VARIANT ROOT MORPHOLOGY OF THE THIRD MANDIBULAR MOLAR IN NORMAL AND IMPACTED TEETH

Investigator: Bokindo Isaac Kipyator

V28/1958/2010

BDS III

A research proposal submitted in partial fulfillment of the requirements for the award of the degree of Bachelor of Dental Surgery, University of Nairobi.

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DECLARATION

I Bokindo Isaac Kipyator hereby declare that this research proposal is my original work and has not been presented to any other institution for examination or any other purpose.

Signature

Date
APPROVAL

I, Bokindo Isaac Kipyator, am submitting this research proposal to the Kenyatta National Hospital! University of Nairobi Research Ethics and Standards committee for approval.

Sign ___________________________ Date ___________________________

This research proposal has been submitted with our approval as the University of Nairobi supervisors:

Supervisors

1. Dr. Fawzia Butt, BDS (Nbi), FDSRCS, MDS-OMFS
   Department of Oral and Maxillofacial Surgery
   School of Dental Sciences
   University of Nairobi
   Sign ___________________________ Date ___________________________

2. Prof. Francis G. Macigo, BDS (Nbi), MPH (Nbi), PGD-STI (Nbi)
   Department of Periodontology / Community and Preventive Dentistry,
   School of Dental Sciences.
   University of Nairobi.
   Sign ___________________________ Date ___________________________
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LIST OF ABBREVIATIONS

DA - disto-angular
H - Horizontal
IAN - Inferior alveolar nerve
MA - mesio-angular
OMFS - Oral and Maxillofacial Surgery
SDS- School of Dental Sciences
SPSS - Statistical Package for Social Sciences
UoN - University of Nairobi
V - vertical
SUMMARY
Background: The prevalence of third molar impaction is high across various population.

Extraction of the impacted tooth is usually indicated where there is associated pathology.

Surgical difficulty in extraction is described in various classification, the most commonly used ones are the Winters and Pell and Gregory. The downside to these classification methods is that morphology of the roots is not put into consideration. Root morphology is known to influence the eruption of teeth, therefore it may have a role in impaction of these teeth. The study aims to describe various root morphologies in different types of impactions and establish any association between the morphology of the teeth and type of impaction.

Objective: To describe the various root morphologies in different types of third molar impaction among residents of Nairobi County visiting the School of Dental Sciences. University of Nairobi.

Study design: Descriptive cross-sectional study

Study Population and Study Area: This study will be carried out among patients visiting the School of Dental Sciences, University of Nairobi.

Materials and methods: 359 panoramic radiographs (179 male and 179 female) will be obtained from the Radiology Division of the Oral and Maxillofacial department, School of Dental Sciences, University of Nairobi. The morphology of the roots of the third molar will be described as straight or dilacerated. The number of roots will also be recorded. The crown and root lengths will be measured using a Vernier caliper and the root to crown length ratio will be calculated.

Data management: Measurements will be coded, tabulated and analyzed using SPSS 17 (version 20.0 Chicago Illinois). Means, standard deviations and variances will be calculated. A P-value of ~0.05 will be considered significant at a confidence interval of 95%. Data will be
presented in form of graphs, pie-charts and tables. Photographs will be used for pictorial representation.

**Study benefits:** The root morphology is useful for a surgeon operating on and around the third molar region to plan well and in extension enrich the current methods utilized in grading the surgical difficulty in extraction of the third molar in which the root component has not been regarded.
CHAPTER 1: INTRODUCTION AND LITERATURE REVIEW

1.1 INTRODUCTION

The mandibular third molars are the most frequently impacted teeth in the human dentition accounting for 98% of all impacted teeth. The incidence of impaction of the third molar has been reported to vary between 8-84% in various studies. There is higher prevalence in females as compared to males. Various theories have been put forward to explain the cause of impaction. The main factor has been lack of space in the jaw. Others include late eruption of the tooth and the size of the third molar.

The level of difficulty in extracting impacted third molar has been described in the Pell and Gregory and the Winter's classification. Various aspects such as level of eruption, position of the tooth in relation to the ramus of the mandible and the angulation of the tooth have been considered. Despite the useful parameters used, root morphology of the tooth is not put into consideration in assessing difficulty in these classification methods. The third molar shows the greatest variation in the root morphology. The variation in morphology accounts for the complications that occur during disimpaction, most common being laceration of the inferior alveolar nerve.

Majority of the third molars (60-70%) studied have two roots. The variations documented on the mandibular third molar include presence of three roots, fused roots, one root. Most studies on the morphologic variants of the third molar have focused on the number of roots. Literature describing the shape of the root of third molars is scarce despite its importance in third molar disimpaction. The shape of the root may be influenced by the nature of impaction since developmentally, growth of tissue has been shown to be determined by the surrounding structures as described in the functional matrix theory proposed by Moss, (1962). Following
this theory, it is expected that the nature of the third molar impaction will have a considerable
effect on the shape of the morphology of the third molar. Knowledge on the root morphology
will help the surgeon to evaluate the difficulty of the operation and anticipate the complications
that may occur. The study therefore aims to describe the various root morphologies occurring in
different types of impaction.
1.2 LITERATURE REVIEW
The third mandibular molar is the most frequently impacted tooth in the human dentition.

Various types of impaction have been observed and documented and classified. The role of the root morphology of the third mandibular molar in impaction is yet to be established.

1.2.1 Types of third molar impaction
The most commonly used classification to assess the difficulty of extracting impacted mandibular molars are the Winter's\textsuperscript{5} and the Pell and Gregory\textsuperscript{14}. Winter’s classification is based on the long axis of the impacted tooth in relation to the long axis of the second molar and as such, the types of impaction in this category include mesial angular, horizontal, bony vertical and distal angular impactions. The Pell and Gregory classification is based on the vertical relation of the third molar to the second molar as well as the relationship of the tooth to the anterior border of the ramus of the mandible.

The Pell-Gregory classification

i) Based on vertical relation of the third molar to the second molar
A- The occlusal plane of the impacted tooth is at the same level as the occlusal plane of the second molar.
B- The occlusal plane of the impacted tooth is between the occlusal plane and the cervical line of the second molar.
C- The impacted tooth is below the cervical line of the second molar.

ii) Based on the relationship with the anterior border of ramus of the mandible
1- There is sufficient space between the ramus and the distal part of the second molar for the accommodation of the mesiodistal diameter of the third molar.
2- The space between the second molar and the ramus of the mandible is less than the mesiodistal diameter of the third molar.
3- All or most of the third molar is in the ramus of the mandible.
The above classifications have been shown not to be a reliable indicator of surgical difficulty in extraction of impacted lower molars with variable intraexaminer and interexaminer agreement. Garcia et al., (2000) obtained low sensitivity test on the Pell and Gregory classification and this can be attributed to the variant root morphology of these teeth in terms the length and the shape or the roots.

1.2.2 Factors involved in third molar impaction
Several theories have been put forward to describe causes of third molar impaction. The most popular has been insufficient development of retromolar space and this may also be related to imbalance in the pattern of bone remodeling at the mandibular ramus. Growth of the condyle occurs in a vertical direction and has been shown to limit resorption at the anterior aspect of the ramus of the mandible. Unfavourable path of eruption has also been implicated in impaction for instance if the tooth bud is in an abnormal position during development and eruption, the tooth ends up impacted. Emes et al., (2011) described the evolutionary decrease in the size of the jaw disproportionately with teeth and this may been due to the change in diet from the hard unprocessed foods to the soft processed ones. The relatively small jaw is more susceptible to impactions. General factors such as genetics, race, gender and environmental factors including dietary habits also play a role in impaction. Third molar impaction have been associated with anterior teeth crowding therefore features of the latter seen in a young patient has been an indicator of third molar impaction.

1.2.3 Root morphology
Literature has focused on the pattern of impaction of the third molar with little mention of the role the roots of the third molar play in the management of the condition. Carvalho and Vasconcelos, (2011) put forward that the number of root (P<0.004) and the morphology (P<0.031) were significant predictors of surgical difficulty. The main parameters in root morphology are dilaceration and length. Dilaceration is a developmental disturbance in the shape
of teeth whereby there is a sharp bend or curvature in the root of a formed tooth. A curvature of greater than 10° poses a greater risk than lower values. Yamaoka et al.,(2009) found the relation between the root angulation and impaction whereby impacted tooth had a higher incidence of angulated roots°. The reported prevalence of dilaceration of the roots are very high at 81 %30. There is little literature on the length of the roots of the third molar which may influence its closeness to the mandibular canal and thus the risk of injuring the inferior alveolar nerve (IAN) during extraction. Crown to root length ratios have been shown to show the development of roots. Unfavorable ratios have been found in females31 and this may explain the higher prevalence of impacted teeth among women. Some authors have recommended coronectomy of impacted wisdom teeth in case the roots are surrounding the mandibular canal32. The morphology of the roots has been shown to influence autotransplantation of the third molar34 in that the morphology of the root may not favor successful transfer of the third molar into the socket of another missing molar.

Park et al.,(2013) assessed the number of roots of third mandibular molars in a Korean population whereby there was high prevalence of two rooted teeth (56.9%) and one rooted (37.9%). Three rooted teeth were seen in only 1.9%. Higher prevalence of two rooted teeth was also observed in the Iran population at 73%. Panoramic radiography is the standard imaging technique for evaluating third molars. The sensitivity of these radiographs have been reported to be fair but the specificity of the radiographs is quite high36.

The study therefore aims to describe the various root morphologies occurring in different types of impaction which will help in surgical approach to this region.
Chapter 2: PROBLEM STATEMENT AND JUSTIFICATION

2.1 Problem statement

The morphology of the roots of the third molar has been shown to influence the clinical decision pertaining the management of impacted third molars. There is high variability in the size and shape and number of the roots of the third molar more than any other teeth in human dentition. Iatrogenic damage to the IAN is the main complication arising from third molar disimpaction and it is highly related to the closeness of the tooth and its form. Current classifications have not put into consideration the impact of root morphology in grading the difficulty in surgical extraction.

2.2 Justification

Although there is overwhelming data on the prevalence of third molar impaction in various populations including the Kenyan, there is little literature that focusses in the role played by root morphology in assessing surgical difficulty in third molar disimpaction. The present study will aim to investigate the root forms in various types of impactions. Data obtained will enable surgeons have more informed decision during third molar disimpaction.

2.3 Objectives

2.3.1 Broad objective

To describe root morphologies in various types of impaction of the third molar in a Kenyan population.

2.3.2 Specific objectives.

2. To classify various impacted third molar teeth radiographically

3. To describe the number and the shape of the roots in each of the class of impaction

4. To obtain the ratio of crown to root length of the impacted third molar
4. To establish the relationship between the morphology of root and the type of impaction

2.4 Hypothesis

Alternative hypothesis

Angulated roots increases the risk of occurrence of impacted teeth.

2.4 Study variables

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<td>Independent Variables</td>
<td>Root morphology</td>
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<td>Dependent Variables</td>
<td>Type of third molar impaction</td>
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Chapter 3: MATERIALS AND METHODS

3.1 Study area
The study is to be carried out at the Radiology division of the Oral and Maxillofacial (OMFS) Department, School of Dental Sciences (SDS), University of Nairobi (UoN). The SDS is located 5 kilometers from the Central Business District of Nairobi City along valley road.

3.2 Study Population
The population will comprise of patients who have come to seek dental treatment in the SDS.

3.3 Study Design
A descriptive cross-sectional study on the root morphology of the impacted third molar

3.4 Sample size
Sample size will be computed using the following formula

\[
 n = \frac{Z^2p(1-p)}{\epsilon^2}
\]

Where,

\( Z \) = z value according to the confidence level chosen

\( P \) = prevalence of impacted teeth recorded at SDS (62.8\%\mn37)

\( \epsilon \) = 1- confidence interval

Using a confidence level of 95\% and a Z value of 1.96

\[
 n = \frac{(1.96)^2 \times 0.628(1 - 0.628)}{(1 - 0.95)^2}
\]

\( n \approx 359.98 \approx 359 \) radiographs

3.5 Sampling methods
Probability sampling will be employed whereby simple random sampling will be utilized.

Panoramic radiographs of patients taken from year 2010 until current date of study at the radiology division will be assessed. Those that will have met the selection criteria will be listed from
the oldest to the newest in terms of the date taken starting from number one. A fare coin will be tossed, with the heads meaning the even numbers selected and the tail, odd numbers.

3.6 Inclusion and exclusion criteria

3.6.1 Inclusion criteria

1) Radiographs from patients 30 years or older

2) Presence of the 3 molars in either quadrant

3.6.2 Exclusion criteria

1) Radiographs lacking good contrast

2) Presence of pathologies such as tumors and cysts

3.7 Data collection instruments and techniques
Radiographs will be retrieved from the computer's archives by the radiology assistant. The main researcher will examine the radiographs selecting those that have met the requirements. The type of impaction will be classified using the Pell and Gregory classification as Al,A2,A3,B1,B2,B3,C1,C2,C3 and also using the Winter's method as mesio-angular (MA), horizontal (H), vertical (V) and disto-angular (OA) The morphology of the roots will also be studied under each classification and categorized as either straight or dilacerated, with the number of roots recorded in each. The lengths of the longest root and crown will be measured using a Vernier caliper in millimetres

3.8 Data analysis and presentation
The ratio of the crown to the root height will also be calculated. The results will be coded and tabulated and analyzed using SPSS v17 (SPSS, Inc. Chicago, IL, USA). Student's t-test will be performed to test the relationship between root morphology and type of impaction. A p value of
<0.05 will be considered significant at a confidence interval of 95%. Photographs, tables and charts will be used for data presentation.

3.9 Ethical Consideration
Ethical approval will be sought from the Kenyatta National Hospital-University of Nairobi-Ethics and Standards Committee before the commencement of the study. Permission and requisite authority will be obtained from the administration of the Radiology Division of OMFS department, SDS, VoN. Information regarding the subjects will be held with maximum confidentiality and will not be disclosed to any unauthorized persons. Case numbers and not names will be used throughout the study. At the end of the study, data sheets will be shredded.

3.10 Study benefits
The study will be useful to surgeons operating on the third molar. Morphology of the roots of the third molars will enable proper planning and to anticipate difficulties. The research proposal and report will be presented in partial fulfillment of the requirements for the award of the degree of Bachelor of Dental Surgery in the University of Nairobi.
## BUDGET

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<td>Data analysis and writing of dissertation</td>
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<td>November</td>
<td>Presentation</td>
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REFERENCES


15. Winter, GB. Impacted Mandibular Third Molar. St Louis, American Medical Book Co. 1926.


DATA SHEET

Radiograph no ..........................................................

CrICK WHERE APPROPRIATE)

| Pell and Gregory (A I) (A2) (A3) (8 I) (82) (83) (C I) (C2) (C3) |
| Winters (MA) (H) (V) (DA) |
| Straight ( ) d i lacerated ( ) |
| No of roots (I) (2) (3) |
| Root length (R) ..... |
| Crown length (C) ...... |
| C/R ratio ........ |
Bokindo Isaac Kipyator  
V28/1958/2010  
School of Dental Sciences  
University of Nairobi

Dear Isaac

Research Proposal - clearance - Variant Root morphology of the third mandibular molar in normal and impacted teeth (UP523/07/2014)

Your above proposal refers.

This is to inform you that permission has been granted by the KNH/UON-Ethics & Research Committee to carry out research on study titled - Variant Root morphology of the third mandibular molar in normal and impacted teeth.

By a copy of this letter, I am requesting the relevant persons to accord you the professional support and other materials that may be useful to your research.

Yours faithfully,

P.M.L. CHINDIA  
SECRETARY, KNH/UON-ERC

c.c. The Principal, College of Health Sciences, UON
The Deputy Director CS, KNH
The Chairperson, KNH/Uon-ERC
AD, Health Information, KNH
The Dean, School of Dental Sciences, UoN
Supervisors: Dr. Fawzia Butt, Prof. Francis G. Macigo