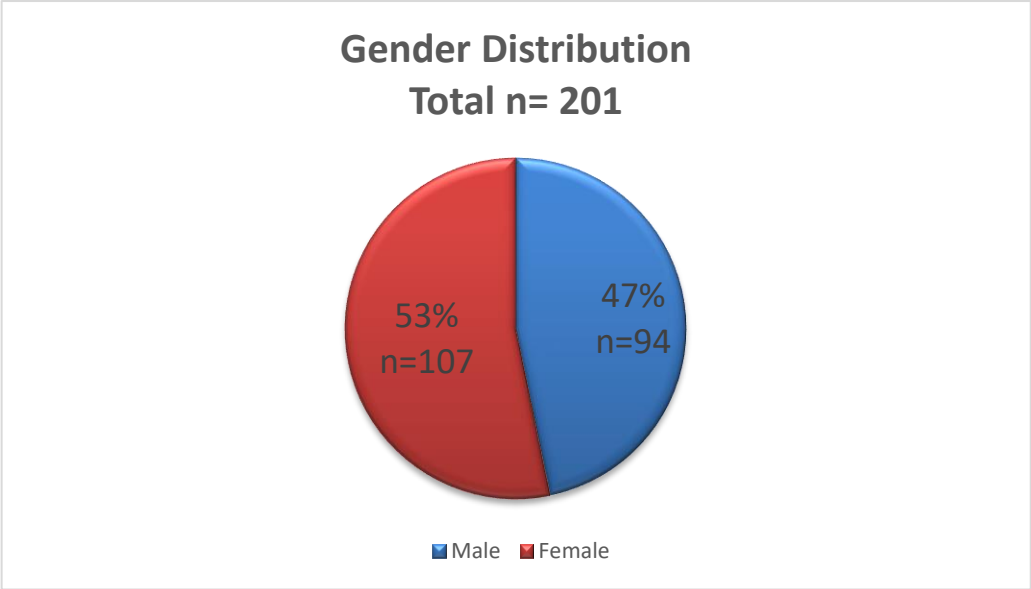


Figure 2: Pie chart showing the distribution between Male and Female patients.

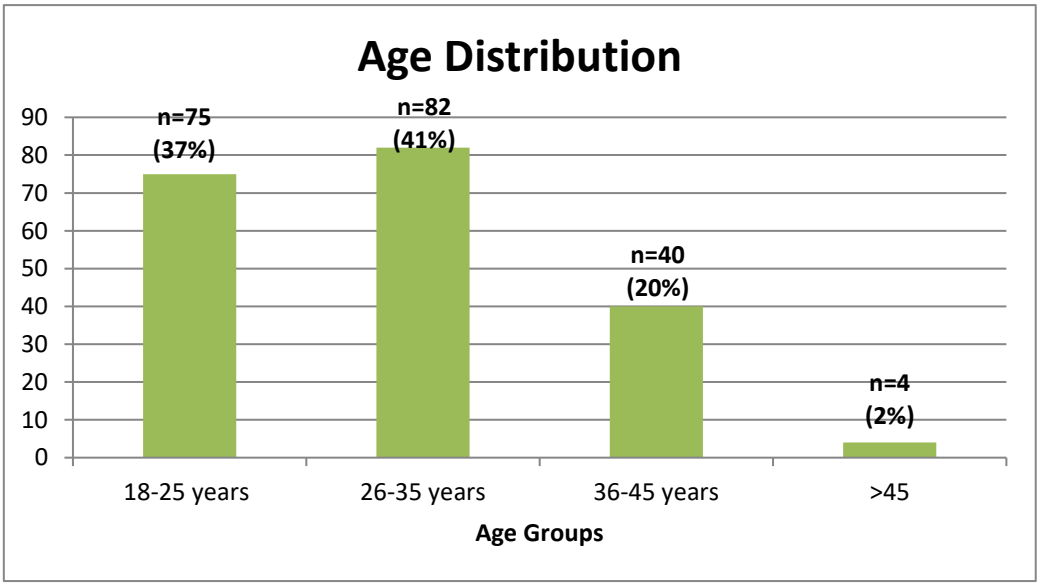


Figure 3: Bar graph showing the distribution of various age groups in this study.

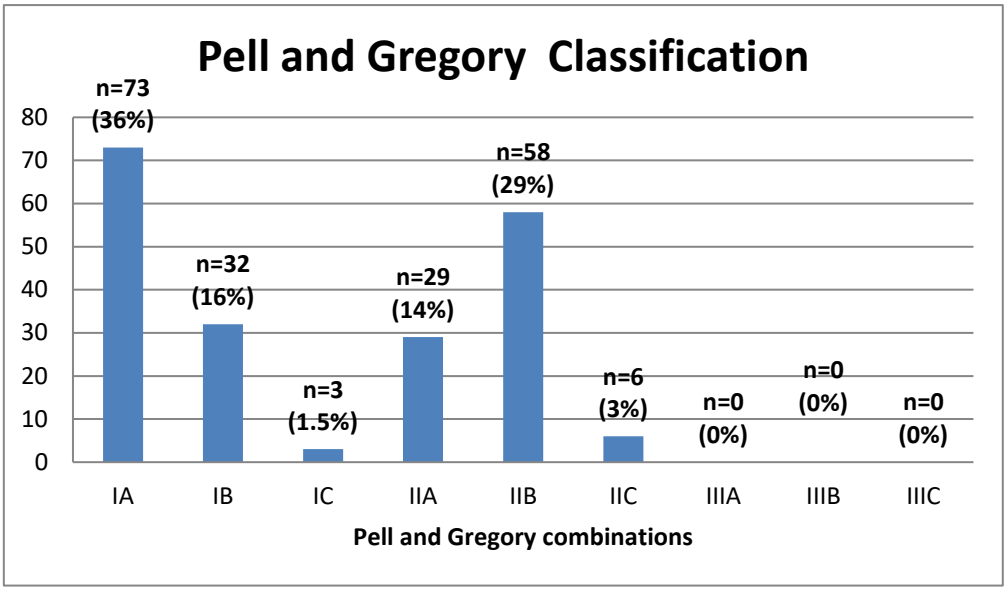


Figure 4: Bar graph showing the totals of each position using Pell and Gregory classification.

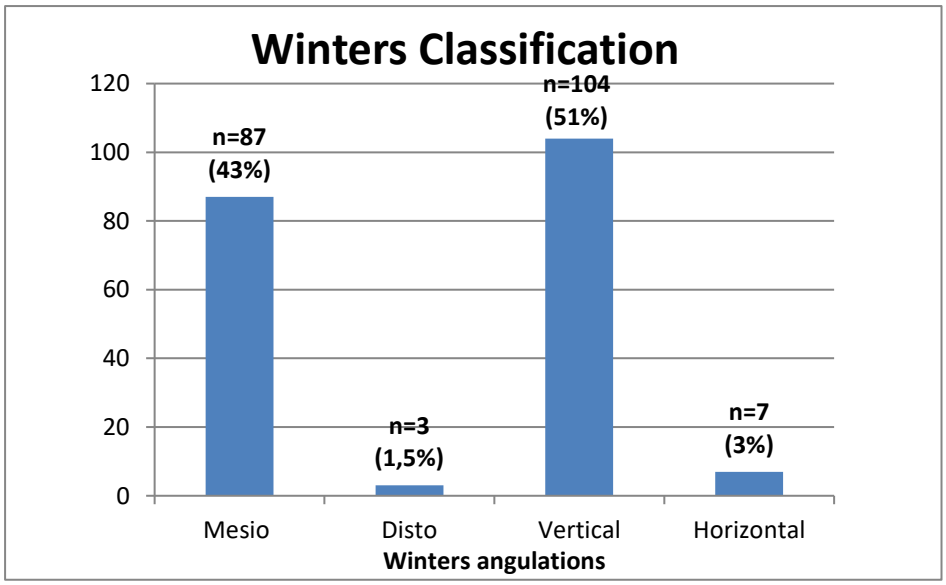


Figure 5: Bar graph showing the totals of each angulation using Winter classification.

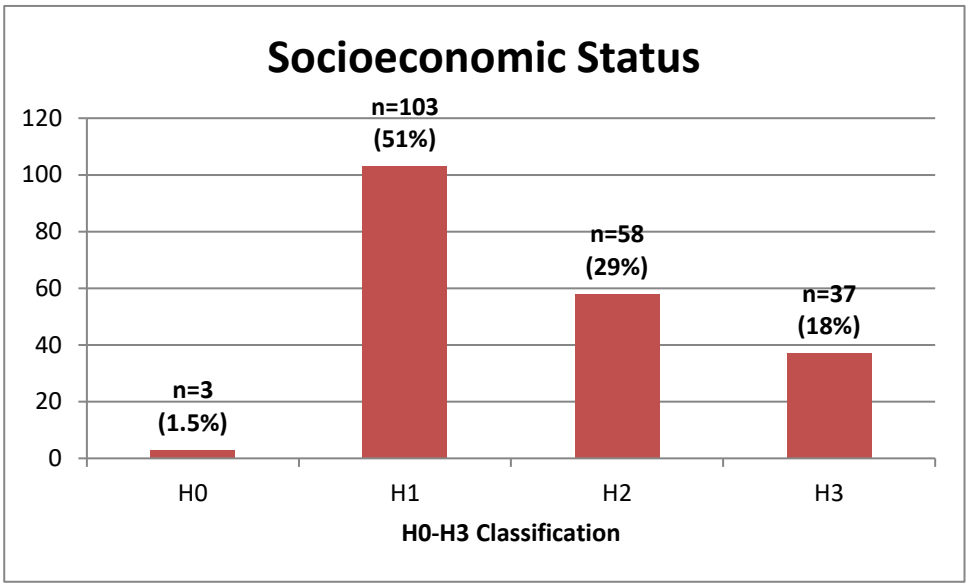


Figure 6: Bar graph showing the totals of each socio-economic category (H0-H1) that suffered from pericoronitis in this study.

Key and Description for figure 6.		
Classification	**Single income**	**Household income**
H1	R0 to R70 000 per annum	R0 to R100 000 per annum
H2	R70 000 to R250 000 per annum	R100 001 to R350 000 per annum
H3	>R250 000 per annum	>R350 000 per annum
H0	Exempted	Exempted

Table 2.1: Table showing the values derived from Pearson Chi-square test for gender and age for Winter's and Pell and Gregory classifications.

Factors	**p-value**		**p-value**	
Gender		**Pell and Gregory**		**Winters**
Male		1		1
Female	*0.000	35.520	*0.001	17.290
Age	0.066	10.36	0.289	3.76
*P<0.05				

Table 2.2: Table showing the results of the bivariate logistic model of Winters and Pell and Gregory classifications for gender.

Classifications	**p-value**	**Bivariate Logistic model OR & 95% C.I**
Winters Classification	**Gender**	
1	0.797	0.205 (0.258 -5.831)
2		-20.497 (1.254E-9)
3	0.243	-0.924 (0.084-1.872)
4	Ref	Ref
Pell Gregory		
1	0.135	-1.345 (0.45- 1.521)
2	0.218	1.253 (0.476 – 25.724)
3	1.000	0.000 (0.053 – 18.915)
4	*0.038	-2.037 (0.019 – 0.89)
5	0.444	-0.693 (0.085 – 0.946)
6	0	0
*P<0.05		

Keys:

Winters Classification: (1) Mesioangular, (2) Distoangular, (3) Vertical, (4) Horizontal

Pell and Gregory Classification: (1) IA, (2) IB, (3) IC, (4) IIA, (5) IIB, (6) IIC

Table 3: Table showing the bivariate logistic model of Winter's classification and the socio-economic status.

Factors		P-Value	Bivariate Logistic model OR & 95% C.I
Socio economic status.	Winters		
1	1	1.260	1.260 (0.000-.[b])
	2	0.858	0.858 (0.000-.[b])
	3	16270783.744	16270783.744 (16270783.744-16270783.744)
	4	.	.
2	1	2.524	2.524 (0.333-19.103)
	2	1.000	1.000 (0.034-29.807)
	3	3.615	3.615 (0.464-28.195)
	4	.	.
3	1	0.413	0.413 (0.061-2.810)
	2	0.667	0.667 (0.025-18.059)
	3	2.103	2.103 (0.316-13.985)
	4	.	.
The reference category is: 4. P<0.05			

Keys:

Winter's Classification: (1) Mesioangular, (2) Distoangular, (3) Vertical, (4) Horizontal

Socio-economic status: (1) H0, (2) H1, (3) H2, (4) H3

Table 4: Table showing the bivariate logistic model of Pell and Gregory classification and the socio-economic status.

Factors		P-Value	Bivariate Logistic model OR & 95% C.I
Socio economic status.	Pell and Gregory		
1	1	0.998	36566183.083 (0.000-.[b])
	2	1.000	3.985 (0.000-.[b])
	3	.	14824128.257 (14824128.257-14824128.257)
	4	0.998	91415457.709 (0.000-.[b])
	5	1.000	2.834 (0.000-.[b])
	6	.	.
2	1	3.600	3.600 (0.520-24.934)
	2	5.750	5.750 (0.777-42.577)
	3	14037458.967	14037458.967 (0.000-.[b])
	4	15.000	15.000 (1.496-150.395)
	5	3.094	3.094 (0.469-20.401)
	6	.	.
3	1	*0.046	11.100 (1.039-118.566)
	2	0.765	1.500 (0.106-21.312)
	3	0.995	56149835.869 (0.000-.[b])
	4	0.120	9.000 (0.563-143.888)
	5	0.670	1.688 (0.152-18.714)
	6	.	.
The reference category is: 4. *P<0.05			

Keys:

Pell and Gregory Classification: (1) IA, (2) IB, (3) IC, (4) IIA, (5) IIB, (6) IIC

Socio-economic status: (1) H0, (2) H1, (3) H2, (4) H3

Table 5: Table showing the totals of each combination of Winter's and Pell and Gregory classifications.

		Pell and Gregory						
		1	*2*	*3*	*4*	*5*	*6*	Total
Winters	*1*	1 1.37	25 78.13	0 0.00	12 41.38	43 74.14	6 100.00	**87** **43.28**
	2	0 0.00	0 0.00	0 0.00	2 6.90	1 1.72	0 0.00	**3** **1.49**
	3	72 98.63	7 21.88	1 33.33	15 51.72	9 15.52	0 0.00	**104** **51.74**
	4	0 0.00	0 0.00	2 66.67	0 0.00	5 8.62	0 0.00	**7** **3.48**
	Total	**73** **100.00**	**32** **100.00**	**3** **100.00**	**29** **100.00**	**58** **100.00**	**6** **100.00**	**201** **100.00**
Pearson chi2(15) = 162.7464 Pr= 0.000								

Keys:

Winter's Classification: (1) Mesioangular, (2) Distoangular, (3) Vertical, (4) Horizontal

Pell and Gregory Classification: (1) IA, (2) IB, (3) IC, (4) IIA, (5) IIB, (6) IIC

CHAPTER 5: DISCUSSION AND CONCLUSION

5.1 Discussion

Pericoronitis is a common condition associated with mandibular third molars (Friedman, 2007). It is an inflammatory soft tissue condition often associated with impactions, especially at the mandibular third molar region (Shahzad *et al*., 2016). Pericoronitis may be seen as a condition with a high rate of recurrence, presenting with acute exacerbations (Hazza'a *et al*., 2009). The common signs and symptoms which patients may experience include; varied pain, inflammation, malaise, restricted jaw opening, difficulty upon closing and halitosis (Langlais and Miller, 2009). In this study two hundred-and-one patient files were examined with the purpose of investigating the relationship between pericoronitis and the positioning of the mandibular third molar.

Table 6: Various studies being compared with regard to the association of pericoronitis and prevalent position and/or angulation of mandibular third molars.

Author	**Year**	**Sample size n.**	**Classification**	**Findings (Prevalent pericoronitis association)**
Shahzad *et al*.	2016	n=324	P&G	IIA
Indira *et al*.	2013	n=50	Winter's + P&G	Vertical / IA
Yamlik and Bozkay	2008	n=102	Winter's	Vertical
Akpata O	2007	n=132	Winter's	Vertical prevalence
This study	2019	n=201	Winter's+ P&G	Vertical / IA

The presentation of results of this study showed that 46.7% of patients were male and 53.2% were female. The higher female prevalence in this study is in accordance with findings from

other studies (Hazza'a *et al*., 2009; Shahzad *et al*., 2016; Yamlik and Bozkay, 2008). However, Ali *et al*. (2014) reported a higher male preponderance presenting with pericoronitis in his study. While another author suggested that there was no sex difference in his study, he further explained that sex differences are not important in the development of a pericoronal flap infection (Akpata, 2007). It was reported that although pericoronitis is more associated with female patients as compared to male patients ($P<0.05$), gender had no significant impact on the angulation type and extent of eruption level of the mandibular third molar ($p>0.05$) (Yamlik and Bozkay, 2008). Nazir *et al* (2014) explains Hellman's theory which states that the jaws of a female stop growing when third molar teeth begin to erupt, whereas the jaws of a male continue to grow even after third molar eruption resulting in decreased impactions amongst males, however this theory could not be justified with this study. The association between pericoronitis and gender in this study was found to be significant when Chi-square tests were applied ($P< 0.05$). The higher female prevalence in this study may be a reflection of the ratio of the population group that visit clinics/hospitals. Anecdotally females present to clinics much early in the course of any health-related issue compared to men.

Eruption of mandibular third molars usually take place between the ages of 17 and 24 years and often have a high rate of impaction due to a lack of space in the dental arches. In these instances, eruption is further delayed or prevented from taking place along the normal eruption pathways. In this study the age of the patients ranged from 18-58 years with the mean age being 29.6 years (Median (IQR), 28(22.5-35)). The age group with the highest occurrences of pericoronitis was the age group between 26-35 years (40.6%). The finding in this study differs with a study carried out by Ali *et al*. (2014) whereby it was reported, that the most common age for pericoronitis presentation was between 17-25 and further

substantiated with a study by Hazza'a *et al*. (2009), whereby the predominant associated age category reported was 21-25. Studies carried out by Knutsson *et al*. (1996) and Mercier and Precious (1992) reported that pericoronitis was most prevalent in the age group of 20-29 years of age. On the other hand, it was expressed that, "Pericoronitis seems to be an event that usually occurs in third decade of life." (Punwutikorn *et al*., 1999:309)

Nazir *et al.* (2014) shared a similar view by expressing that pathologies associated with impacted mandibular third molars are most commonly seen in the third decade of life. The second most prevalent age group in this study was the age group of 18-25 years (37%). It can be reported that the outcomes of the first and second most prevalent age groups associated with pericoronitis in this study are closely related to the age group categories most affected by pericoronitis in the above-mentioned literature studies. In this study the age group older than 45 years was the group representing the lowest numbers of pericoronitis occurrences i.e. 2% and is in correlation with Mercier and Precious (1992) who suggested that pericoronitis very rarely occurs over the age of 40. A study reported that there was a decrease in number of cases of pericoronitis with increase in age (Nazir *et al*., 2014). There was no statistically significant association between age and pericoronitis ($P>0.05$) The possible reasons for pericoronitis occurrence in the prevalent age group in this study could be associated with factors such as; long term exposure of irritants to surrounding gingiva in the oral cavity together with poor oral hygiene practices and maintenance, other causative factors include formation of deep periodontal pockets and maxillary molar eruption causing further aggravation to gingival tissues.

Patients from various socio-economic backgrounds seek treatment at state hospitals. The findings in this study reported that the most predominant category of patients seeking

treatment was from the H1 category (51%). H1 category is whereby the individual's income is between R0 – R70 000 per annum. According to the Income Dynamics and Poverty Status of Households in South Africa by Statistics South Africa (2015), the representation of people with no income was 15.5% nationally and representation of people with low-income was 29% nationally. In this study there was statistically significant association between socio economic status and the classifications used to determine impactions ($P<0.05$). Almendros-Marques *et al*. (2008) expressed that tooth removal may be influenced on a number of sociological factors such as socio-economic level, public expenditure on oral health and professional approach at healthcare institutions. Based on the prevalent age group i.e. 26-35 years and socio-economic status, it may be that these are young individuals that do not have employment or are in a low earning income bracket. Another possible explanation may be that these individuals are still undergoing or attending tertiary educational training.

In this study, the angulation (according to Winter's classification) most prone to pericoronitis was a vertically positioned mandibular third molar (51.7%), followed by mesioangular (43.2%). The findings of vertical angulation predominance amongst mandibular third molars in this study are comparable with a number of studies (Yamlik and Bozkay, 2008; Hazza'a *et al*., 2009; Knutsson *et al*., 1996). In the study by Yamlik and Bozkaya (2008), it is reported there is statistically significant association between pericoronitis and the predominant angulation, however in this study despite the close association of pericoronitis and the vertical angulation, there is no statistical significance ($P>0.05$). Some authors reported that the predominant angulation most closely associated with pericoronitis was mesioangular (Almendros-Marques *et al*., 2006; Shahzad *et al*., 2016). Although in this study mesioangular associations with pericoronitis were second most predominant, it had presented with a higher

frequency as compared to distal angulations, thus it can be said that the findings in this study is closely associated with that of other studies.

When the Pell and Gregory classification was used, this study showed that the most prevalent category associated with pericoronitis was IA (36.3%). The results of this study are in agreement with the literature, with regard to the impaction depth i.e. class A, however most study's results show that the most common ramus relationship class was II (Shahzad *et al*., 2016; Almendros-Marques *et al*., 2008; Ali *et al*., 2014). The findings in a study conducted by Indira *et al*. (2013) was found to be in accordance with the findings of this study in terms of impaction depth and the ramus relationship i.e. IA. In this study the second most common ramus relation was a class II and depth B. In a study carried by Almendros-Marques *et al*. (2008) the most common impaction class was IIB and therefore is in alignment with this study's second most common ramus relation and depth combination. A few studies expressed that there were low numbers of the ramus relation C and depth III; this would also prove to be true in this study (Almendros-Marques *et al*., 2008; Ali *et al*., 2014). The Pell and Gregory classification categories and its association with pericoronitis was not found to be statistically significant ($P>0.05$). Differences in angulation and position may be due to varied characteristics amongst different population groups. Other variations may arise from differences in anatomical structures of the gingiva surrounding the mandibular third molars. Furthermore, impactions may be a result of lack of space on the dental arches and therefore eruption of the tooth into the oral cavity is delayed or prevented, this may exacerbate the pericoronal infection.

In this study 129 (64.1%) patients suffered from pericoronitis at the left mandibular third molar,72 (35.8%) patients reported pericoronitis at the right mandibular third molar, and 28

(13.9%) patients reported pericoronitis on the left and right mandibular third molars. Hazza'a *et al*. (2009) reported that 51.7% of cases suffered from pericoronitis on the left mandibular third molar and 48.3% of cases suffered from pericoronitis on the right mandibular third molar. However, no study showed correlation between pericoronitis and the side affected. Findings in this study may be related to generalised factors such as the individual's clinical manifestations of anatomy and/or poor oral hygiene status.

In this study the combinations i.e. of Pell and Gregory and Winter's classifications and the prevalence of pericoronitis was most commonly found with the combination of a IA position and vertical angulation respectively (35.8%). These results are in agreement with Indira *et al.* (2013) whose results reflect the same predominant combinations. The results of another study are in partial agreement, with the only difference being that the most common ramus relation in the study being class II (Almendros-Marques *et al*., 2008). The second most common combination recorded in this study was IIB and mesioangular angulation which is in close proximity with the results of Ali *et al*. (2014). It can be suggested that vertically angulated teeth and position IA combination are closely associated with pericoronitis occurrence. In this study it was found that there was a statistically significant association between combination of classifications (angulation and position) and pericoronitis (P> 0.01*).

5.2 Conclusion

From the findings of this study and correlation with the literature, it can thus be said that pericoronitis is an inflammatory condition that may be seen mostly between the ages of 26-35 years, with a higher predilection for females. Pericoronitis occurrence is highly associated with vertically angulated mandibular third molars and/or mostly present in positions of class I/II ramus relation and class A depth. Patients presenting with unfavourable angulations,

positions and patterns of mandibular third molars should be aware of the possibility of developing a pericoronal infection and symptoms thereof. It is therefore advisable to consider some form of assistance or treatment modality. The treatment plan should be one that is individualised. An extraction of the impacted tooth should only be carried out after consulting scientific guidelines/protocols such as the NICE guidelines; which suggest an extraction only after recurrent episodes of pericoronitis. In the case of a non-extraction/non-surgical approach; regular (long-term) clinical and radiographic follow ups should be maintained subsequent to the initial symptomatic management of pericoronitis.

5.3 Future recommendations

A recommendation of similar future studies to be conducted as a prospective study rather than retrospective. This may reduce the limitations of poor clinical record keeping and insufficient details provided by the patient to the clinician. Clinical observation/assessment should be carried out as an adjunct to radiographic assessment. The gingival/mucosal coverage index surrounding an impacted tooth should also be considered to acquire better understanding together with hard tissue classifications. Similar studies accommodating a larger sample size (larger than current study) could assist with determining the possible indications for prophylactic extraction of impacted mandibular third molars. Development of a standardised record keeping practice/protocol regarding pericoronitis could be useful when analysing patients records and files e.g. acute or chronic episode, number of pericoronitis episodes/ recurrences, severity, associated factors and treatment provided etc.

REFERENCES

Akpata, O. (2007). Acute Pericoronitis And The Position Of The Mandibular Third Molar in Nigerians. Journal of Medicine and Biomedical Research, 6(1), 41-46.

Ali, S., Nazir,A., Shah, S.A., Akhtar, M.U. (2014). Dental caries and pericoronitis associated with impacted mandibular third molars- A clinical and radiographic study. Pakistan Oral & Dental Journal, 32(2), 268-273.

Almendros-Marque, N., Alaejos-Algarra, E., Quinteros-Borgarello, M.,Berini-Aytes, L., Gay-Escoda, C. (2008). Factors influencing the prophylactic removal of asymptomatic impacted lower third molars. International Journal of Oral and Maxillofacial Surgery, 34, 29-35.

Almendros-Marques, N.,Berini-Aytes, L., Gay-Escoda, C. (2006). Influence of lower third molar position on the incidence of preoperative complications. Journal of Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontics, 102, 725-732.

Bjork, A. (1956). Mandibular growth and third molar impaction. The Royal Dental College .

Cunha-Cruz, J., Rothen, M., Spiekerman, C., Drangsholt, M., McClellan, L., Huang, G.J. (2014). Recommendations for Third Molar Removal: A Practice-Based Cohort Study. American Journal of Public Health, 104(4) 735-738.

Dhonge, R. P., Zade, R. M., Gopinath, V., Amirisetty, R. (2015). An Insight into Pericoronitis. Int J Dent Med Res, 1(6), 172-175.

Friedman, J. (2007). The Prophylactic Extraction of Third Molars: A Public Health Hazard. American Journal of Public Health, 97(9), 1554-1559.

Hashemipour, M.A., Tahmasbi-Arashlow, M., Fahimi-Hanzaei, F. (2013). Incidence of impacted mandibular and maxillary third molars: a radiographic study in a Southeast Iran population. Med Oral Patol Oral Cir Bucal, 18(1), 140–145.

Hazza'a, A., Bataineh, A., Odat, A. (2009) Angulation of Mandibular Third Molars as a Predictive Factor for Pericoronitis. The journal of Contemporary Dental Practice, 10(3), 51-58.

Indira,A.P., Kumar, M., David, M.P., Rajshekar, V.M. (2013). Correlation of Pericoronitis and the Status of Eruption of Mandibular Third Molar: A Clinicoradiographic Study. Journal of Indian Academy of Oral Medicine and Radiology , 25(2), 112-115.

Kamuda, M.N., Nalini, M.S., Shivaprasad, B.M. (2014). Operculectomy as a conservative approach to third molar extraction. Journal of Health Sciences and Research, 5, 28-31.

Kazemian, M., Zarch, S., Banihashemi, E., Khajavi, M.A., Moradi, E. (2015). Frequency of Impacted Teeth in Patients Referred to a Radiology Center and the Radiology Department of Mashhad School of Dentistry. Bangladesh Journal of Medical Science, 14(2),165-168.

Knutsson, K., Brehmer, B., Lysell, L., Rohli, M. (1996). Pathoses associated with mandibular third molars subjected to removal. Journal of Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontics , 82, 10-17.

Langlais, R., Miller C.S., (2009). Color Atlas of Common Oral Diseases. Philadelphia, Pennsylvania: Lippincott Williams and Wilkins.

Lehohla, P. (2015). Census 2011: Income Dynamics and Poverty Status of Households in South Africa. Stats SA Library Cataloguing-in-Publication (CIP) Data, Report no.: 03-10-10, 66pp.

Mercier, P., Precious, D. (1992). Risks and benefits of removal of impacted third molars. Journal of Oral and Maxilofacial Surgery, 21, 17-27.

Myburgh, N.G., Solanki, G.C., Smith, M.J., Lalloo, R. (2005). Patient Satisfaction with health care providers in South Africa: the influences of race and socioecomonic status. International Journal for Quality in Health Care Advance Access, 10.1093, 1-5.

National Institute for Clinical Excellence: Guidance on the extraction of wisdom teeth. London, UK,National Institute for Clinical Excellence, 2000

Nazir, A., Usman, M., Ali, S. (2014). Assessment of Different Patterns of Impacted Mandibular Third Molars and their Associated Pathologies. J Adv Med Dent Scie, 2(2), 14-22.

Neville, B. W., Damm, D.D., Alen, C.M, Bouquot, J.E. (2010). Oral and Maxillofacial Pathology,4rd edition Philadelphia: Saunders- Elsevier, 171-172.

Punwutikorn, J., Waikakul, A., Ochareon, P. (1999). Symptoms of unerupted mandibular third molars. Oral Surgery Oral Medicine Oral Pathology, 87, 305-310.

Renton, T., Al-Haboubi, M., Pau, A., Shepard, J. (2012). What Has Been the United Kingdom's Experience With Retention of Third Molars?. American Association of Oral and Maxillofacial Surgeons - Journal Oral Maxillofacial Surgery,70, 48-57.

Shahzad, M.A., Marath, M.A., Chatha, R., Sohail, A. (2016). Evaluation of Patterns of Mandibular Third Molar Impactions and Associated Pathologies. Pakistan Oral and Dental Journal, 36(2), 192-196.

Shira, R., Leone, S.A., Edenfield, M.J., Cohen, M.E. (1986). Correlation of acute pericoronitis and the position of the mandibular third molar. Journal of Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontics, 62, 245-250.

StataCorp. 2017. *Stata Statistical Software: Release 15*. College Station, TX: StataCorp LLC.

Steed, M.B. (2014). The indications for third-molar extractions. American Dental Association, 145(6), 570-573.

Van der Linden, W.J., Lownie, J.F., Cleaton-Jones, P.E. (1993). Should impacted third molars be removed? A review of the literature. Journal of the Dental Association of South Africa, 48**,** 235-240.

Yamlik, K., Bozkaya, S. (2008). The predictivity of mandibular third molar position as a risk indicator for percoronitis. Clin Oral Invest, 12, 9-14.

Yilmaz, S., Adisen,M.Z., Misirlioglu,M., Yorubulut, S. (2015). Assessment of Third Molar Impaction Pattern and Associated Clinical Symptoms in a Central Anatolian Turkish Population. Medical Principals and Practice, 25, 169-175.

Young, M. (2016). Private vs. Public Healthcare in South Africa. Honors Theses, 2741, 6-24.

APPENDICES

Appendix I



PLAGIARISM DECLARATION TO BE SIGNED BY ALL HIGHER DEGREE STUDENTS

SENATE PLAGIARISM POLICY: APPENDIX ONE

I _____ VISHAL BHIKHA _____ (Student number: ___ 351127 ___) am a student registered for the degree of _____ MSc-DENT _____ in the academic year 2020

I hereby declare the following:

- I am aware that plagiarism (the use of someone else's work without their permission and/or without acknowledging the original source) is wrong.
- I confirm that the work submitted for assessment for the above degree is my own unaided work except where I have explicitly indicated otherwise.
- I have followed the required conventions in referencing the thoughts and ideas of others.
- I understand that the University of the Witwatersrand may take disciplinary action against me if there is a belief that this is not my own unaided work or that I have failed to acknowledge the source of the ideas or words in my writing.
- I have included as an appendix a report from "Turnitin" (or other approved plagiarism detection) software indicating the level of plagiarism in my research document.

Signature: _____ Date: 1/07/2020

Appendix II

23/03/20

To whom it may concern

I, Dr Maphefo Thekiso, research supervisor of Vishal Bhikha (351127) acknowledge the Turnitin report submitted as part of the research report “The Relation between Pericoronitis and the Positioning of Impacted Mandibular Third Molars”.

Yours sincerely

Dr Maphefo Thekiso

Cell: 082 498 6702

Email: maphefo.thekiso@wits.ac.za

ORIGINALITY REPORT

10%	7%	8%	6%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	www.jamdsr.com Internet Source	2%
2	Almendros-Marques, N.. "Influence of lower third molar position on the incidence of preoperative complications", Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology and Endodontology, 200612 Publication	2%
3	wiredspace.wits.ac.za Internet Source	2%
4	exodontia.info Internet Source	1%
5	Endi Lanza Galvão, Esmeralda Maria da Silveira, Evandro Silveira de Oliveira, Timilly Mayra Martins da Cruz et al. "Association between mandibular third molar position and the occurrence of pericoronitis: A systematic review and meta-analysis", Archives of Oral Biology, 2019 Publication	1%

6	Submitted to University of Warwick Student Paper	1%
7	Submitted to University of the Western Cape Student Paper	1%
8	S.A. Leone, M.J. Edenfield, M.E. Cohen. "Correlation of acute pericoronitis and the position of the mandibular third molar", Oral Surgery, Oral Medicine, Oral Pathology, 1986 Publication	1%
9	Almendros-Marques, N.. "Factors influencing the prophylactic removal of asymptomatic impacted lower third molars", International Journal of Oral & Maxillofacial Surgery, 200801 Publication	1%
10	Submitted to University of Central Lancashire Student Paper	1%

Exclude quotes	On	Exclude matches	< 1%
Exclude bibliography	On		

Appendix III

R14/49 Dr Vishal Bhikha

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M170802

NAME: (Principal Investigator)	Dr Vishal Bhikha
DEPARTMENT:	School of Oral Health Sciences Department of Maxillofacial and Oral Surgery
PROJECT TITLE:	The Relationship between Pericoronitis and the Positioning of Impacted Mandibular Third Molars
DATE CONSIDERED:	25/08/2017
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Dr Mzubanzi Mabongo
APPROVED BY:	Professor P. Cleaton-Jones, Chairperson, HREC (Medical)
DATE OF APPROVAL:	11/10/2017

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

DECLARATION OF INVESTIGATORS

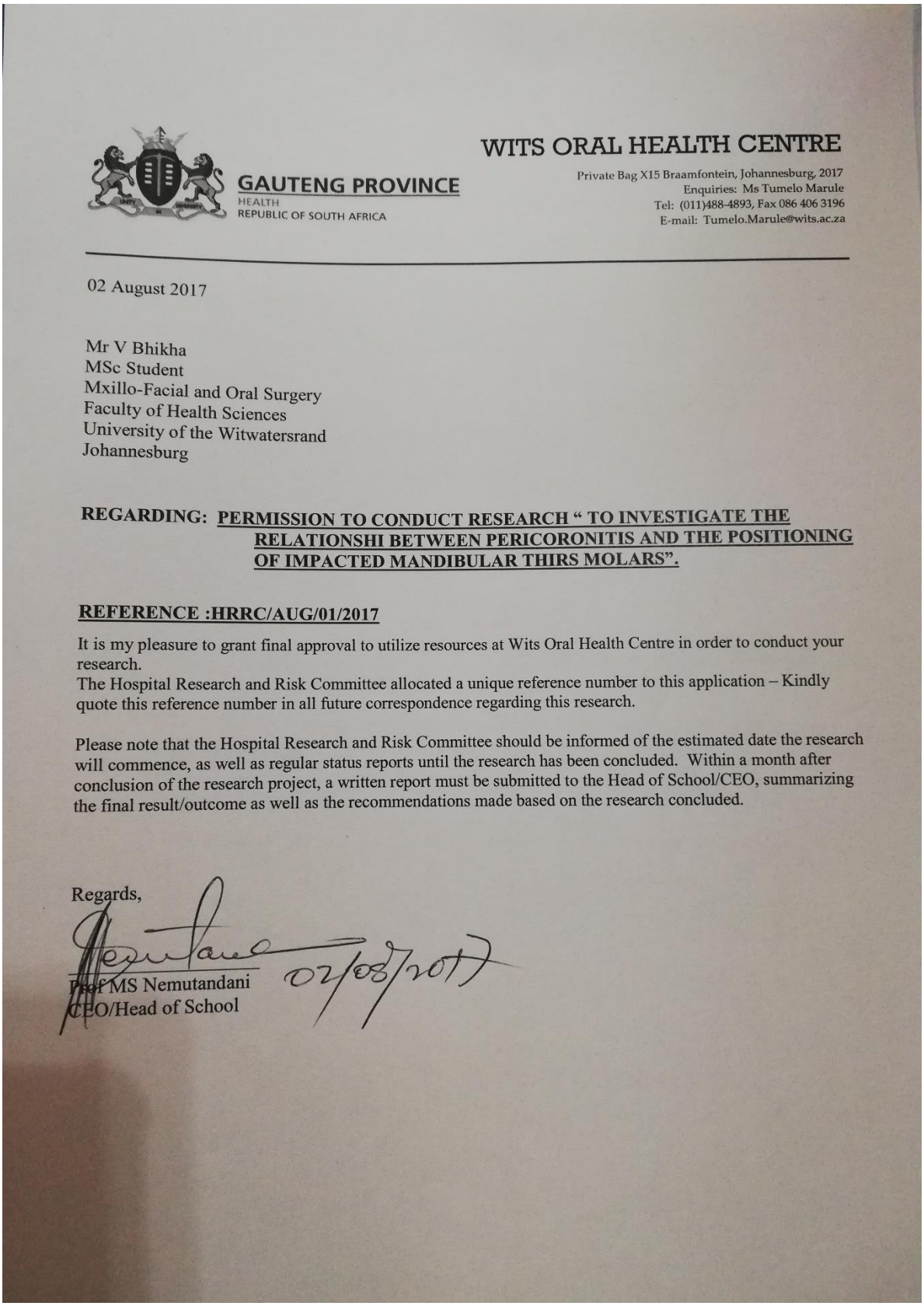
To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary in Room 301, Third Floor, Faculty of Health Sciences, Phillip Tobias Building, 29 Princess of Wales Terrace, Parktown, 2193, University of the Witwatersrand. I/we fully understand the conditions under which I am/we 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. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

Principal Investigator Signature

Date 12/03/2020

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

Appendix IV



GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

WITS ORAL HEALTH CENTRE

Private Bag X15 Braamfontein, Johannesburg, 2017
Enquiries: Ms Tumelo Marule
Tel: (011)488-4893, Fax 086 406 3196
E-mail: Tumelo.Marule@wits.ac.za

02 August 2017

Mr V Bhikha
MSc Student
Mxillo-Facial and Oral Surgery
Faculty of Health Sciences
University of the Witwatersrand
Johannesburg

REGARDING: PERMISSION TO CONDUCT RESEARCH " TO INVESTIGATE THE RELATIONSHI BETWEEN PERICORONITIS AND THE POSITIONING OF IMPACTED MANDIBULAR THIRS MOLARS".

REFERENCE :HRRC/AUG/01/2017

It is my pleasure to grant final approval to utilize resources at Wits Oral Health Centre in order to conduct your research.
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,

02/08/2017

Prof MS Nemutandani
CEO/Head of School

Appendix V

Data collection sheet

Unique no	Age	Gender: Male (1) Female (2)	Socioeconomic status H0 - H3	Tooth number 38(1) 48(2)	Pell n Gregory Classification (1)IA, (2)IB, (3)IC, (4)IIA, (5)IIB, (6)IIC,(7)IIIA, (8)IIIB, (9)IIIC	Winters Classification:(1) Mesioangular, (2) Distoangular, (3) Vertical, (4) Horizontal	Indication for removal Caries to the impacted tooth (1), caries to adjacent tooth(2), pericoronitis(3), periodontal lesion associated with second molar(4)