PREVALANCE OF IMPACTED THIRD MOLAR TEETH IN THE GREATER DURBAN METROPOLITAN POPULATION

by

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CLINICAL ANATOMY

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To my parents, Roopanand and Lenisha Ishwarkumar,

sister, Yashmika and best friend, Prenesen

ABSTRACT

Tooth impaction is a pathological condition in which a tooth is completely or partially unerupted and positioned against another tooth, bone or soft tissue, thus preventing further eruption. Many theories have been proposed to explain the prevalence of impacted third molars. These theories discuss relationship of jaw size to tooth size which is suggested to result from difference in genetics and dietary habits, as the latter differs from one region to another. The aim of this study is to investigate the prevalence of an impacted third molar tooth on a mixed population in the Greater Durban Metropolitan area.

The third molar was classified using Winter's and Pell and Gregory's classification schemes. Various morphometric parameters of the mandible were measured and assessed in 320 digital panoramic radiographs (n=640). Each parameter recorded was statistically analyzed, using SPSS, to determine if a relationship existed between the aforementioned parameters and sex and age of each individual.

77.9% of cases presented with at least one impacted third molar, with the most prevalent type of impaction being mesio-angulation in the mandible and vertical angulation in the maxilla. In respect to the level of impaction, class IIB and class A was most frequent in the mandible and maxilla, respectively. For correlation with sex, only the length of the mandibular ramus was statistically significant (p-value=0.000). No statistically significant relationship was found between each morphometric parameter and age. However, these results correlated with previous studies indicating that impacted third molars are most prevalent in individuals between 20-25 years. In addition, all morphometric parameters in this study differed from that recorded in previous studies conducted in the Northern Hemisphere.

The findings of this study may assist maxillofacial surgeons, dentists, anatomists, anthropologist and forensic investigators.

KEYWORDS: Third molar, impaction, prevalence, radiology, mandibular, maxillary

SUPPORTING SERVICES

In this study, the digital panoramic radiographs was obtained from Public (King Dinuzulu Hospital Complex) and Private (Dr. Nankoo; Dr. Haffejee; Dr. Padayachee; Dr. Maistry) Dental Health Care Facilities in the Greater Durban Metropolitan region.

PREFACE

This study presents original work by the author and has not been submitted in any other form to another university. Where use was made of the work published by others, it has been duly acknowledged in the text.

The research described in this dissertation was supervised by Prof. M.R. Haffajee, Ms. P. Pillay and Prof. K.S. Satyapal of the Department of Clinical Anatomy, School of Laboratory Medicine and Medical Science, Westville Campus, University of Kwa-Zulu Natal. This study was conducted in the Public (King Dinuzulu Hospital Complex) and Private (Dr. Nankoo; Dr. Haffejee; Dr. Padayachee; Dr. Maistry) Dental Facilities in the Greater Durban Metropolitan region.

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S.Ishwarkumar	Date

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ABBREVIATIONS

A – Anterior

I – Inferior

L – Lateral

M – Medial

P - Posterior

S – Superior

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CHAPTER ONE

INTRODUCTION

Tooth impaction is a pathological condition in which a tooth is completely or partially unerupted and positioned against another tooth, bone or soft tissue, thus preventing further eruption (Ramamurthy *et al.,* 2012; Hashemipour *et al.,* 2013). Consequently, the tooth cannot or will not erupt into its normal functioning position (Ramamurthy *et al.,* 2012; Hashemipour *et al.,* 2013). The third molars, which are commonly called wisdom teeth, are the only teeth to erupt during adolescence or even adulthood, which is often, referred to by some as the age of "wisdom", hence the name wisdom teeth. (Ramamurthy *et al.,*2012). However, there is variation that exists in the age of eruption, with a general eruption between the ages of 18 – 24 years (Esposito and Coulthard, 2006). Several methods have been used to classify the impaction which is based on factors such as i) level of impaction, ii) angulations of the third molar and iii) the relationship to the anterior border of the ramus of the mandible (Hashemipour *et al.,*2013).

The mandibular third molars are the most frequently impacted teeth in humans followed by the maxillary third molars, maxillary canines and mandibular canines (Omar, 2008). The factors causing the third molar impaction include crowding, ectopic position of the tooth germs, supernumerary teeth, genetic factors and soft tissue or bony lesions (Omar, 2008; Syed *et al.,* 2013). Upon comparison with the primitive races, modern man appears to present with a higher prevalence of third molar impaction (Tsabedze, 2012). Many theories have been proposed to explain the prevalence of the impacted mandibular third molar, and the majority discuss the relationship of jaw size to the tooth size which is suggested to result from the regional differences in dietary habits (Syed *et al.,* 2013). Standring *et al.* (2009) stated that there is disproportion between the size of the teeth and the size of the jaw resulting in insufficient space for all the teeth to erupt. Since the third mandibular molar teeth are the last to erupt, they are often impeded in their eruption and either become impacted or remain unerupted within the jaw bone. The findings of the study conducted by Ramamurthy *et al.*

(2012) concurred with that of Standring *et al.* (2009) and confirmed the frequency of an impacted third molar tooth.

According to Hashemipour *et al.* (2013), the prevalence of the third molar impaction ranges from 16.7% to 68.6% and with no sexual predilection being recorded (Brown *et al*., 1982 and Kaya *et al*., 2010). However, the studies conducted by Hugoson *et al.* (1988) and Quek *et al*. (2003) recorded a higher frequency of third molar impaction in females. Hellman (1988) stated that there are differences in the growth rate of males and females with an average age of eruption in males of approximately 3 to 6 months ahead of females, hence the higher frequency of impaction noted in females.

In a study carried out in Kenya in 1992, Mwaniki and Guthua recorded the prevalence of the impacted mandibular third molar teeth to be very low at $\frac{15.8}{1000}$ (1.6%). A similar study conducted in a Nigerian population recorded the prevalence of the impacted mandibular third molar teeth as 1.9% and 15.1% in the rural and urban populations respectively (Obiechina *et al*., 2001). Tsabedze (2012), conducted a study in a South African population in Limpopo, in which he recorded the prevalence of impacted mandibular third molars to be $\frac{206}{1215}$ (17.0%).

Impacted teeth are often associated with pericoronitis, incisor crowding, resorption of the adjacent tooth roots and temporo-mandibular joint dysfunction (Ramamurthy *et al.,* 2012; Hashemipour *et al*., 2013). This study may assist orthodontists and maxillofacial surgeons in treatment planning of surgical procedures, viz. the early prediction, evaluation and possible treatment of impacted third molar teeth, as well as in future prevention of impaction with the use of gene therapy (Ramamurthy *et al.,* 2012). Furthermore, the development of the third molar is used as a tool by many forensic dentists to assign age to young adults who have been victims of violent crimes, fires, motor vehicle and airplane accidents (Pretty and Sweet, 2001).

There is only a single study available on the prevalence of impacted third molar teeth in South Africa (Tsabedze, 2012). It is important to determine the prevalence of the impacted third molar teeth in other regions of South Africa to verify whether the previously determined prevalence can be generalised or whether it varies by region or population.

Therefore, this study will investigate the prevalence of an impacted third molar tooth for the population served by the Public and Private Health Dental Facilities that serves the greater Durban Metropolitan area.

This study aims to:

1. Investigate the prevalence of impacted third molar teeth from the population served by the Public and Private Health Dental Facilities in the Greater Durban Metropolitan region

The objectives are to:

1. Evaluate the level at which the impaction occurs using Pell and Gregory's Classification scheme
2. Radiographically evaluate the angulation of impaction
3. Determine the sex and age distribution of the impacted third molar
4. Use Winter's classification scheme to describe the impacted third molar
5. Determine the most common type of third molar impaction among the different sex groups
6. Determine if a relationship exists between the prevalence of impacted wisdom teeth and jaw morphometry.

CHAPTER TWO

LITERATURE REVIEW

2.1. HISTORICAL BACKGROUND

2.1. Evolution of teeth

A number of evolutionary theories regarding the evolution of teeth are being re-examined due to emerging genetic discoveries (Anthony *et al*., 2003). The most commonly and accepted explanation of tooth evolution contends that the molars evolved when humanity's ancestors roamed the earth on four legs approximately 100 million ago (Anthony *et al*., 2003). Some jawless fish developed superficial, dermal structures called odontodes (Koussoulakou *et al*., 2009) (Figure 1). These small tooth-like structures were found outside the mouth and were utilized for protection, sensation and hydrodynamic advantages (Koussoulakou *et al*., 2009). In several cases, the teeth evolved from scale-like epidermal structures, the odontodes, which "migrated" into the mouth after sufficient maturation. This can be seen in modern sharks, which have placoid scales on the skin that grade into the teeth on the jaws. Natural selection favoured teeth-bearing organisms that have major advantages in their ability to catch and process food (Koussoulakou *et al*., 2009).

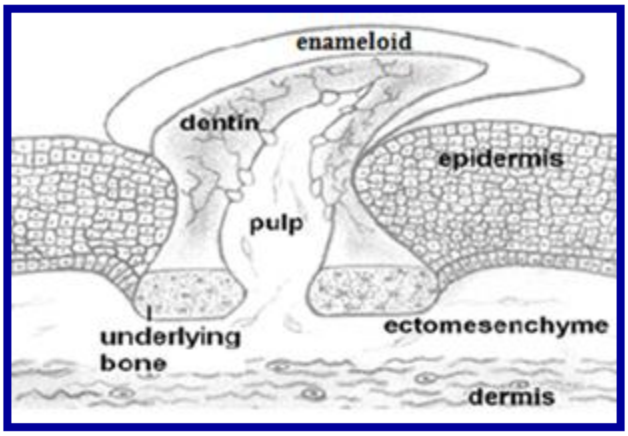


Figure 1: Odontodes, the ancestors of teeth (Adapted from Koussoulakou et al., 2009)

Quadruped ancestors faced their environment with their heads and had limited use of their fore limbs other than for movement. The position of the heads and spinal column rotated backwards, hence placing the jaw and teeth in the front of the body, which is in the optimal position for use (Anthony *et al*., 2003). Teeth served many purposes including, protection, catching and killing, and mastication. Therefore, the evolution favoured the development of larger third molars with pronounced chewing surfaces, which served as an advantage in their survival (Anthony *et al*., 2003).

A few million years ago when Hominids adopted the bipedal stance, the dependency of teeth for survival reduced drastically (Figure 2). The upper limbs greatly assisted in survival as they were utilized for hunting, defence and harvesting of food which was previously performed by teeth (Anthony *et al*., 2003). As the central nervous system developed over the last million years or so, it lead to the creation of defensive hand held tools, which further reduced the use of teeth as survival tools (Koussoulakou *et al*., 2009). The discovery of fire and cooking lead to food becoming softer thus ensuring the survival of humanity, even if they possessed no teeth at all (Anthony *et al*., 2003).

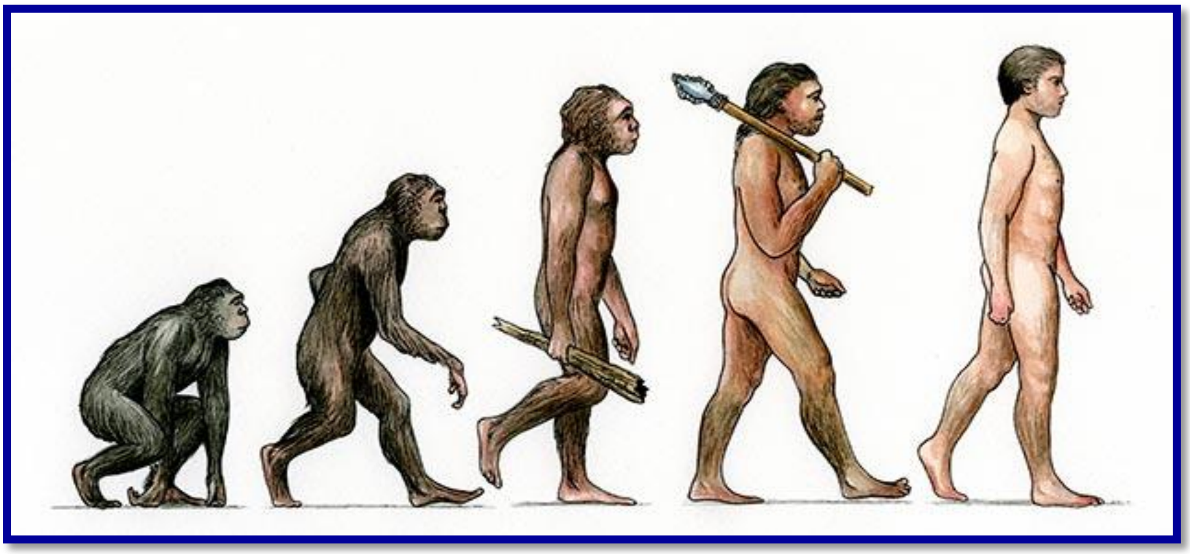


Figure 2: Evolution to erect homo-sapiens (Adapted from http://thesocietypages.org/ socimages/files/2012/08/26.jpg)

Due to these dramatic biological and cultural evolutionary changes over time, mankind has slowly reduced its dependency on all tooth types, particularly that of the third molar (Anthony *et al*., 2003). Hence, the increase in the frequency of the impacted third molar in modern man may be related to the decreasing size of the jaw that has occurred in man over time (Anthony *et al*., 2003).

2.2 GROSS ANATOMY

2.2.1. Oral Cavity

The oral region includes the oral cavity, teeth, gingivae, tongue, palate and a region of the palatine tonsils (Figure 3). The oral cavity is the region in which food is ingested and prepared for digestion (Moore *et al*., 2010).

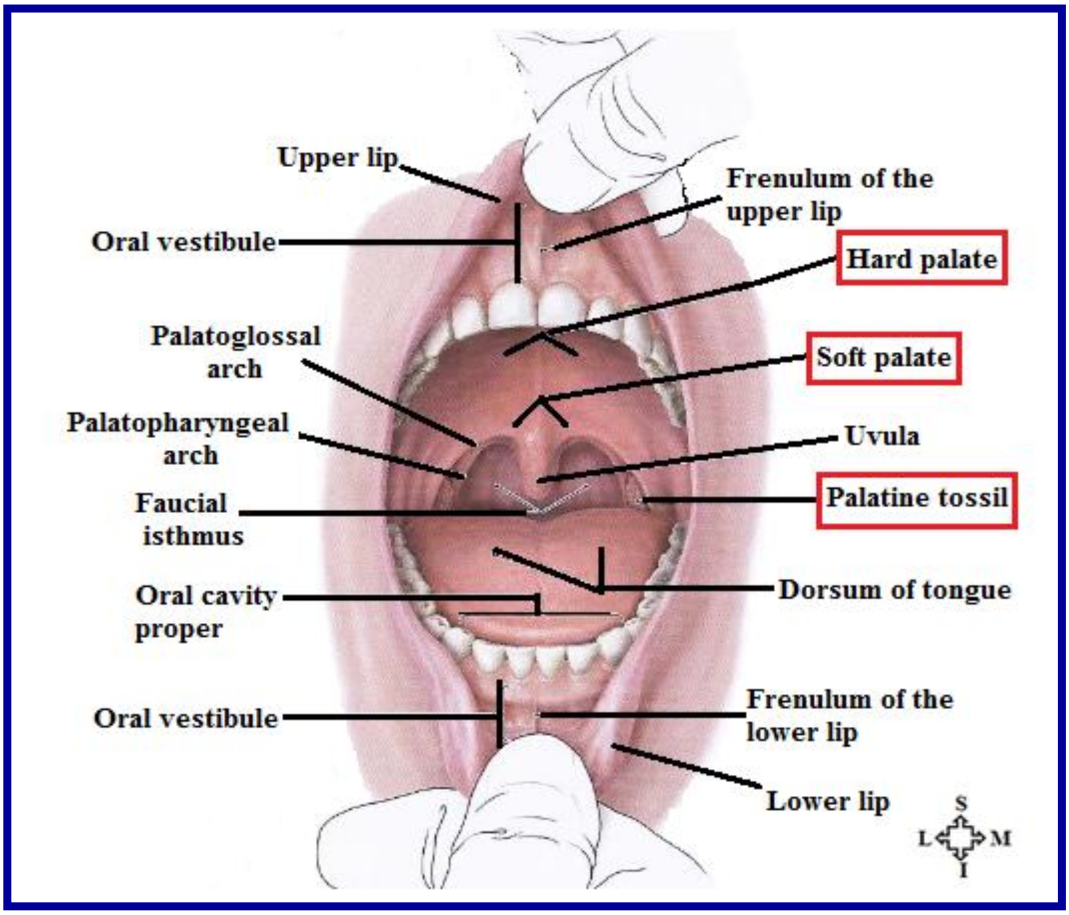


Figure 3: Different parts of the oral cavity (Adapted from Scheunke et al., 2007)

The oral cavity consists of a vestibule, external to the teeth and the oral cavity proper, internal to the teeth. The oral cavity is limited by a roof and floor, the roof is formed by the palate, while the floor is formed by the mylohyoid muscles and is occupied mainly by the tongue (Standring *et al*., 2009) (Figure 4).

The oral vestibule is the slit-like space between the teeth, gingivae, lips and cheeks, while the oral cavity proper is the space between the upper and the lower dental arches (Figure 4). The vestibule communicates with the exterior through the oral fissure. The oral cavity proper appears to be limited by the dental arches antero-laterally (Moore *et al*., 2010)

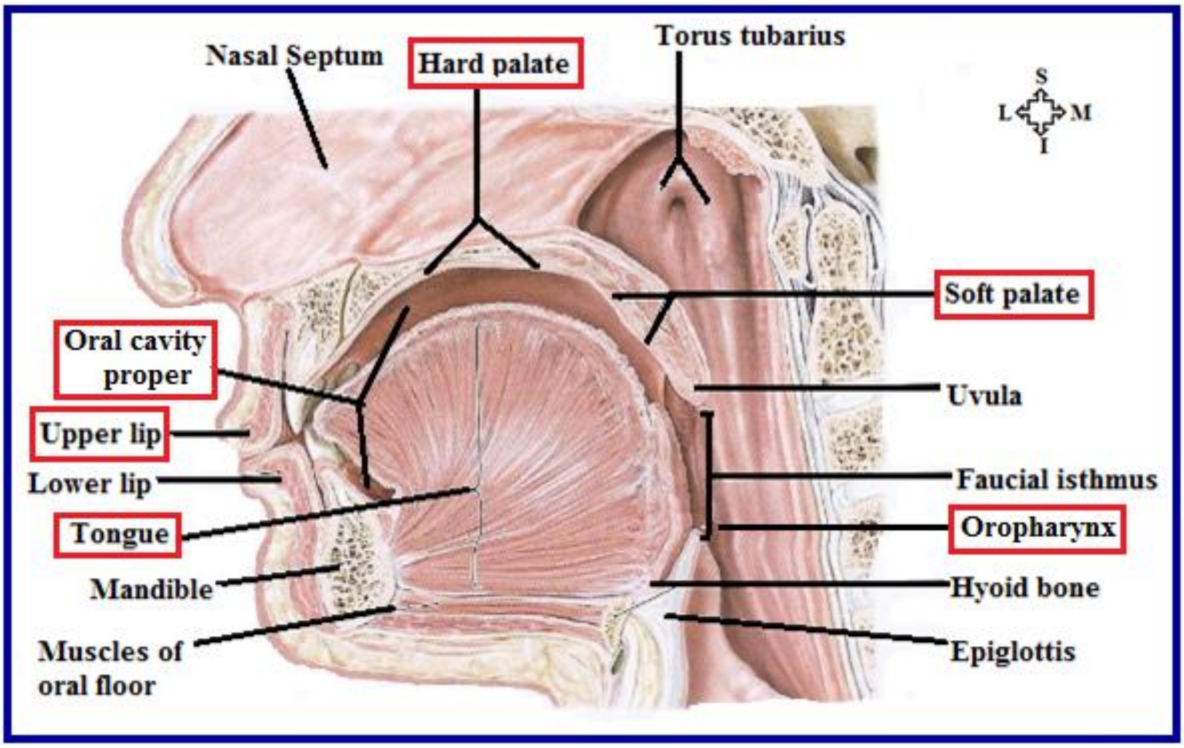


Figure 4: Sagittal section of the oral cavity (Adapted from Schuenke et al., 2007)

The lower part of the face is formed by the alveolar arch of the maxillae and the upper dentition, and the body of the mandible, the alveolar process of the mandible and the lower dentition (Standring *et al*., 2009) (Figure 5).

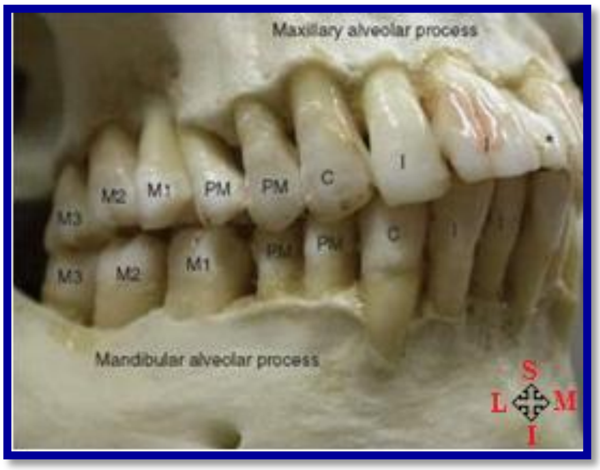


Figure 5: Right antero-lateral view of the jaw (Adapted from Moore et al., 2010)

The teeth are set in the tooth sockets and are used in mastication, and in assisting in articulation. The tooth sockets are in the alveolar processes of the maxillae and mandible and the skeletal features of the tooth sockets display the greatest change during a lifetime (Moore *et al*., 2010). The adjacent sockets are separated by inter-alveolar septa within the socket and the roots of teeth are separated by inter-radicular septa (Moore *et al*., 2010) (Figure 6).

The bone of the socket has a thin cortex separated from the adjacent labial and lingual cortices by a variable amount of trabeculated bone. The labial wall of the socket is particularly thin over the incisor teeth and the reverse is true for the molars, where the lingual wall is thinner (Moore *et al*., 2010). The roots of the teeth are connected to the bone of the alveolus by a springy suspension forming a special type of fibrous joint called a dento-alveolar syndesmosis (Moore *et al.,* 2010). The periodontal membrane is composed of collagenous fibres that extend between the cement of the root and the periosteum of the alveolus (Moore *et al.*, 2010).

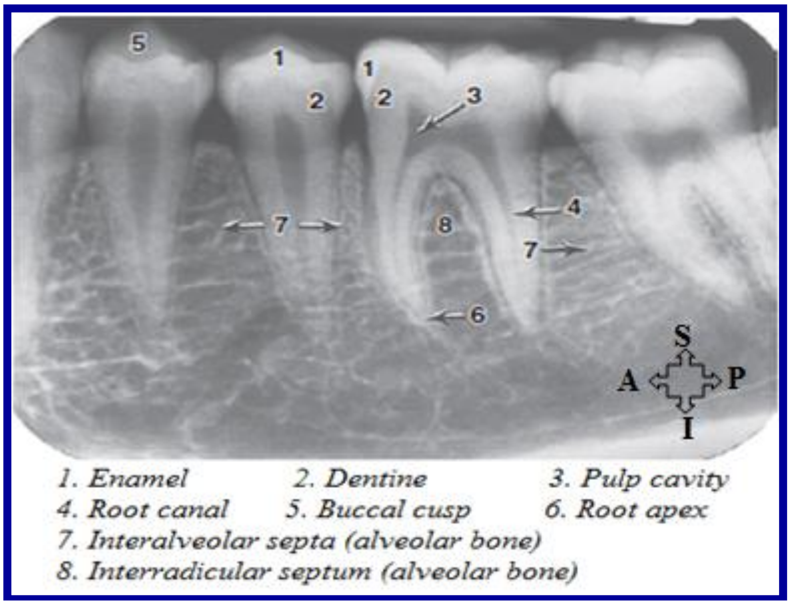


Figure 6: Lateral radiograph showing the different parts of teeth (Adapted from Moore et al., 2010)

2.3. DEVELOPMENT

Teeth are derived by the budding of the epithelium lining in the mouth. The buds of ectoderm produce only the enamel and they evoke a reaction in the surrounding ectomesenchyme which differentiates to produce the dentine, tooth pulp, cementum and periodontal ligaments (Figure 7). This occurs under the influence of the neural crest cells (Sinnatamby, 2006).

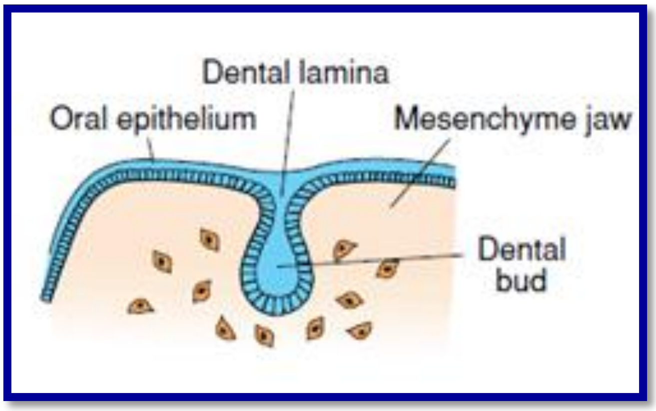


Figure 7:Budding stage at 8 weeks (Adapted from Sadler, 2010)

The pharyngeal arches are heavily infiltrated with neural crest cells. In the first arch (maxillary and mandibular), the neural crest cells have profound influence on the development of the dental lamina and other dental structures (Allan and Kramer, 2002). At a very early stage (approximately 4 weeks) in the development of the face, it is possible to identify the adjacent surfaces of the maxilla and mandibular prominences, as a thickening of stomodeal ectoderm, which covers these prominences. This is known as the primary epithelial bands (Allan and Kramer, 2002). On the lateral side of the primary epithelial band a further thickening in the epithelium develops. This deepens and gives rise to the labio-gingival sulcus. The cheeks eventually separate from the outer gingival surface to form the vestibule of the mouth (Allan and Kramer, 2002). The maxillary and mandibular prominences extend to the ventral mid-line and fuse there, forming the arches (Allan and Kramer, 2002).

At 5 weeks, a curved sheet of ectoderm grows downwards into the adjacent mesoderm, tilting medially to form the primary dental lamina (Sinnatamby, 2006). In the 6th week of embryonic development, the solid ectodermal dental buds arise from the deep surface of each dental lamina and project into the underlying mesoderm. These form the rudimentary enamel organs of the deciduous teeth. Later on, the deep surfaces of these buds invaginate resulting in the cap stage of tooth development (Figure 8). The cap stage consists of an outer layer, the outer dental epithelium, an inner layer, the inner dental epithelium (Figure 8) and a central core of loosely woven tissue, called the stellate reticulum. The mesenchyme, which originates in the neural crest cells in the indentation, forms the dental papilla (Sadler, 2010).

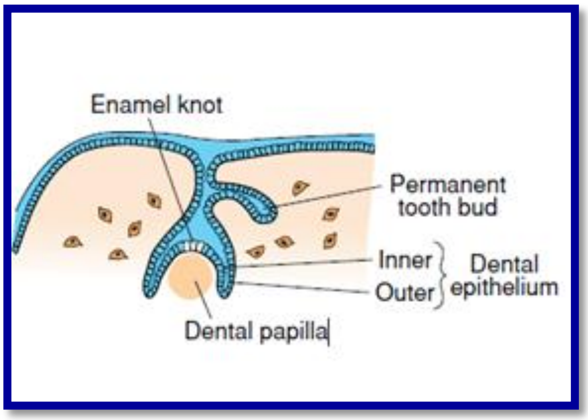


Figure 8: Cap Stage at 10 weeks (Adapted from Sadler, 2010)

As the dental cap grows and the indentation deepens, the tooth takes on the appearance of a bell (bell stage) (Figure 9) (Allan and Kramer, 2002 and Sadler, 2010). The mesenchyme cells of the papilla, adjacent to the inner dental layer, differentiate into odontoblasts which, later produces dentine. The dentine layer thickens and the odontoblasts retreat into the dental papilla leaving behind a thin cytoplasmic process in the dentine. The odontoblast layer persists throughout the life of the tooth and continuously provides pre-dentine. The remaining cells of the dental papilla form the pulp of the tooth (Sadler, 2010). Simultaneously, the epithelial cells of the inner dental epithelium differentiate into ameloblasts which deposits organic matrix and mineral crystals of enamel into the underlying dentine (Dixit, 2004). A cluster of these cells within the inner dental epithelium forms the enamel knot that is responsible for the regulation of early tooth development (Sadler, 2010).

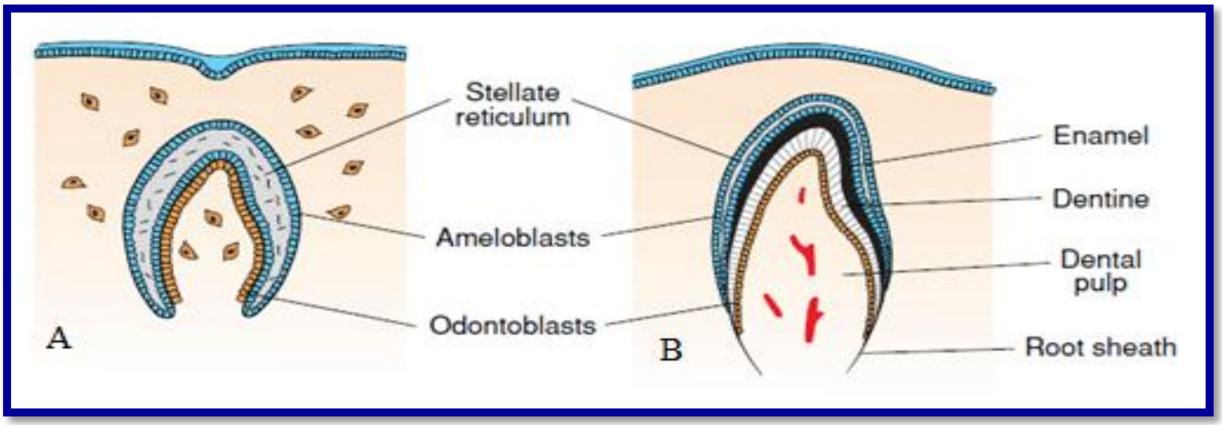


Figure 9: Bell stage at 3 months (A) and 6 months (B) (Adapted from Sadler, 2010)

The enamel is first laid down at the apex of the tooth and from there spreads towards the neck. As the enamel thickens, the ameloblasts retreat towards the stellate reticulum. The cells regress and the dental cuticle gradually sloughs off following the eruption of the tooth (Sadler, 2010).

The formation of the root of the tooth begins when the dental epithelial layer penetrates in the underlying mesenchyme. Consequently, the epithelial root sheath cells of the dental papilla are formed by continuously lying down a layer of dentine with the crown (Dixit, 2004; Sadler, 2010). As more and more dentine is deposited, the pulp chambers narrow and finally form a canal containing neurovascular structures of the tooth (Sadler, 2010). The mesenchymal cells on the outside of the tooth and those in contact with the dentine at the root differentiate into cementoblasts. (Allan and Kramer, 2002; Sadler, 2010). The cementoblasts are cells secreting cementum, which produce a thin layer of specialised bone (Allan and Kramer, 2002; Sadler, 2010) (Figure 10). Outside the cementum layer the mesenchyme gives rise to a periodontal ligament which functions as a shock absorber and holds the tooth firmly in position (Figure 10).

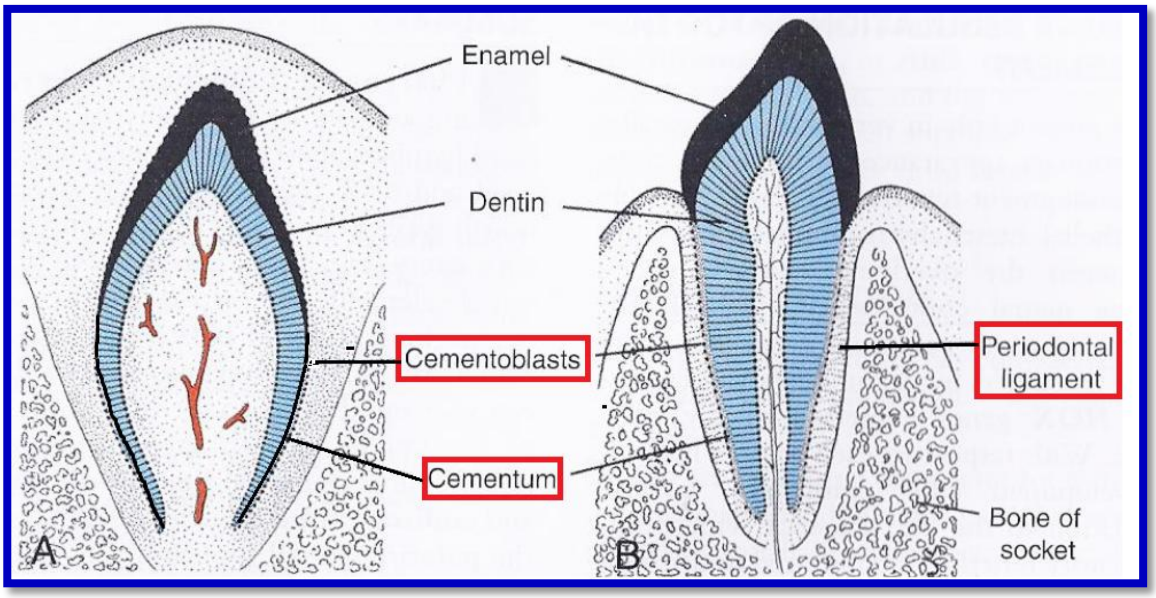


Figure 10: A. Before birth and B. After birth (Adapted from Sadler, 2010)

The developed tooth erupts by a combination of root elongation and absorption of the overlying bone. The elongating root remains ensheathed within an upgrowth of alveolar bone (Sinnatamby, 2006). The crown is gradually pushed through the overlying tissue layers in the oral cavity (Sadler, 2010). The eruption of the deciduous teeth occurs 6 – 24 months after birth. The buds for the permanent teeth lie on the lingual aspect of the deciduous teeth and are formed during the third month of fetal development (Sadler, 2010). These buds will remain dormant until approximately the sixth year of postnatal life. The buds then begin to grow, pushing against the underside of the deciduous teeth and aiding in the shedding of them (Sadler, 2010). As the permanent teeth grow, the root of the overlying deciduous tooth is resorbed by osteoclast (Sadler, 2010).

2.4. PARTS AND STRUCTURES OF TEETH

A tooth has a crown, neck and root (Figure 11). The crown projects from the gingiva, while the neck is the junction between the crown and the root, and the root is fixed in the tooth socket by periodontium. The bulk of the tooth is composed of dentine, which is covered by enamel over the crown and cementum over the root (Moore *et al*., 2010) (Figure 11). Inside the dentine is a pulp cavity, this cavity is filled by dental pulp, which is composed of loose connective tissue, with neurovascular structure and lymphatics, all of which is transmitted through the apical foramen (Sinnatamby, 2006). The tooth is suspended in its bony socket by the periodontal ligament, which consist of collagen fibres that pass obliquely from the alveolar bone towards the apex of the tooth (Sinnatamby, 2006).

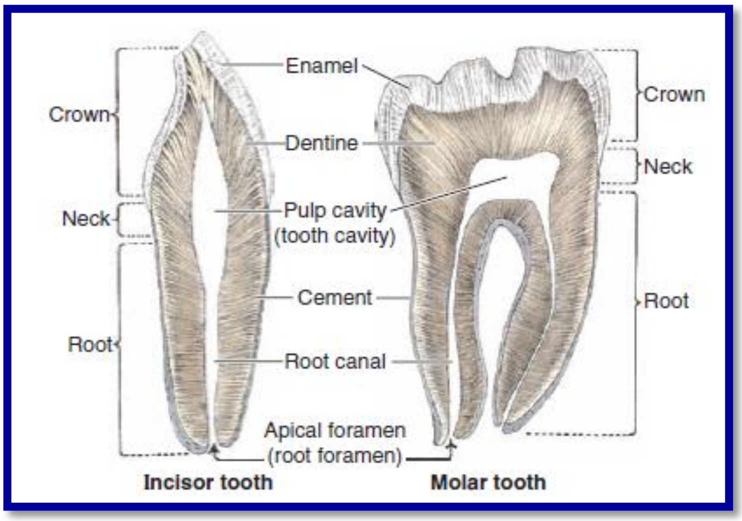


Figure 11*: *Longitudinal section of the incisor and molar tooth (Adapted from Moore et al., 2010)

2.5. TOOTH ERUPTION

The mechanism of tooth eruption (Figure 12) involves dental growth pressure, vascular pressures in the papillae and molecular kinetics of the periodontal collagen fibres (Brookes and Zietman, 1998).

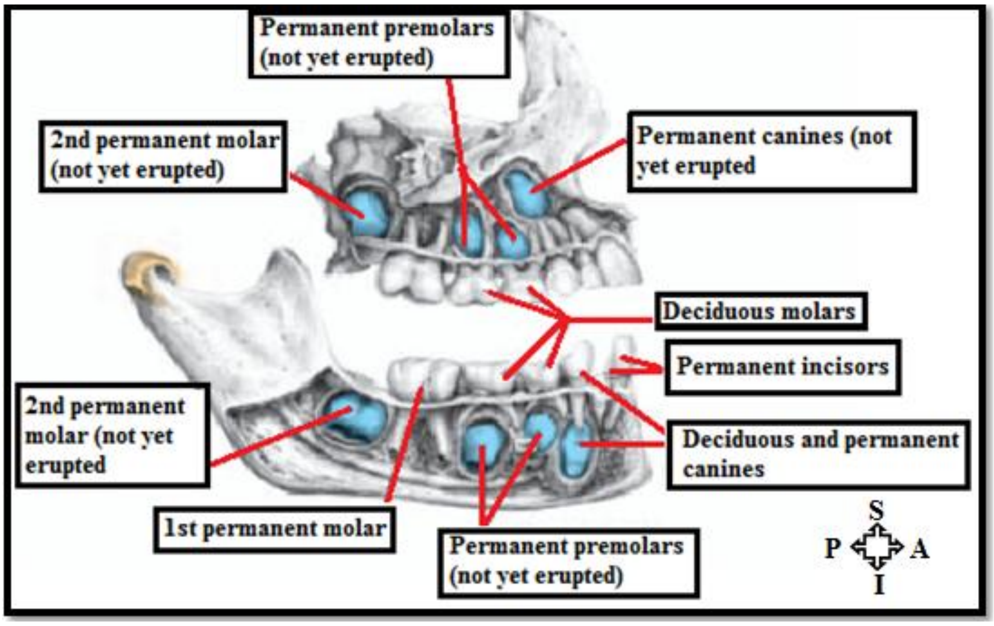


Figure 12: Replacement of deciduous teeth by permanent teeth in a child of 8 or 9 years (Adapted from Sadler, 2010)

According to Sinnatamby (2006) the standard times of tooth eruption are (Table 1):

Table 1: Standard times of tooth eruption

Deciduous Teeth	Permanent Teeth
• **6 months** – Lower central incisors	• **6 years** – First permanent molars
• **7 months** – Upper central incisors	• **7 years** – Central incisors
• **8 – 9 months** – Lateral incisors	• **8 years** – Lateral incisors
• **1 year** – First molars	• **9 year** – First premolars
• **18 months** –Canines	• **10 years** –Second premolars
• **2 years** – Second molars	• **11 years** – Canines
	• **12 years** – Second permanent molars
	• **17 – 21 years** –Third permanent molars (Wisdom teeth)

2.6. DEFINITION OF IMPACTED MOLAR TEETH

The definition of impacted teeth has varied over time as more details on its causation became more evident over time. In 1954, Mead defined an impacted tooth as a tooth that is prevented from erupting into position due to malposition, lack of space, or other impediments. In 1998, Peterson characterized impacted teeth as those that fail to erupt within the expected time into the dental arch, whereas Farman (2004) characterized impacted teeth as those teeth that did not erupt due to a physical barrier within the path of eruption.

According to Syed *et al.* (2013), an impacted tooth is one that is erupted, partially erupted or unerupted and will not assume a normal arch relationship with the other teeth and tissue. Impaction also refers to the prevention of tooth eruption on its scheduled date, or the tooth is impacted if the time of its eruption has passed (Sabra and Soliman, 2013). However, Chu *et al.* (2003) defined an impacted tooth as one tooth that is obstructed along its path of eruption by an adjacent tooth, bone or soft tissue. In addition, a tooth was defined as embedded only if it was covered by bone with no obstruction from an adjacent tooth.

The third molar tooth generally erupts between the ages of 18 – 24 years. However, there is a high variation in the age of eruption (Esposito and Coulthard, 2006; Ramamurthy *et al*., 2012).

2.7. ETIOLOGY

There have been a number of theories proposed to describe the etiology of tooth impaction, viz. Omar (2008), stated that the prevalence of impaction has increased in recent years due to the decrease in functional activity of the jaws. He reported that the prevalence of impaction may differ from one race group to another as the growth of the jaw may be influenced by genetically inherited factors, lack of proper dental care, type of food and dietary habit (change from a coarse abrasive diet to a soft western diet) (Omar, 2008). Furthermore, he recorded a significant effect between chewing gum and singing on impaction as he recorded that individuals who chewed gum and sang often are less likely to have impacted third molars than individuals who do not. The normal development of the mandible is believed to be in response to the growth of the tongue and mastication muscles. In addition, by the continuous movement of the jaw the development of the mandible is enhanced by appositional growth (Omar, 2008).

However, Yamaoka *et al.* (1997) recorded that a relationship between root angulation (the angulated roots) and impaction were commonly found in impacted mandibular third molars as compared to erupted mandibular third molars (Figure 13). In 2006, Esposito and Coulthard stated that in some people the teeth become partially or completely impacted below the gum line due to a lack of space, abnormal position or obstruction, while Ramamurthy *et al*. (2012) reported the lack of space to be the major cause for abortive eruption.

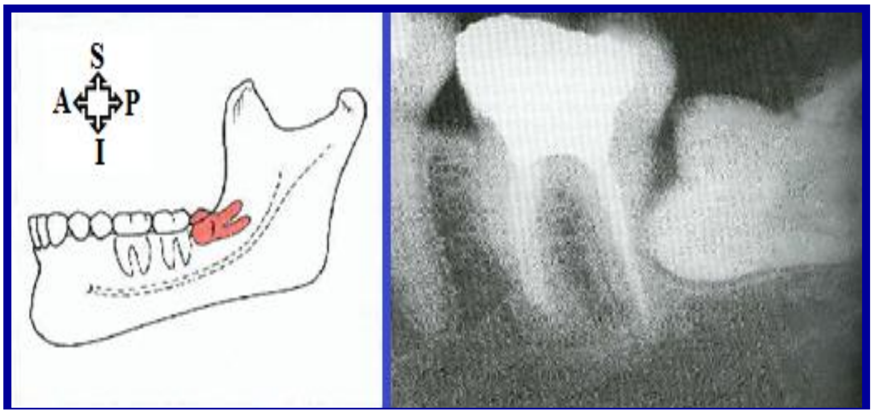


Figure 13: Angulated impacted third molar (Adapted from http://dc224.4shared.com doc/WLV06QxM/preview_html_ m2d015e71.gif)

Evolution suggests two possible theories as to why the prevalence of impacted third molar teeth increased over time. The first theory states that evolution of the third molars in the longer jaws of the human ancestors reveals the benefit these teeth may have added to dentition millions of years a. However, in the modern human the third molar teeth add little to the chewing efficiency of the dentition. Therefore, this lack in functionality has resulted in a decrease in the length of the jaw, thus providing insufficient space for the inclusion of third molar in the dentition (Anthony *et al*., 2003) (Figure 14). Biswari *et al*. (2010) further stated that our ancestors had larger jaws; therefore there was sufficient room in the human mouth to accommodate 32 permanent teeth (including the third molars). However, because the modern jaw is smaller thus resulting in insufficient room to house 32 teeth. Since the third molars are the last teeth to develop, they are often impacted and unable to erupt. The process of evolution may explain another etiology of impaction; viz. the size of the human jaw has gradually reduced from the larger ape size to the smaller modern human size.

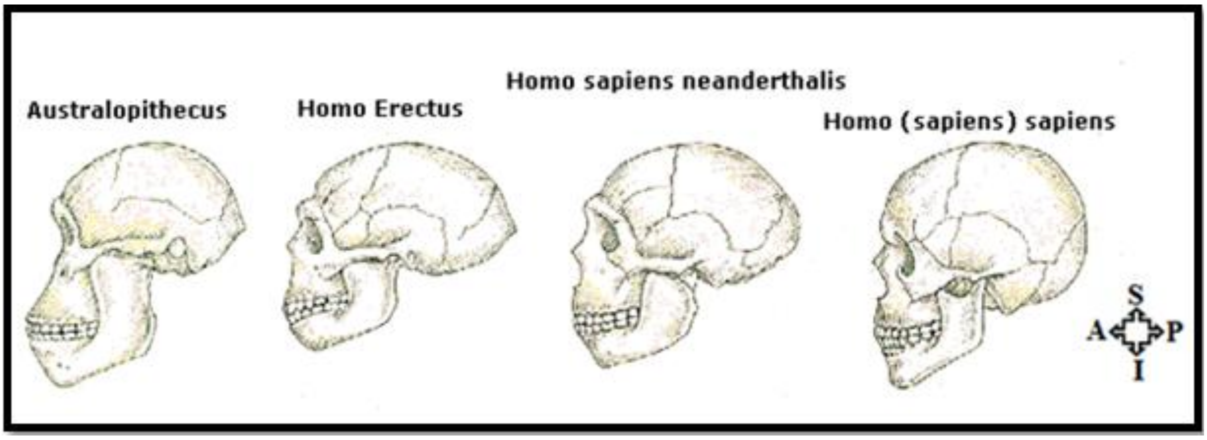


Figure 14: Decrease in jaw size (Adapted from http://chsweb.lr.k12.nj.us/mstanley/outlines /evolution/human/hevolutionin.html)

The second theory of evolution explains that there is an increased brain size at the expense of the jaw size (MacGregor, 1985) (Figure 15). Hence, the jaw has become too small for the third molar to erupt normally (Biswari *et al*., 2010).

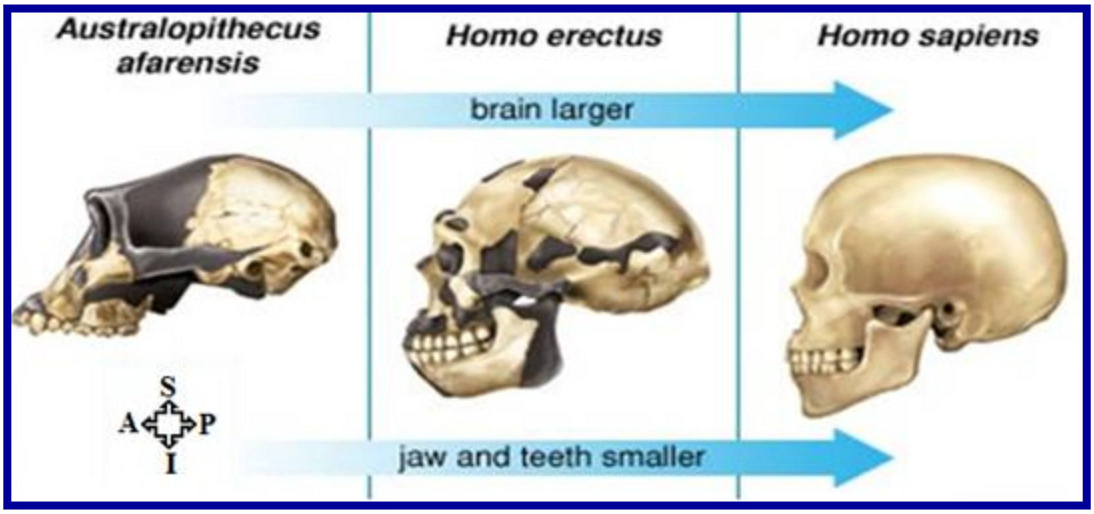


Figure 15: Evolution of the brain (Adapted from http://www.heritageinstitute.com/zoro astrianism/images/cave/human Evolution.jpg)

2.8. CLASSIFICATION OF IMPACTED THIRD MOLARS

Several methods have been used to classify the impaction of the third molar. These classifications are based on the level of impaction, the angulation of the third molar or the relationship to the anterior border of the ramus of the mandible (Hashemipour *et al*., 2013).

2.8.1. Angulation of impacted third molar – Winter's Classification Scheme

The classifications of the impacted third molar teeth may be related to the angulation of the impacted third molar. This is generally determined using the Winter's Classification Scheme, which is based on the angle formed between the intersected longitudinal axis of the second molar and third molars (Tsabedze, 2012; Hashemipour *et al*., 2013). This classification defines impaction as follows (Figure 16):

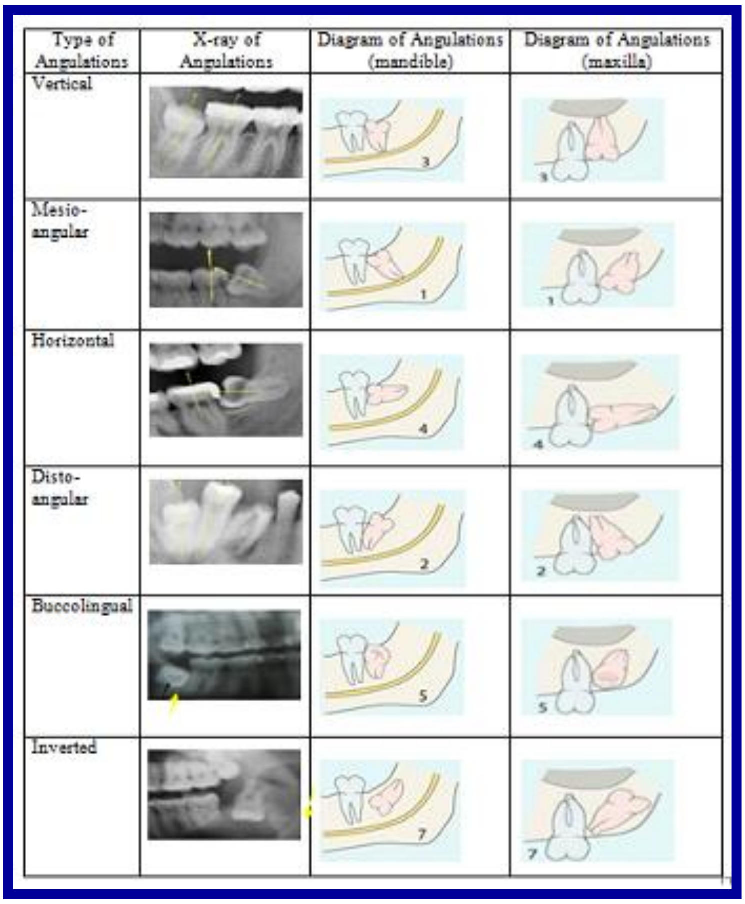


Figure 16: Winter's classification system (Adapted from Hahemipour et al., 2013)

- **Vertical impaction** – The long axis of the third molar is parallel to that of the second molar but tilted vertical towards the occlusal plane.
- **Mesio-angular impaction** – The impacted tooth is tilted forward towards the front of the oral cavity in a mesial or anterior direction of the adjacent second molar.
- **Horizontal impaction** – The long axis of the third molar is perpendicular to that of the second molar. As a result the crown of the third molar is directed towards the root of the adjacent second molar.
- **Disto-angular (Distal) impaction –** The long axis of the third molar is angled distally or posteriorly away from the second molar but towards the posterior end of the oral cavity.

- **Buccolingual impaction** – The crown of the impacted tooth is directed buccally (tilted towards the cheeks) or lingually (tilted towards the tongue).
- **Inverted impaction** – The impacted tooth is in a vertical position with the crown of it rotated in the direction opposite to that of the second molar.

2.8.2. Angulation of third molar impaction – Quek's Classification Scheme

Quek *et al*. (2003) proposed an alternative classification method based on the angle of impaction. This method measures the angle of impaction using an orthodontic protractor. The angulation of the impacted molar can be determined by the angle formed between the intersected long axis of the second and third molars (Figure 17). Quek *et al*, (2003) classified the third molar impaction as follows (Syed *et al*., 2013):

- **Vertical** : 10º to - 10º
- **Mesio-angular :** 11º to 79º
- **Horizontal** : 80º to 100º
- **Disto-angular** : -11º to - 79º
- **Other** : -111º to -80º

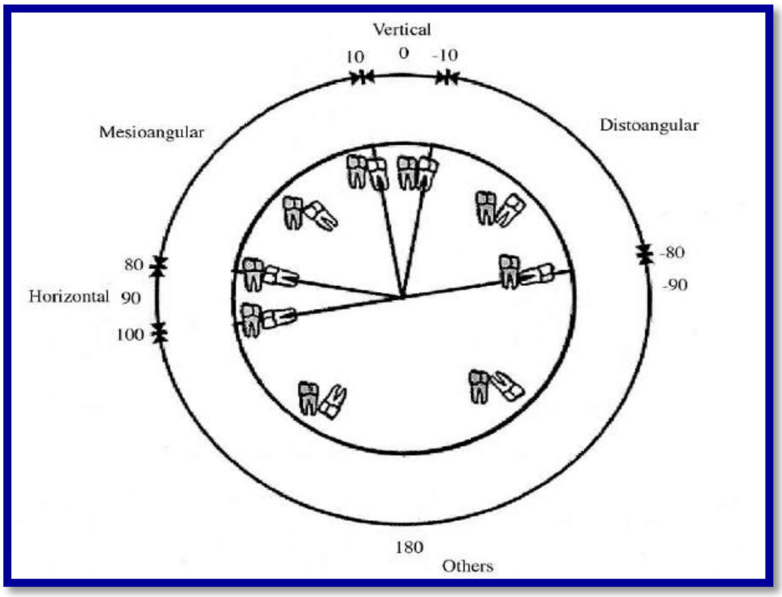


Figure 17: Quek's classification system (Adapted from Quek et al., 2003)

2.8.3. Level of impaction

The impacted third molar can also be classified according to Pell and Gregory's (1933) classification system by determining their depth in relation to the occlusal plane along the distance from the ramus of the mandible to the posterior surface of the adjacent second molar (Figure 18) (Tsabedze, 2012; Hashemipour *et al.*, 2013).

- **Class A** – Not buried by bone or the occlusal plane of the impacted tooth is at the same level of the adjacent tooth.
- **Class B** – Partially buried in bone or the occlusal plane of the impacted tooth is between the occlusal plane and the cervical line of the adjacent tooth (if part of the cement-enamel junction is lower than the level of the bone).
- **Class C –** Completely buried by bone or the occlusal plane of the impacted tooth is apical to the cervical line of the adjacent tooth.

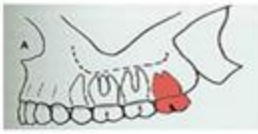
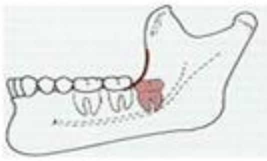
Level of impaction	Diagram of level of impaction (Mandible)	Diagram of level of impaction (Maxilla)
CLASS A		
CLASS B		
CLASS C		

Figure 18: Pell and Gregory's classification system for level of impaction (Adapted from Hashemipour et al., 2013)

2.8.4. Relationship with the anterior border of the ramus of the mandible

The Pell and Gregory classification system also relates the position of the third molar to the ascending mandibular ramus and the second molar (Figure 19):

- **Class I** – The third molar is situated anterior to the anterior border of the ramus. Also when there is sufficient space between the ramus of the mandible and the posterior surface of the second molar for the accommodation of the crown of the third molar.
- **Class II** – The crown is half covered by the anterior border of the ramus. The space between the ramus of the mandible and the posterior surface of the second molar is less than the mesio-distal size of the crown of the third molar.
- **Class III** – The crown of the third molar is completely or almost completely covered by the anterior border of the ramus.

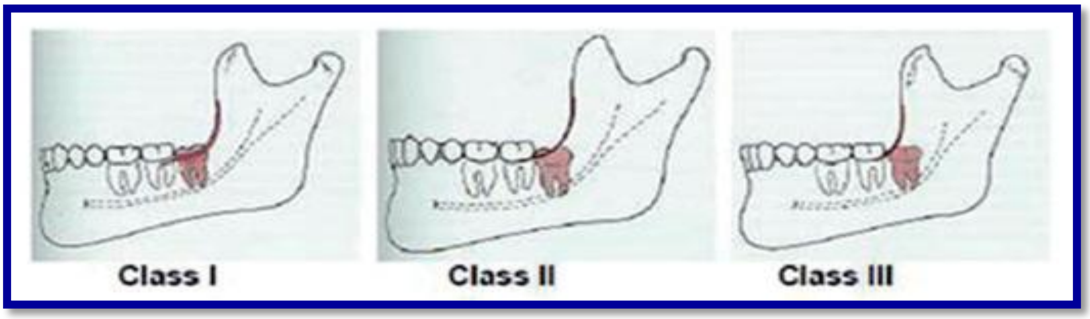


Figure 19: The relationship between the impacted third molar and anterior border of the ramus (Adapted from Hashemipour et al., 2013)

2.9. IMAGING TECHNIQUES

The location and organization of impacted third molars, surrounding bone, mandibular canal and adjacent teeth are vital in imaging diagnosis for surgical procedures (Juodzbalys and Daugela, 2013).

2.9.1. Intraoral

2.9.1.1. Paralleling Technique

Periapical radiographs have been used for many years to assess the jaw during impacted tooth surgery (Juodzbalys and Daugela, 2013). The long cone paralleling technique for taking periapical x-rays is the technique of choice, since there is reduction of radiation dose, less magnification and the relationship between the mandible height and the adjacent teeth can be demonstrated (Juodzbalys and Daugela, 2013). The use of film that is highly flexible results in processing that may be suboptimal and it often lead to poor imaging is seen as a disadvantage of periapical radiographs (van der Stelt, 2013). In addition, the mandibular canal is not clearly identified in the third molar region, as the angulation of the periapical film can affect the supposed position of the canal with respect to the bone crest (Juodzbalys and

Daugela, 2013). This technique also provides discomfort to the patient (Iannucci and Howerton, 2012).

2.9.2. Extraoral Technique

2.9.2.1. Panoramic Imaging

Panoramic radiographs are the preferred choice when a region is too large to be seen on the periapical view (Juodzbalys and Daugela, 2013). Furthermore, panoramic images display a wide view of the maxilla and mandible in a single projection (Iannucci and Howerton, 2012). In panoramic imaging, the tubehead and receptor rotates around the patient to produce a sequence of images that combine to create the overall view of the mandible and maxilla (Iannucci and Howerton, 2012). Panoramic radiographs are commonly used for, viz. i) the evaluation of impacted teeth; ii) the assessment of eruption patterns, growth and development; iii) the detection of lesions and diseases and iv) the examination of trauma (Iannucci and Howerton, 2012). The advantages of panoramic radiographs are: minimal radiation exposure, low cost of using the panoramic radiograph equipment (Juodzbalys and Daugela, 2013), it has a large field size that covers the entire maxilla and mandible, and patients cooperate as there is no discomfort involved (Iannucci and Howerton, 2012). The disadvantages are lower imaging resolution and high distortion (Juodzbalys and Daugela, 2013). Sarawati *et al.* (2010) stated that panoramic imaging remains the radiograph of choice for impacted molar teeth and is frequently used in practices today.

2.9.2.2. Cone Beam Computer Tomography

Cone Beam Computed Tomography (CBCT) has been the method of choice when a three dimensional view of the mandibular third molar and adjacent anatomical structures are required, as it contributes to optimal risk assessment and subsequently to more adequate surgical planning (Juodzbalys and Daugela, 2013). The advantages of CBCT include: lower radiation dose, brief scanning time (8-10 seconds) and anatomically accurate images (Iannucci and Howerton, 2012). The disadvantages are: the small field view, the cost of equipment and the lack of training in the interpretations of image data on areas outside the maxilla and mandible, as most dental professionals have not been trained to interpret data on anatomical areas beyond the maxilla and mandible (Iannucci and Howerton, 2012).

2.10. PREVALENCE OF IMPACTED THIRD MOLAR

2.10.1. Gross prevalence of impacted third molars

There is considerable variation in the prevalence and distribution of impacted teeth in the different regions of the jaw (Chu *et al*., 2003). A review of the literature depicts variability in the prevalence of impacted third molar teeth from one population to another and several authors have reported that the prevalence of the impacted third molar ranges from 17.0% to 73.0% (Table 2). Chu *et al*. (2003) stated that there are many factors affecting the prevalence of impacted teeth, viz. selected age group, timing of dental eruption and radiographic methodology for dental development and eruption. The disparity in the prevalence of impaction may also be due to genetic and racial differences (Hashemipour *et al.*, 2013).

Table 2: Prevalence of impacted third molars in different population groups

Authors	Year	Population	Prevalence of impacted third molars (%)	Region of the jaw
Morris and Jerman	1971	American	65.9	Mandibular and Maxillary
Sandhu and Kapila	1982	Indian	26.0	Mandibular and Maxillary
Hattab *et al*	1995	Jordanaian	33.0	Mandibular and Maxillary
Elsey and Rock	2000	European	73.0	Mandibular and Maxillary
Chu *et al*	2003	Hong Kong Chinese	27.8	Mandibular and Maxillary
Quek *et al*	2003	Singaporean	68.6	Mandibular and Maxillary
Omar	2008	Hawler	43.8	Mandibular and Maxillary
Ramamurthy*et al*	2012	Indian	41.3	Mandibular
Tsabedze	**2012**	**South African**	**17.0**	**Mandibular**
Hashemipour*et al*	2013	Iranian	44.3	Mandibular and Maxillary
Sabra and Soliman	2013	Saudi Arabian	67.9	Mandibular
Syed *et al*	2013	Saudi Arabian	18.7	Mandibular and Maxillary

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2.10.2. Prevalence of maxillary and mandibular impaction

2.10.2.1. Gross prevalence of impacted third molars in the mandible and maxilla

Previous studies depict that tooth impaction is a frequent phenomenon. However, there is substantial variation in the prevalence and distribution of impacted teeth in different regions of the jaw (Chu *et al.*, 2003). In an early study conducted by Kramer and William (1970), the authors recorded that the maxillary third molar was more frequently impacted (58.87%) than mandibular third molar (33.49%) (Table 3) (Chu *et al.*,2003). In a later study in 1984, the findings of Kruger, confirmed that of Kramer and William (1970) as 62.57% of patients had a maxillary impacted molar, while 37.44% were found to have a mandibular impacted molar (Table 3). According to Othman *et al*. (2009), however, the mandibular third molar is the most frequently impacted tooth in humans. In 2013, Syed *et al.* (2013), recorded similar findings to Othman *et al.* (2009), as they found that the mandibular and maxillary third molars were the most frequently impacted teeth, with slight propensity of the former. They recorded that 49.3% of patients had a mandibular third molar impaction and 18.4% had a maxillary third molar impaction only (Table 3). Sandhu and Kapila (1982), Omar (2008) and Hashemipour *et al.* (2013) concurred with the aforementioned author and reported that mandibular third molars are the most frequently impacted teeth (Table 3).

Table 3: Distribution of impacted third molars in the mandible and maxilla

Authors	**Year**	**Population**	**Sample size**	**Prevalence of impacted third molar (%)**	
				Mandible	**Maxilla**
Kramer and William	1970	American	-	33.47	58.87
Sandhu and Kapila	1982	Indian	1015	63.21	36.79
Kruger	1984	-	-	37.44	62.57
Chu *et al.*	2003	Hong Kong Chinese	7486	82.50	15.60
Omar	2008	Hawler	1150	59.04	39.42
Hashemipour *et al.*	2013	Iranian	1215	54.90	28.80
Syed *et al.*	2013	Saudi Arabian	3800	49.40	18.40

2.10.2.2. Prevalence of mandibular and maxillary third molar impaction in relation to sex

Quek *et al.* (2003) and Syed *et al.* (2013) recorded that the prevalence of impacted mandibular third molars was higher in males than females, with prevalence of 82.2% and 49.5% in males and 74.8% and 48.6% in females, respectively. However, the aforementioned authors reported that maxillary third molar impaction is more common in females than males; as Quek *et al*. (2003) recorded prevalence of 17.8% and 25.2% in males and females, respectively while Syed *et al.* (2013) recorded a 17.9% prevalence in males and a 21.1% prevalence in females. Literature suggests that mandibular third molar impaction is more prevalent in males than in females, while maxillary third molar impaction is more prevalent in females rather than in males.

2.10.2.3. Prevalence of impacted mandibular and maxillary third molars in relation to laterality

Ramamurthy *et al.* (2009) found that the bilateral impaction of the mandibular third molar presented in 29.6% of patients, while the unilateral impaction of the third mandibular molar was found in 6.3% and 5.4% on the left and right sides respectively. However, in a Kenyan study conducted by Mwaniki and Guthua, (1992), a frequency of 68.2% was recorded for bilateral impaction. In a similar study conducted by Sobra and Soliman, 2013, they found that the prevalence of unilateral and bilateral impaction was 67.9% and 32.1% respectively. Variation in literature concerning the laterality of impacted third molars exist, as Ramamurthy *et al.* (2009) and Mwaniki and Guthua, (1992) who suggest that bilateral impaction is more prevalent than unilateral impaction, to the contrary Sobra and Soliman (2013) reported that unilateral impaction is most prevalent.

2.10.2.4. Etiology of the prevalence of mandibular and maxillary third molar impaction

There are a number of proposed theories to explain why impaction is more prevalent in the mandible than maxilla. Broadbent (1943) suggested that mandibular third molar impaction occurs when the mandible fails to achieve its full growth potential. However, Ricketts (1979) claimed that impacted third molar teeth is related to the arcial growth of the mandible as he explained that third molars usually develop by a mesial direction of tooth eruption rather than the resorption at the anterior border of the ramus. Popescu and Popoviou (2008) reported that growth in the mandible influences the frequency of impacted mandibular third molar teeth, as slow skeletal growth and maturation results in a small retromolar space hence insufficient area for the mandibular third molars to erupt. The authors further stated that maxillary third molar are less frequently impacted than mandibular third molars, as the obstacle of impaction is musculo-ligament (gum tissue). While, Lakhani *et al.* (2011) recorded that if resorption at the anterior surface of the ramus is restricted then the mandibular third molars do not have enough space to erupt. In addition, Miloro *et al.* (2012) stated that individuals with impacted teeth have larger-sized teeth than those without impaction and mandibular third molars that are positioned laterally usually do not erupt due to the dense bone present in the external oblique ridge.

2.10.3. Prevalence of impaction in correlation with age

Several authors recorded similar findings and the highest prevalence of impaction was reported in the 20 -25 year age group (Table 4). Chu *et* al. (2003) and Syed *et al*. (2013) stated that an increase in age (greater than 29 years) results in a decrease in third molar impaction.

Table 4: The prevalence of an impacted third molar correlated with age

Authors	Year	Prevalence (%)				Age group for the highest prevalence of impaction (Years)
		Patients with an impacted molar	Patients with impacted mandibular 3rd molar	Patients with impacted maxillary 3rd molar	Patients with both molars impacted	
Sandhu & Kapila	1982	26.0	63.2	36.8	-	21 -25
Chu *et al.*	2003	27.8	82.5	15.6	-	20 – 29
Omar *et al.*	2008	43.8	59.0	39.4	-	21 – 25
Hashemipour *et al.*	2013	44.3	54.9	28.8	16.3	-
Syed *et al.*	2013	18.8	49.3	18.4	32.3	20 -25

2.11. PREVALENCE OF IMPACTED THIRD MOLAR ANGULATIONS

2.11.1. Prevalence of impacted mandibular third molar angulation

The common pattern of angulation documented in previous studies is mesio-angulation, which is defined as the tilting forward of the third molar, towards the adjacent second molar tooth (Syed *et al.*, 2013). Chu *et al*. (2003) recorded that more than 80% of impacted mandibular third molars were either horizontally (47.5%) or mesially (36.6%) angulated against the second molar. In these cases, this pattern appeared to be bilaterally symmetrical (Chu *et al*., 2003). Syed *et al.* (2013) reported that 50.8% of patients presented with mesio-angular impaction. Khan *et al.* (2010) and Hashemipour *et al.* (2013) confirmed similar rates of 48.0% and 48.3%, respectively. Quek *et al.* (2003) recorded that mesio-angulation was the most prevalent type of impaction in both males and females, with prevalence of 60.6% and 58.6%, respectively. Ramamurthy *et al*. (2013) concurred with Quek *et al*. (2003), as they reported that mesio-angulation was prevalent in 16.3% males and 12.3% females. However, Bataineh *et al.* (2002), Sasano *et al.* (2003) and Almendros-Marque *et al*. (2006) recorded vertical impaction to be the most common type of mandibular third molar impaction with a prevalence rate of 61.4%, 46.0% and 47.9%, respectively. Mesio-angular impaction appears to be the most frequent type, which may be due to the path of eruption, delayed development and maturation, and lack of space in the mandible at a late stage (Hashemipour *et al*., 2013). According to the Belfast Study Group (study group at Queen's University), the development of the type of impaction among the mandibular third molars was explained as follows: there may be differentiated root growth between the mesial and distal roots, which causes the root to either remain mesially inclined or rotate to a vertical position depending on the amount of root development. Consequently, this under development of the mesial root results in mesio-angular impaction (Miloro *et al*., 2012; Syed *et al*., 2013).

2.11.2. Prevalence of impacted maxillary third molar angulation

A number of authors suggest that vertical angulation is more common in maxillary impaction (Quek *et al*., 2003; Hashemipour *et al*., 2013; Syed *et al*., 2013). Syed *et al*, (2013) and Hashemipour *et al*, (2013) recorded vertical impaction of the maxillary third molar in 52% and 45.3% of patients respectively. However, Kruger *et al*, (2001) differed and recorded that mesio-angular impaction was the most common pattern of impaction observed in the maxilla. On the other hand, Fonseca (1956) and Leite (1986) recorded disto-angular impaction to be the most prevalent type of maxillary third molar impaction as it was present in 75.5% and 58.5% of cases, respectively. Artun *et al*. (2005) stated that maxillary third molars generally attain various positions of distal angulation during the initial development therefore during root development a vertical position is essential for normal eruption to occur. Additionally, Popescu and Popovioiu (2008) stated that mal-position is frequently favoured by insufficient alveolar room necessary for the third molar to develop or erupt into its normal functional position.

2.13. PREVALENCE OF LEVEL OF IMPACTION

2.13.1. Level of mandibular third molar impaction and its relation to mandible

According to the Pell and Gregory classification scheme, Obiechina *et al.* (2001) recorded the most prevalent class of mandibular third molar impaction to be IIA (31%). This finding was confirmed by Monaco *et al.* (2004), Jaffar and Tin (2009), Khan *et al.* (2010); Hashemipour *et al.* (2013). However, Almendros-Marques *et al.* (2008) and Blondeau and Daniel (2007) reported class IIB as the most common class of mandibular third molar impaction.

The variation may be a result of dietary differences between the population groups, as fibrous diets promote jaw growth while circumferential attrition of teeth provides space for the third molars to erupt (Khan *et al*., 2010). Mendelian theory further elaborated on this by stating that the abrasive nature of the Stone Age diet had the effect of producing extensive wearing a way of teeth thus creating enough space to accommodate the third molars (Tsabedze, 2012). Furthermore, the author theorized that the activity of chewing could have stimulated a greater jaw size during development, subsequently providing more space (retromolar space) for the third molars to erupt (Kaifu *et al.* 2003; Tsabedze, 2012). In addition, racial and genetics differences may also account for the variation in the level of impaction from one population to another (Khan *et al.*, 2010).

2.13.2. Level of maxillary third molar impaction

Quek *et al.* (2003) reported class B to be the most common type of maxillary third molar impaction according to Pell and Gregory classification scheme in both sexes with a prevalence of 57% and 63% in males and females, respectively. However, Hashemipour *et al.* (2013) recorded the most frequent class of maxillary third molar impaction to be class A. Therefore, variations exist in the depth of impaction in different population groups, and this may be influenced by genetically inherited factors, lack of proper dental care, lack of functional activity of the jaw and dietary habits (Omar, 2008). In addition, Radhika *et al.* (2013) stated that since the maxillary third molar is the last tooth to erupt it had to adapt to the existing space, and this space limited by the adjacent second molar, maxillary sinus and pterygoid fossae.

2.14. SEX DISTRIBUTION

Previous research has shown no sexual predilection in third molar impaction (Brown *et al*., 1982; Hattab *et al*., 1995; Omar, 2008; Kaya *et al*., 2010) (Table 5).

Table 5: Absence of a relationship between the prevalence of the impacted molar and sex

Author	Year	Prevalence of impacted third molar (%)	
		Male	Female
Omar	2008	49.1	51.0

However, some studies have shown a higher frequency in females rather than in males (Sandhu and Kapila, 1982; Hellman *et al.*, 1988; Quek *et al.*, 2003; Marzola *et al*., 2006;

Hashemipour *et al*., 2013) (Table 6). A possible explanation for this could be that the average age of eruption for mandibular third molars in males are approximately 3 to 6 months ahead of females (Juodzbalys and Daugela, 2013). Therefore, Juodzbalys and Daugela (2013) stated that females have a higher prevalence of impacted mandibular third molars than males (Figure 20). The higher frequency reported in females is due to the difference in growth between males and females (Hashemipour *et al*., 2013). Furthermore, a number of authors attributed these findings to the fact that the jaws of females discontinues to grow when the third molars are beginning to erupt, however the growth of the jaws in males continues beyond the time of eruption of the third molars (Kramer and Williams, 1970; Hellman, 1988; Silling, 1993; Hashemipour *et al*., 2013).

Table 6: Higher prevalence of the impacted molar in females

Author	**Year**	**Prevalence of impacted third molar (%)**	
		Male	**Female**
Sandhu & Kapila	1982	44.3	55.7
Hellman	1988	45.2	56.8
Marzola *et al.*	2006	35.9	64.1
Hashemipour	2013	35.1	64.9

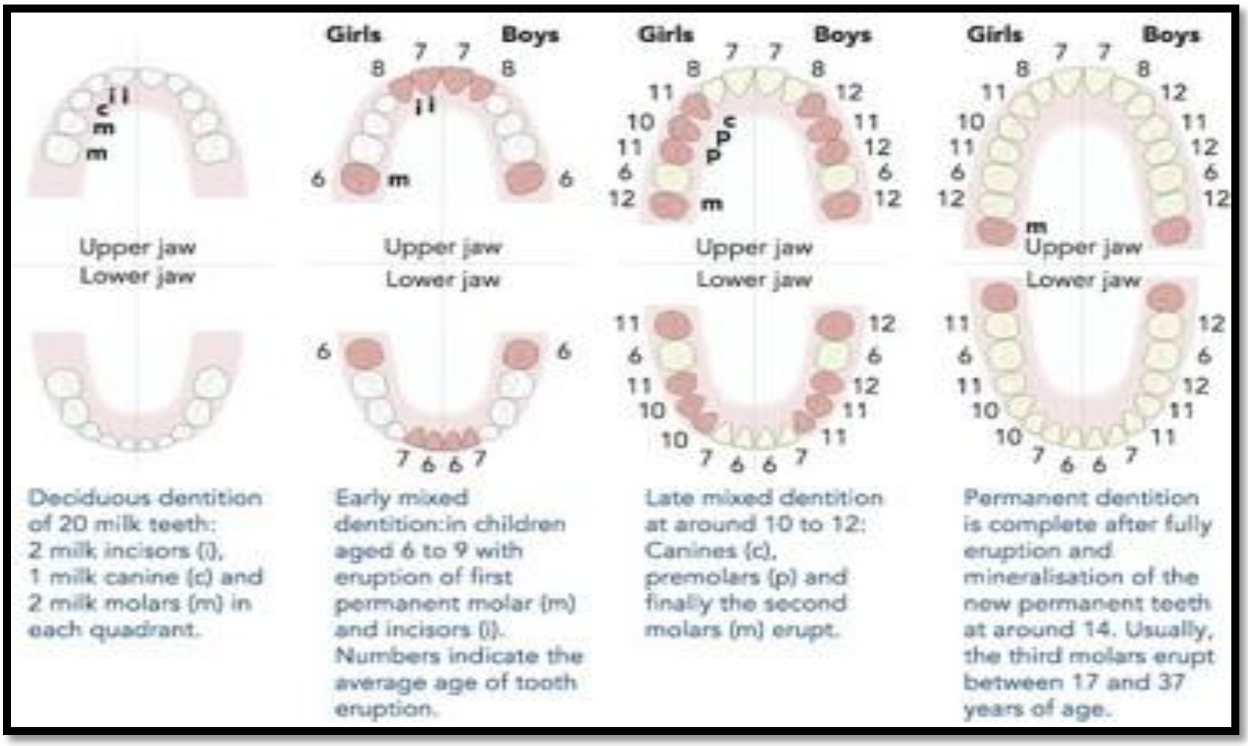


Figure 20 : Sex difference in tooth eruption (Adapted http://www.gaba.com/data/do cs/cache/1/1/7/2/_rgb_72_370_266_ fitAndCrop.jpg)

On the other hand, Haidar & Shalhoub (1986) and Tsabedze (2012) reported that males had a higher prevalence of an impacted third molar (Table 7). Males have a smaller gonial angle in comparison to females, therefore this may increases the occurrence of third molar impaction in males (Chloe *et al.*, 2013; Behbehani and Artun. 2006).

Table 7: Higher prevalence of the impacted molar in males

Author	**Year**	**Prevalence of impacted third molar (%)**	
		Male	**Female**
Haidar & Shalhoub	1986	34.0	29.0
Tsabedze	2003	61.8	38.2

2.15. MORPHOMETRIC EVALUATION OF THE MANDIBLE AND ITS RELATION TO IMPACTED THIRD MOLARS

Indira *et al*. (2012) stated that the identification of an individual from skeletal remains plays a critical role in forensic investigations and is essential for further analysis and the identification of age, sex, and race. Sex determination is the primary step in the identification of skeletal remains, as age, race and stature are dependent on the sex of an individual. Hence, gender determination is the first priority, followed by age, race and specific identification in the determination of unidentified human skeletal remains.

Forensic investigators often receive dismembered, partial and decomposing remains to determine identity, sex and age. Therefore, in cases of accidents, plane crashes, natural disasters and explosions, when only some skeletal remains and body parts are available, forensic medical experts should be able to determine identity, age and from these remains (Akhlaghi *et al*., 2012). Currently, unidentified skeletal remains in South Africa are being classified (age, sex and race) according to the Northern Hemisphere standards. However, a study conducted on a South African (white and black) population revealed that there are differences that exist in the craniometric dimensions when compared to the North American standards (Iscan and Steyn, 1999). Iscan and Steyn (1999) further stated that majority of the unidentified South African skulls used in their study were misclassified when using the North American standards, thus indicating that the craniometric measurements in a South African are different to those of the Northern Hemisphere. Therefore, a standard for a South African population needs to be developed.

The mandible is the largest, strongest and most durable compact facial bone and therefore remains the best preserved after death (Indira *et al*., 2012; Pillai *et al*., 2014), even in recovered paleoanthropological hominid specimens. While the sexual dimorphism of the mandible is indicated by its shape and size, morphometric analysis is the more accurate in the determination of sex from the skull (Indira *et al*., 2012).

2.15.1. Methodology of morphometric analysis of the mandible

According to literature the morphometric parameters of the mandible is recorded using panoramic radiographs, dry bone specimens and lateral cephalometric radiographs (Figure 21 and 22) (Indira *et al.*, 2012; Vinay and Gowri, 2013 and Yassir, 2013). The digital radiographs is analyzed using either the AutoCAD, Kodak or Master View Computer programmes, the aforementioned programmes were used calculate the linear measurements and angles of the mandible (Figure 22) (Indira *et al.*, 2012 and Yassir, 2013). The linear measurements were carried out using a mouse driven method, which involves moving the mouse and drawing linear lines between two chosen points on the digital radiograph (Figure 22) (Indira *et al.*, 2012). On the other hand, a mandibulometer; goniometer or sliding calliper was used to record the morphometric parameters on the dry bone mandibles (Vinay and Gowri, 2013).

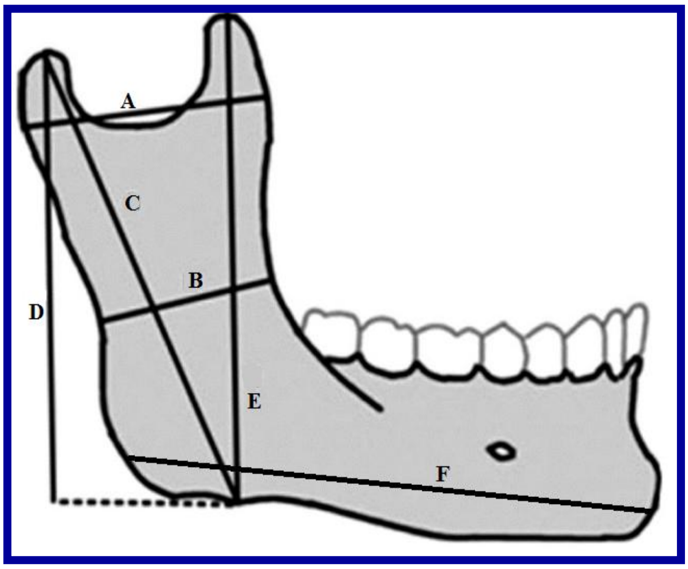


Figure 21: Morphometric measurements on a dry bone specimen (Adapted from Saini et al., 2011)

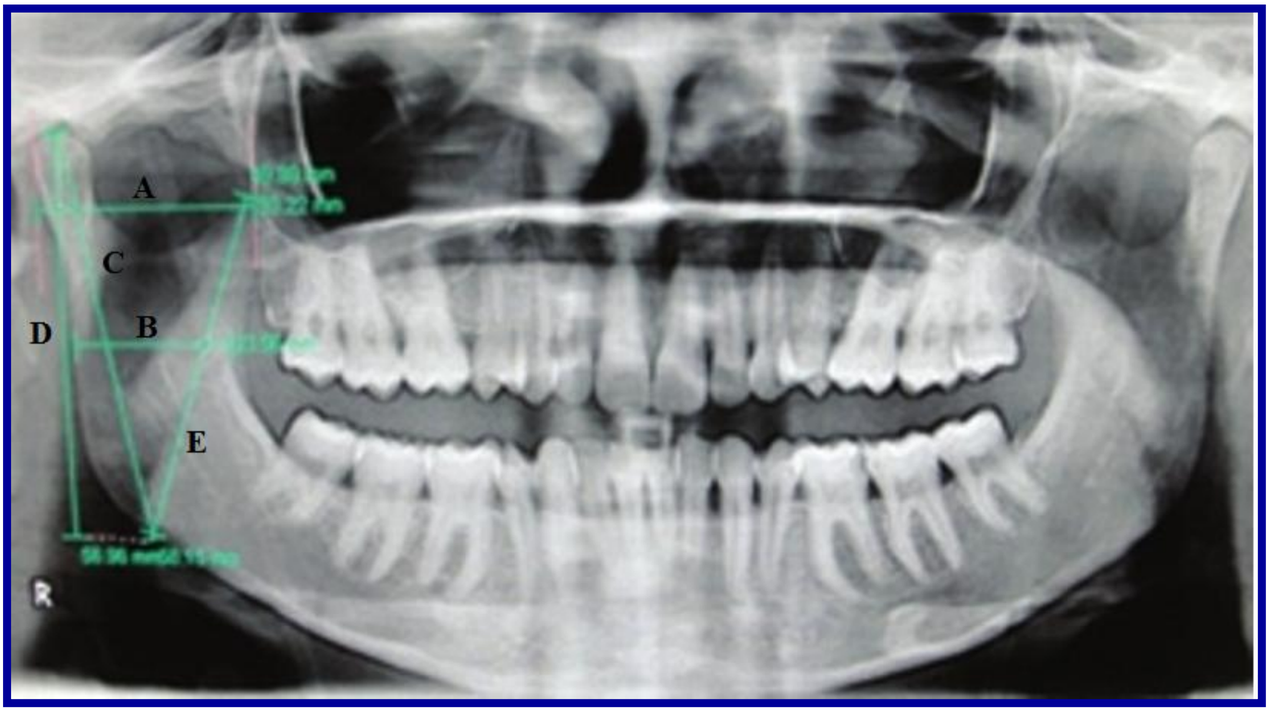


Figure 22: Morphometric measurements on a digital panoramic x-ray (Adapted from Indira et al., 2012)

Key for Figure 21 and 22 (Adapted from Saini *et al.*, 2011 & Indira *et al.*, 2012):

A) **Maximum ramus breadth:** the distance between the most anterior point on the mandibular ramus and a line connecting the most posterior point of the condyle and the angle of the mandible

B) **Minimum ramus breadth:** smallest antero-posterior diameter of the ramus

C) **Maximum height of the ramus:** is from the most superior point on the mandibular condyle to the tubercle or the most protruding portion of the interior border of the ramus

D) **Projective height of the ramus:** is between the highest point of the mandibular condyle and lower margin of the bone

E) **Coronoid height:** projective distance between the coronion (tip of the coronoid process) and lower border of the mandible

F) **Mandibular length:** distance between the gonion (mandibular angle) to the menton (mental protuberance)

2.15.2. Length of the mandibular ramus

A high sexual dimorphism is indicated by the morphometric analysis of the ramus of the mandible as compared to the body of the mandible (Indira *et al*., 2012). The authors below in Table 8 recorded that the length of the mandibular ramus was longer in males than females. The longest length of the mandibular ramus was recorded in the Zimbabwean (Mbajorgu *et al*., 1996) and Kenyan population (Kenyanya, 2011), while the shortest length was recorded by Fabian and Mpembeni (2002) in the Tanzanian population.

Table 8: Length of the mandibular ramus in males and female (in mm)

Author	Year	Population	Length of mandibular ramus (in mm)	
			Male	Female
Burstone *et al.*	1978	American	52.0	46.8
Mbajorgu *et al.*	1996	Zimbabwean	61.3	59.8
Fabian & Mpembeni	2002	Tanzanian	49.9	44.2
Rai *et al.*	2007	Indian	53.9	51.8
Kenyanya	2011	Kenyan	57.7	52.0
Shamout *et al.*	2012	Jordanian	53.2	49.1
Yassir	2013	Iraqi	51.4	45.1

2.15.3. Width of the mandibular ramus

In an earlier study conducted by Suzuki and Takahshni in 1975, the authors recorded that the width of the male mandibular ramus was greater than females (Table 9). Vinay and Gowri (2013) concurred with the aforementioned authors as they recorded the width of the mandibular ramus is greater in males than females, with a width of 41.7 mm and 38.9 mm, respectively. However, Ranganath *et al*. (2008) found that the width of mandibular ramus is greater in females as compared to males (Table 9).

Table 9: Width of the mandibular ramus in males and female (in mm)

Author	**Year**	**Population**	**Width of mandibular ramus (mm)**	
			Male	**Female**
Suzuki & Takahashni	1975	Japanese	32.9	31.9
Ranganath *et al.*	2008	Indian	38.8	40.7
Vinay *et al.*	2013	Indian	41.7	38.9

2.15.4. Length of the mandibular body

The authors in Table 10 revealed that the male mandibular body is greater in males than females. The mean length of the mandibular body in both males and females was greatest in the Kenyan population, as Kenyanya (2011) reported a mean length of 99.8 mm and 93.4 mm, in males and females respectively. While the smallest length was recorded by Yassir (2013) in the Iraqi population, as he reported that the mean mandibular length was 79.9 mm in males and 69.9 mm in females.

Table 10: Length of the mandibular body in males and female (in mm)

Author	Year	Population	Length of mandibular body (in mm)	
			Male	Female
Mbajorgu *et al.*	1996	Zimbabwean	77.8	72.3
Jayakaran *et al.*	2000	Indian	74.4	70.6
Ongkana *et al.*	2009	Thai	89.4	85.3
Kenyanya	2011	Kenyan	99.8	93.4
Vinay *et al.*	2013	Indian	75.4	72.5
Yassir	2013	Iraqi	74.9	69.9

2.16. CLINICAL SIGNIFICANCE

The classification of the third molar impaction and degree of difficulty related to extraction may enable the clinician to re-evaluate the removal of the impacted tooth, and to select an appropriate treatment, as well as to avoid possible complications (Juodzbalys and Daugela, 2013). The classification scheme of impacted third molars describes the relation of the impacted third molar to adjacent anatomical structures, viz. mandibular ramus, adjacent second molar, alveolar crest, mandibular canal and spatial position of the tooth, therefore this will assist clinician in the extraction of impacted teeth (Juodzbalys and Daugela, 2013). Standring *et al.* (2009) stated that surgery is not immediately advised as it may cause a degree of morbidity since the lingual and inferior alveolar nerves, which are often in close proximity to the tooth, may be damaged during impacted tooth removal.

Hashemipour *et al*. (2013) stated that in addition to pericoronitis (Figure 23), the impacted teeth are often associated with periodontitis, cystic lesions, neoplasm, root resorption and may cause severe effects on the adjacent tooth. Other studies showed that the impacted third molar weakens the angle of the mandible therefore making it susceptible to fracture (Krimmel and Reinert, 2000 and Meisami *et al*., 2002). Tooth impaction also causes temporo-mandibular joint disorders, vague orofacial pain and neuralgias (Beeman, 1999; Almendros-Marques *et al*., 2008 and Omar, 2008).

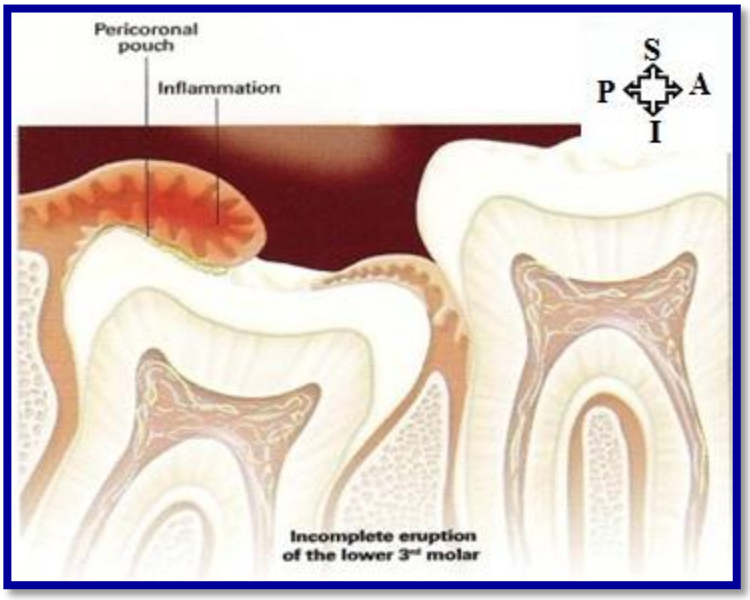


Figure 23: Pericoronitisof an impacted third molar (Adapted from http:// www.juniordentist.com/wp-content/uploads/2012/09/ pericoronitis-pericoronal-pouch-or-operculum1.gif)

CHAPTER THREE

MATERIALS&METHODS

3.1. RESEARCH DESIGN

The third molar teeth were studied in individuals who presented within an age range from 16 to 30 years. The methodology was devised to determine the prevalence of impaction among the greater Durban Metropolitan population and to determine if impaction is related to age, sex, side and mandible size using digital panoramic radiographs (orthopantomographs). Ethical Clearance was obtained from the Biomedical Research Ethics Committee (BREC). Ethical Clearance No: BE: 410/13 (Appendix 1).

3.2. SAMPLE SIZE

Four hundred digital panoramic radiographs of patients aged between 16 and 30 years were studied, however only three hundred and forty of those radiographs met the inclusion criteria below (pg. 48). The required information (sex, age and ethnic group) of the patients presenting with an impacted third molar was recorded. This information was kept anonymous and confidential and was saved in a password coded document. The radiographs were obtained from the Radiology Departments of Provincial Hospitals (10%) and Private Practices (90%). The gate-keepers approval for the collection of radiographs was obtained from the CEO of the relevant provincial hospitals, the KwaZulu-Natal Department of Health and the Manager of the Private Practice (Appendix 1). The x-rays were grouped according to sex and age. The ages were categorized in three intervals, viz. 16 - 19; 20 - 25 and 26 - 30 years. A statistician was consulted to confirm the sample size and for statistical analysis methodology.

3.3. DEMOGRAPHIC REPRESENTATION OF THE SAMPLE

3.3.1. Sex Distribution:

In this study 164 male and 176 female patients met the inclusion criteria (Figure 24)

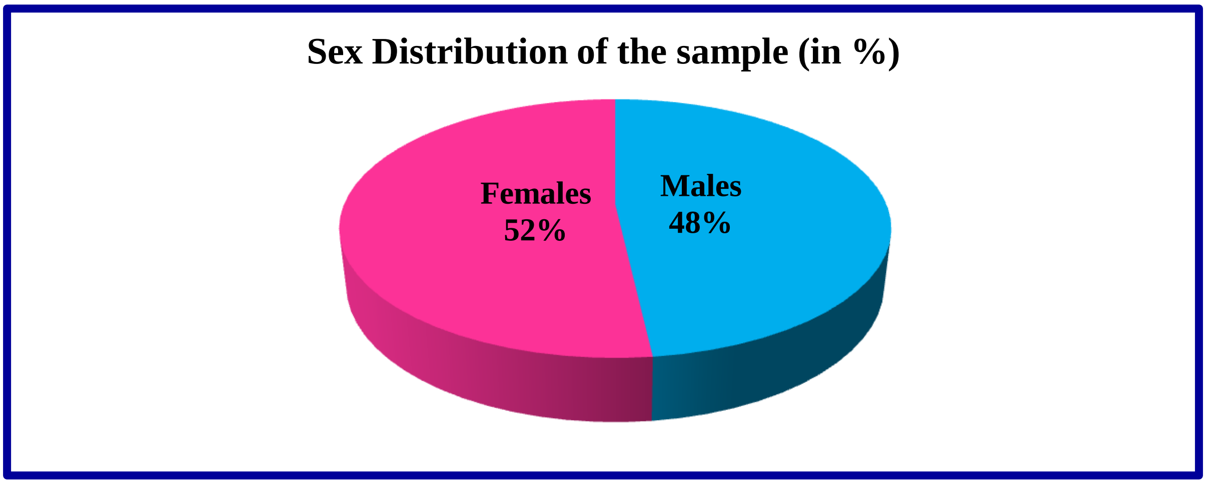


Figure 24: The sexual distribution of the sample (in %)

3.3.2. Age Distribution:

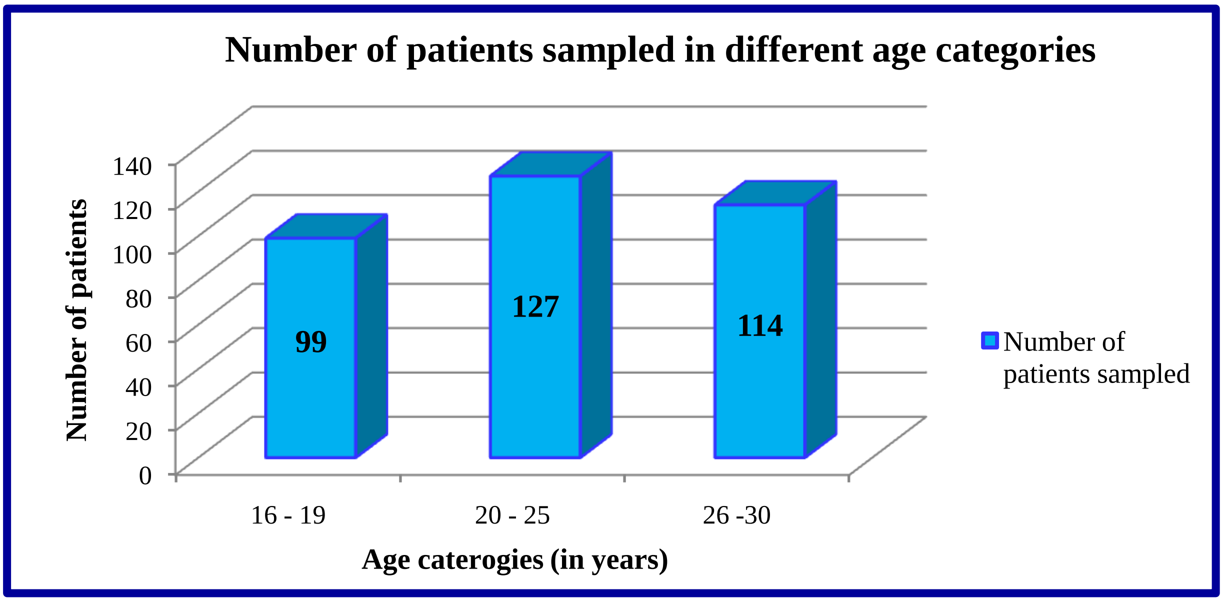


Figure 25: Age distribution of patients according to age categories (in years)

3.3.3. Ethnic Distribution:

All radiographs were obtained by random sampling, this sample included Black (56); Coloured (8); Indian (274) and White (2) ethnic groups (Figure 26).

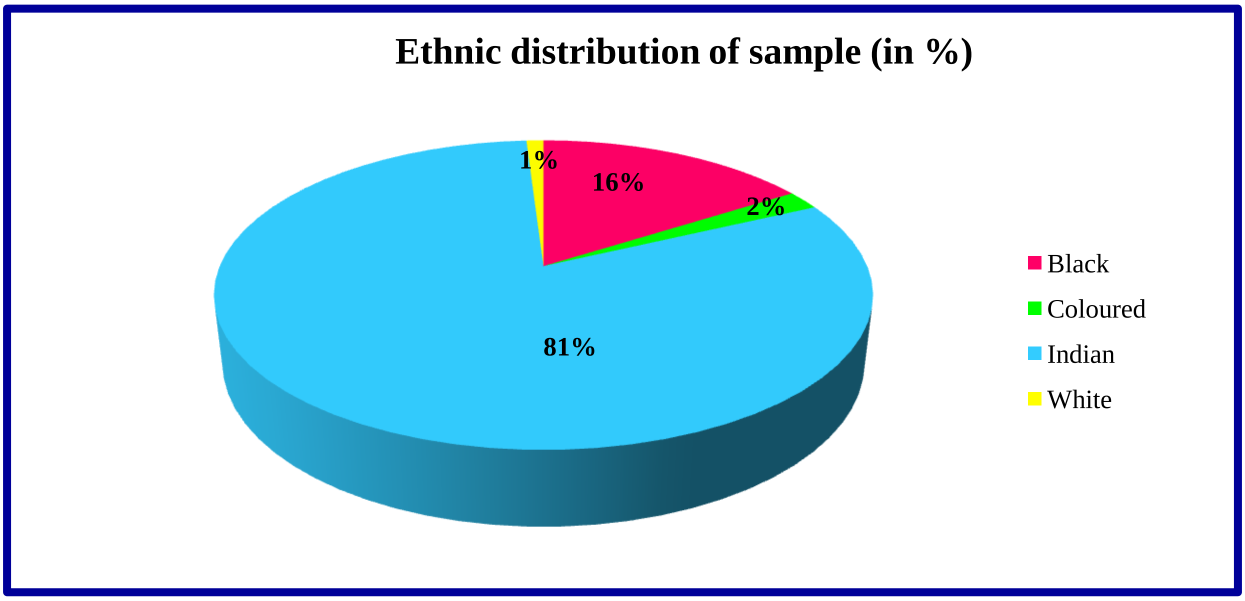


Figure 26: Ethnic distribution of the patients sampled

3.4. SELECTION CRITERIA

3.4.1. Inclusion criteria:

The inclusion criteria of this study were:

- Panoramic radiographs of patients between 16 and 30 years of age
- No history of trauma (No pathology of third molar besides impaction)
- Panoramic radiographs with complete patient records

3.4.2. Exclusion criteria:

The exclusion criteria of this study were:

- Panoramic radiographs of patients of below 16 and above 30 years
- Any fracture of the jaws that may affect the normal growth of permanent dentition
- Panoramic radiographs that showed absence of adjacent second molar
- Poor quality of radiographs (Poor techniques or positioning)

3.5. DATA COLLECTION AND ANALYSIS

3.5.1. Morphological Analysis:

The panoramic radiographs were examined by a single examiner, using a Kodak digital x-ray viewer, to determine the prevalence and characteristics of the impacted third molars in the sample. This also included the angulations and directions of the impacted third molars.

The classifications of the impacted mandibular and maxillary third molar teeth were as follows:

3.5.1.1. Angulation of impacted third molars

The angulations of the impacted third molar was recorded using Winter's classification scheme as previously detailed on pages 21-22 (Tsabedze, 2012; Hashemipour *et al*., 2013)

3.5.1.2. Level of impaction and relation to the ramus of the mandible

The level of impaction was recorded using Pell and Gregory's Classification Scheme as previously detailed on pages 23-25.

3.5.2. Morphometric Analysis:

3.5.2.1. The mandibular size was measured three times as follows:

- The **length of the ramus** of the mandible was recorded from the angle of the mandible to the head of the mandible (B to C) (Figure 27: 1)
- The **width of the ramus** was measured from the posterior point of the head of the mandible to the anterior point on the coronoid process (C to D) (Figure 27: 2)
- The **length of the body** of the mandible was recorded from the mental protuberance to the angle of the mandible (A to E) (Figure 27: 3)

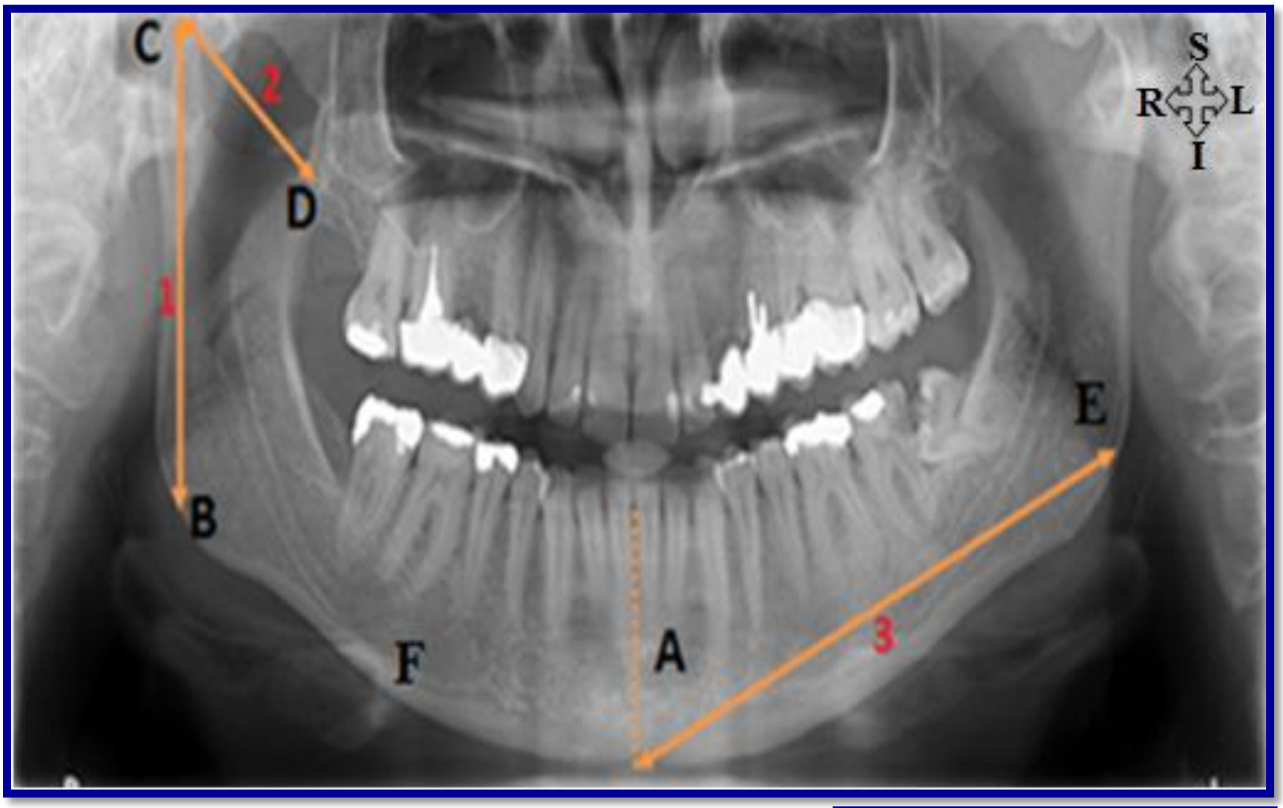


Figure 27: Measurement of the mandible on a panoramic x-ray of the jaw (Adapted http://www.head-face-med.com)

KEY:
A: Mental Protuberance
B: Angle of the mandible (Right side)
C: Head of the mandible
D: Coronoid process of the mandible
E: Angle of the mandible (Left side)
F: Body of the mandible

3.6. STATISTICAL ANALYSIS

The collected data was captured and analyze. A comparison between the different ages, sex and mandiblar size was made using the Statistical Package for Social Sciences (SPSS version 21.0) with the assistance of a biostatistician. The statistics used included the mean, range and standard derivation for each age interval. The Pearson Chi-Square test, Anova and Independent sample T-test was used to analyse the relationship between age, sex and the prevalence of impaction. A 95% confidence level was adhered to for all statistical tests. A p-value of less than 0.05 was considered to be statistically significant. The reliability and validity of this study was maintained by measuring each morphometric parameter three times and an average was calculated and recorded (Appendix 2).

CHAPTER FOUR

RESULTS

4.1. SAMPLE DEMOGRAPHICS

In this study, a total of 340 (164 males; 174 females) digital panoramic radiographs of patients, aged between 16 to 30 years were reviewed and analyzed using the Kodak Digital X-ray Software.

4.2. PREVALENCE OF IMPACTED THIRD MOLAR

Of the 340 panoramic radiographs, 265 (77.9%) were found to have at least one impacted third molar with a male: female ratio of 124:141 (i.e. 1:1.1) (Figure 28). A total of 851 impacted third molar teeth were identified among the 265 patients. The number of impacted third molars varied from 1 to 4 impactions. A majority of patients (60.0%) presented with impaction of viz. i) all four third molars (60.0%), ii) by impaction of two (21.5%), iii) three (9.8%) and iv) one molar tooth (8.7%). The prevalence of these is indicated in Table 11 and Figure 28 and 29 on page 58. In addition, third molar impaction was slightly more prevalent on the left side of the mandible in comparison to the right (Figure 29 – Pg. 58).

Table 11: Prevalence of the number of impacted third molars

No. of Impactions	Males			Females		
	Right	Left	Both	Right	Left	Both
One (Plate 1 and 2)	1	7	8	3	12	15
Two (Plate 3 and 4)	30	30	30	28	26	27
Three (Plate 5 and 6)	21	24	15	15	18	11
Four (Plate 7 and 8)	144	144	72	174	174	87

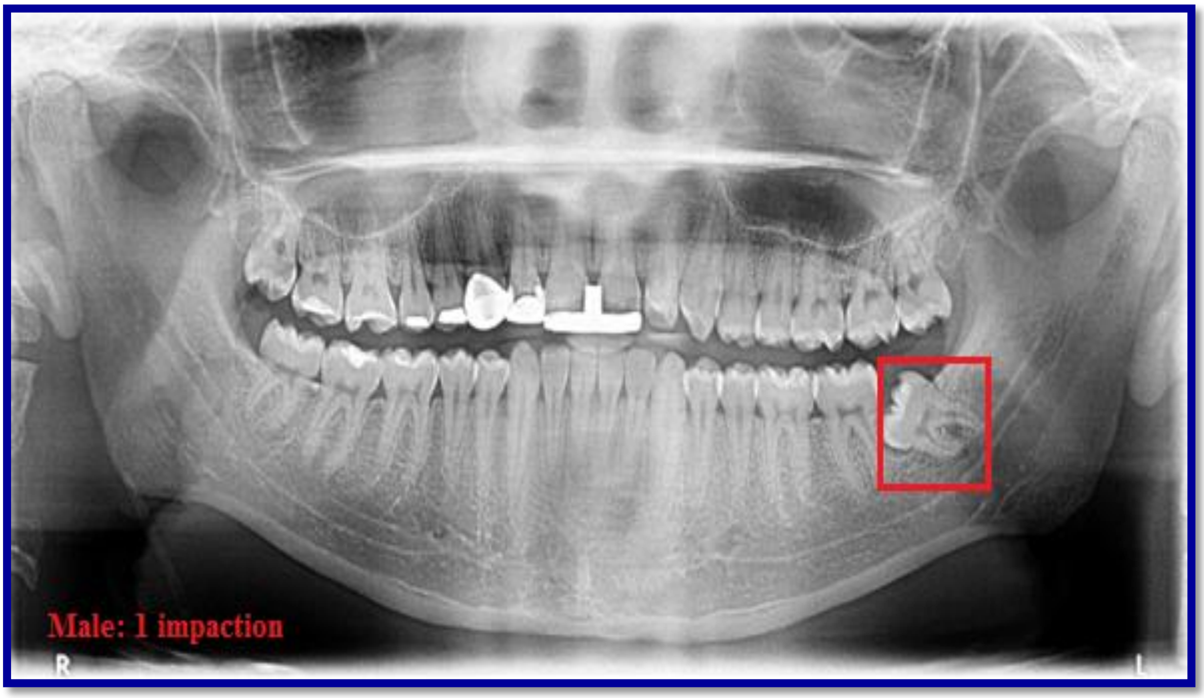


Plate 1: One left third mandible third molar impaction in a male patient

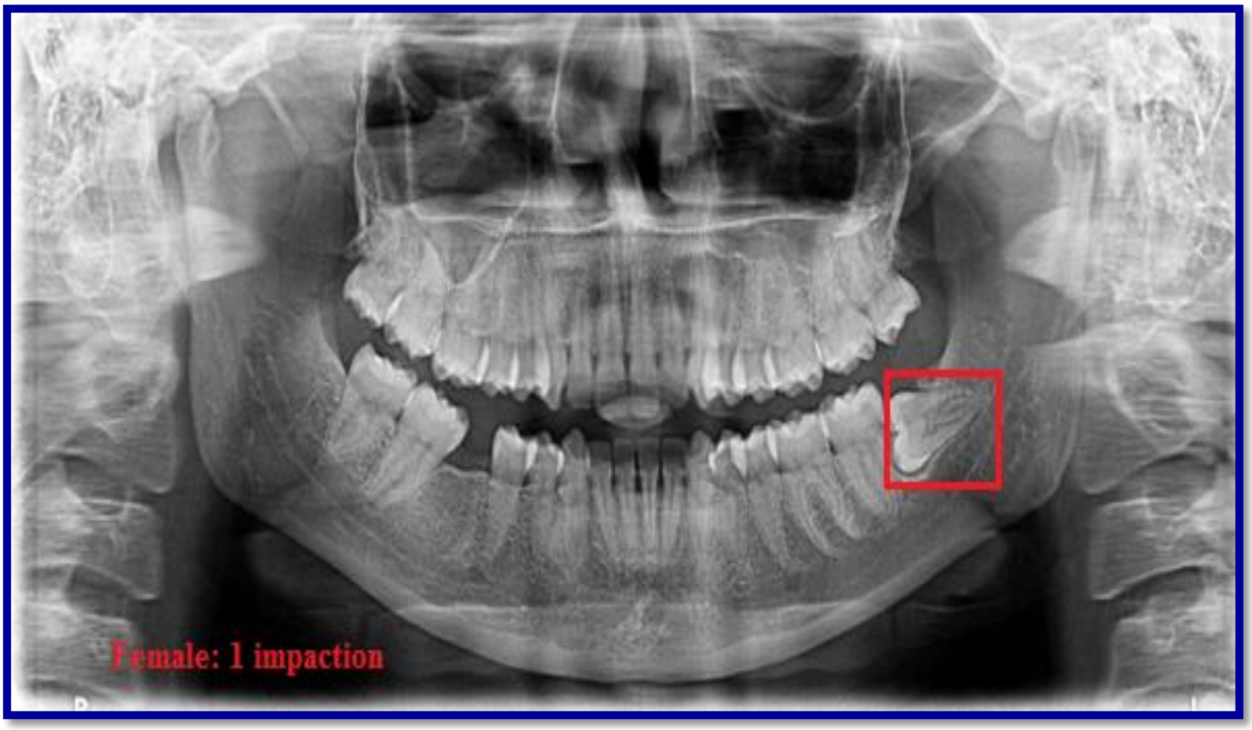


Plate 2: One left third mandible third molar impaction in a female patient

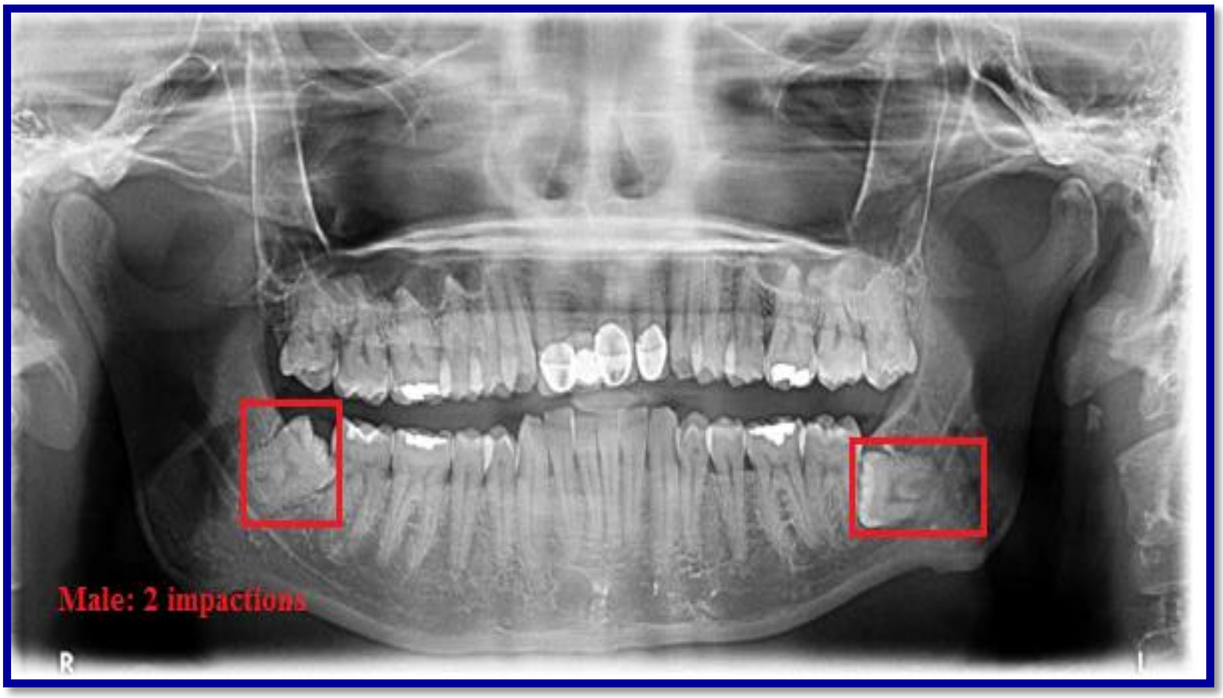


Plate 3: Two third mandible third molar impaction in a male patient

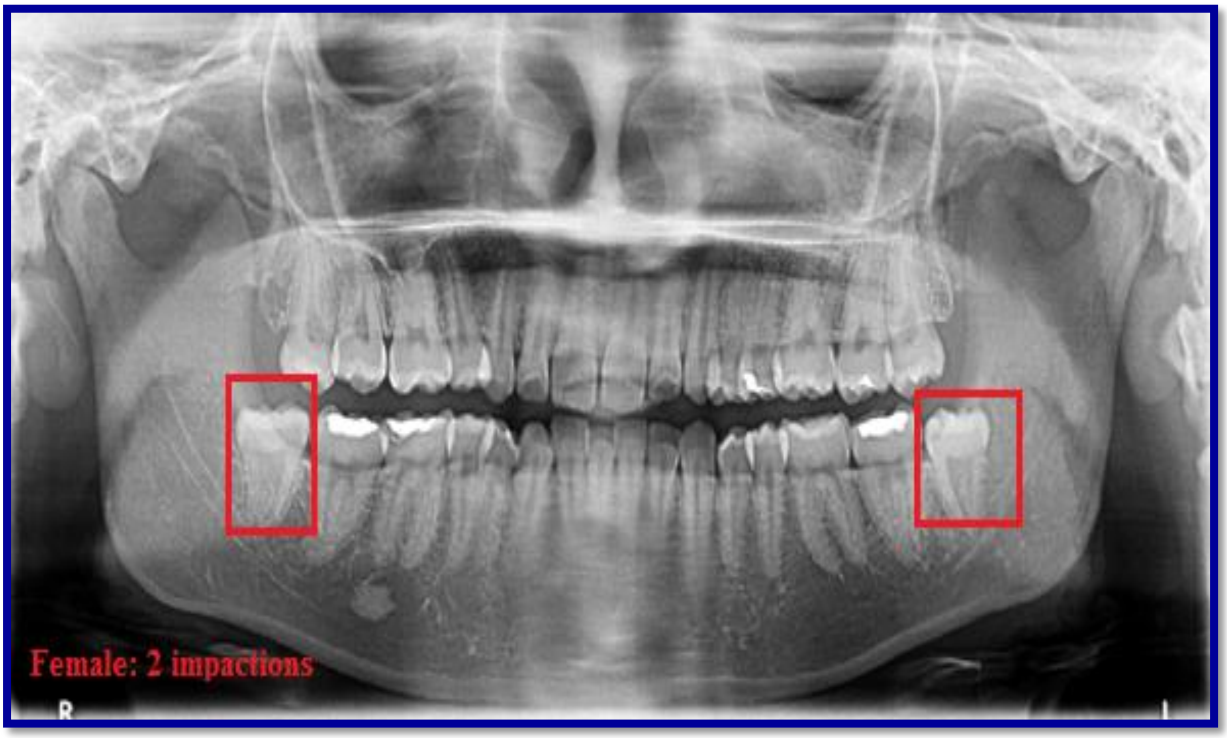


Plate 4: Two mandible third molar impaction in a female patient

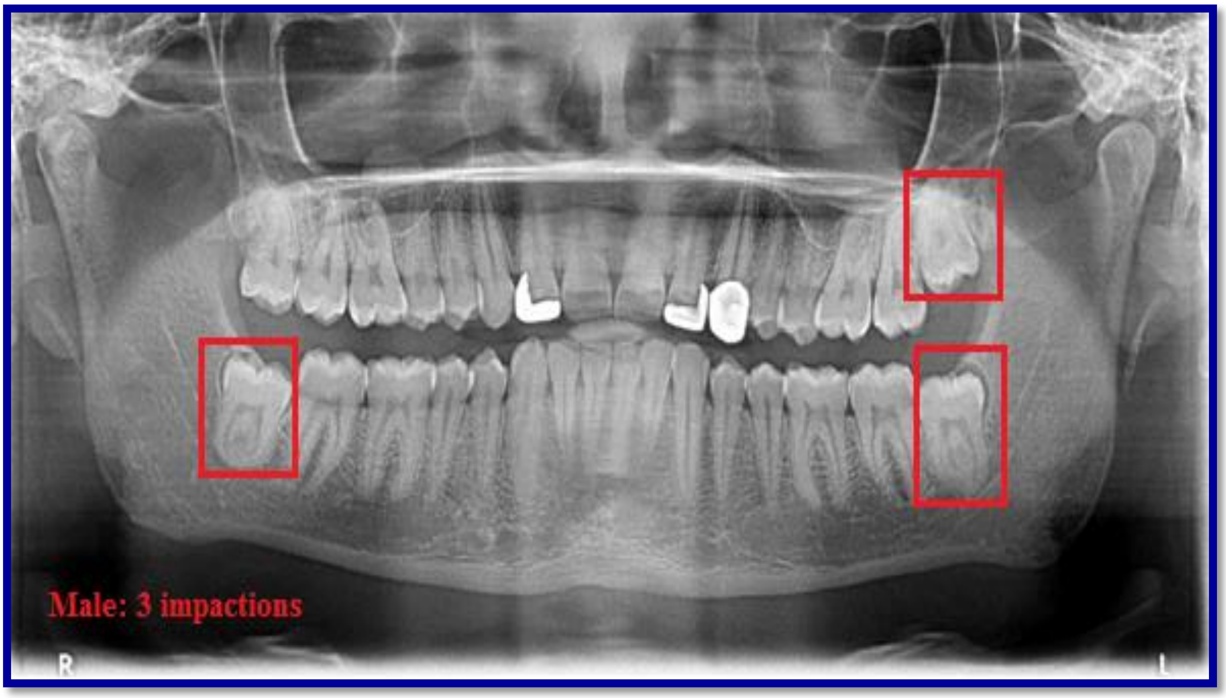


Plate 5: Three third molar impaction in a male patient

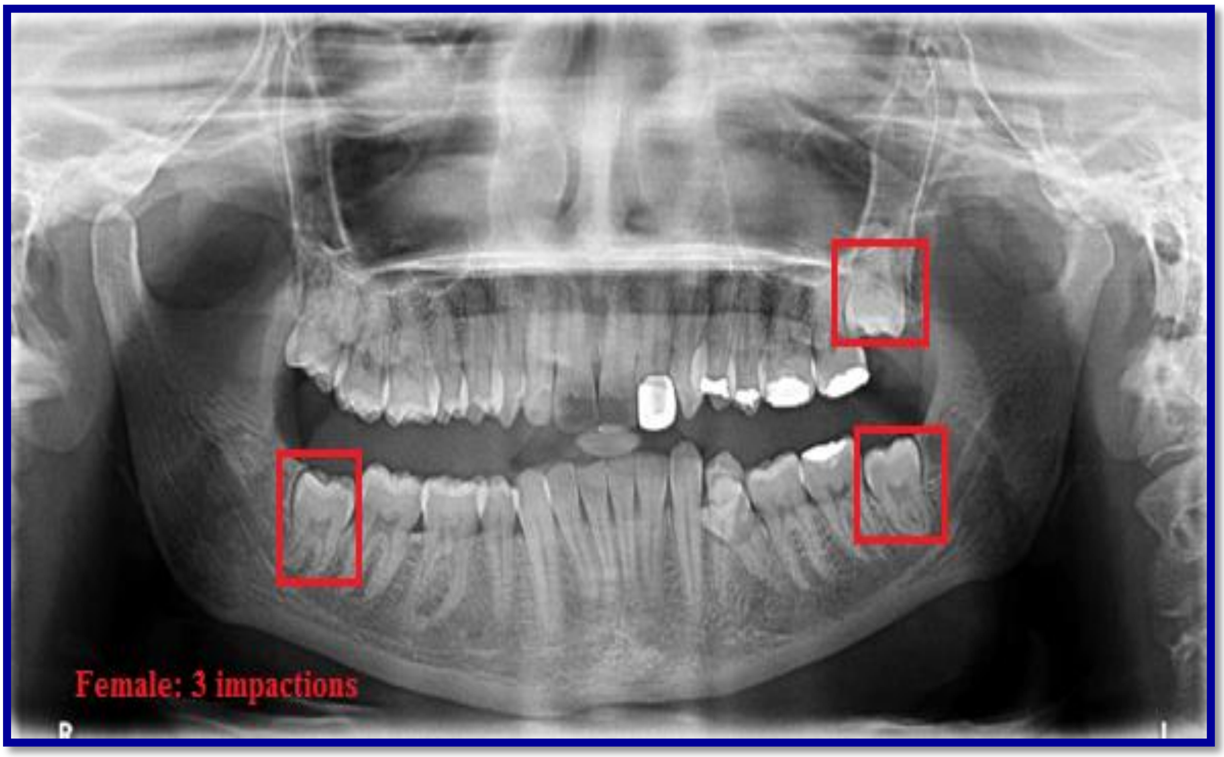


Plate 6: Three third molar impaction in a female patient

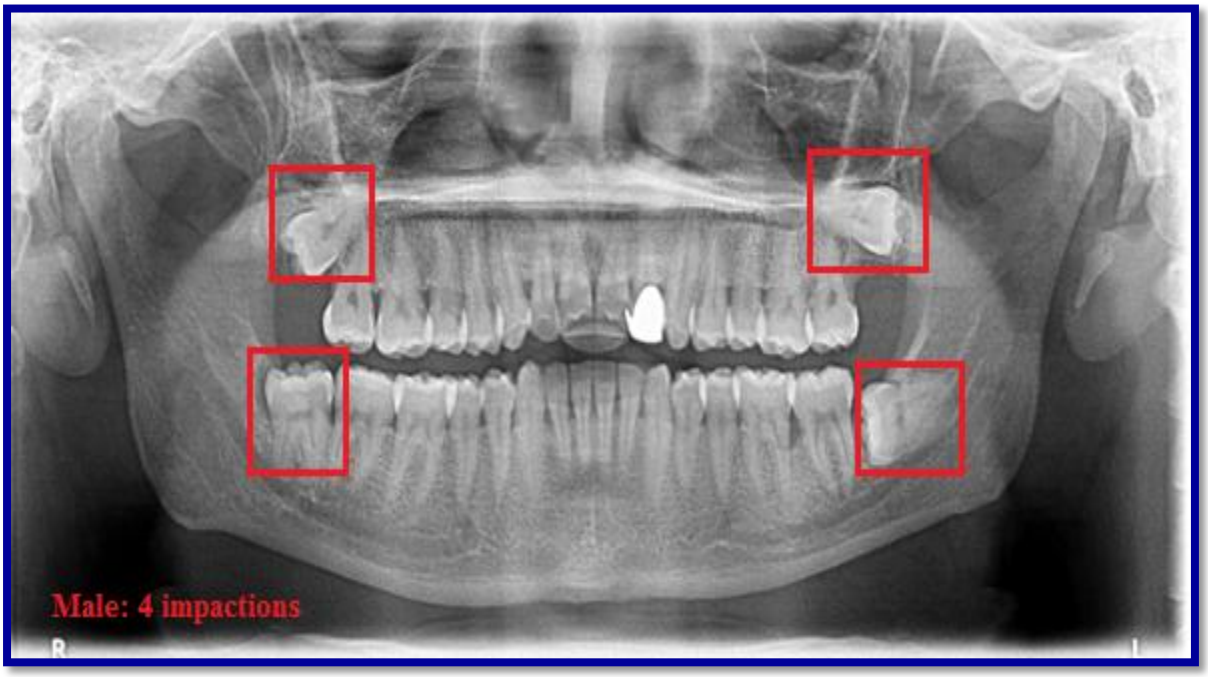


Plate 7: Four third molar impaction in a male patient

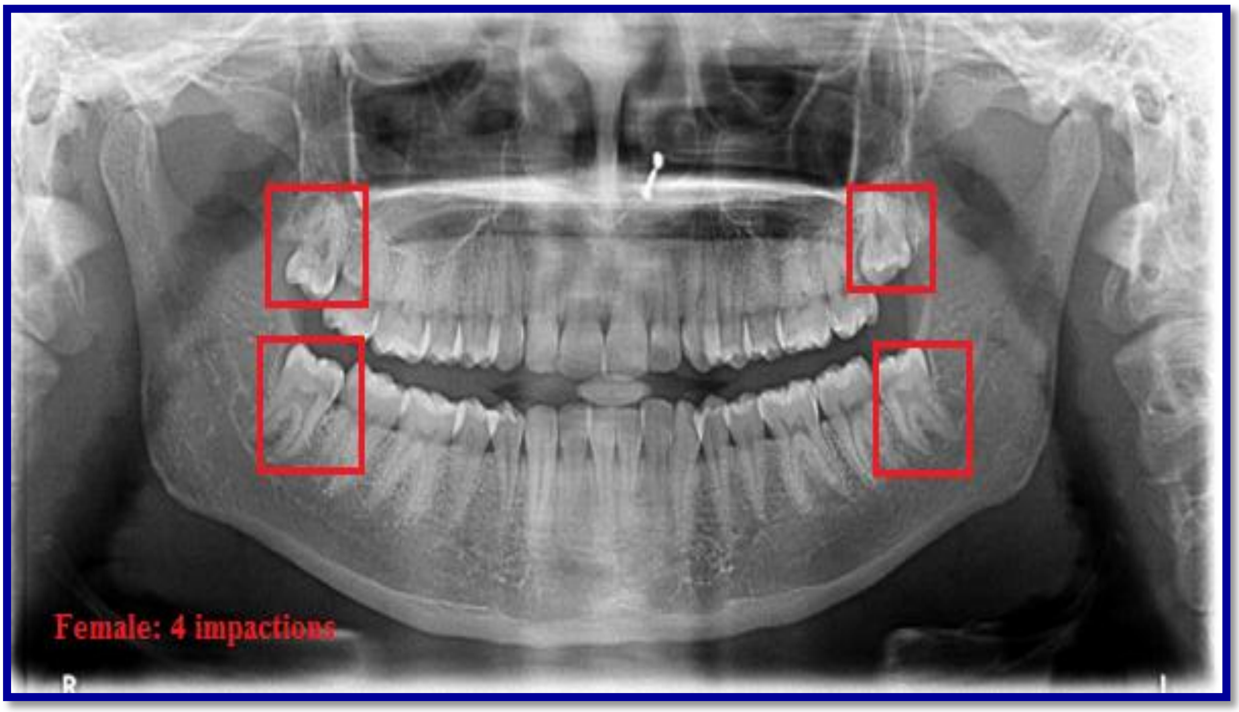


Plate 8: Four third molar impaction in a female patient

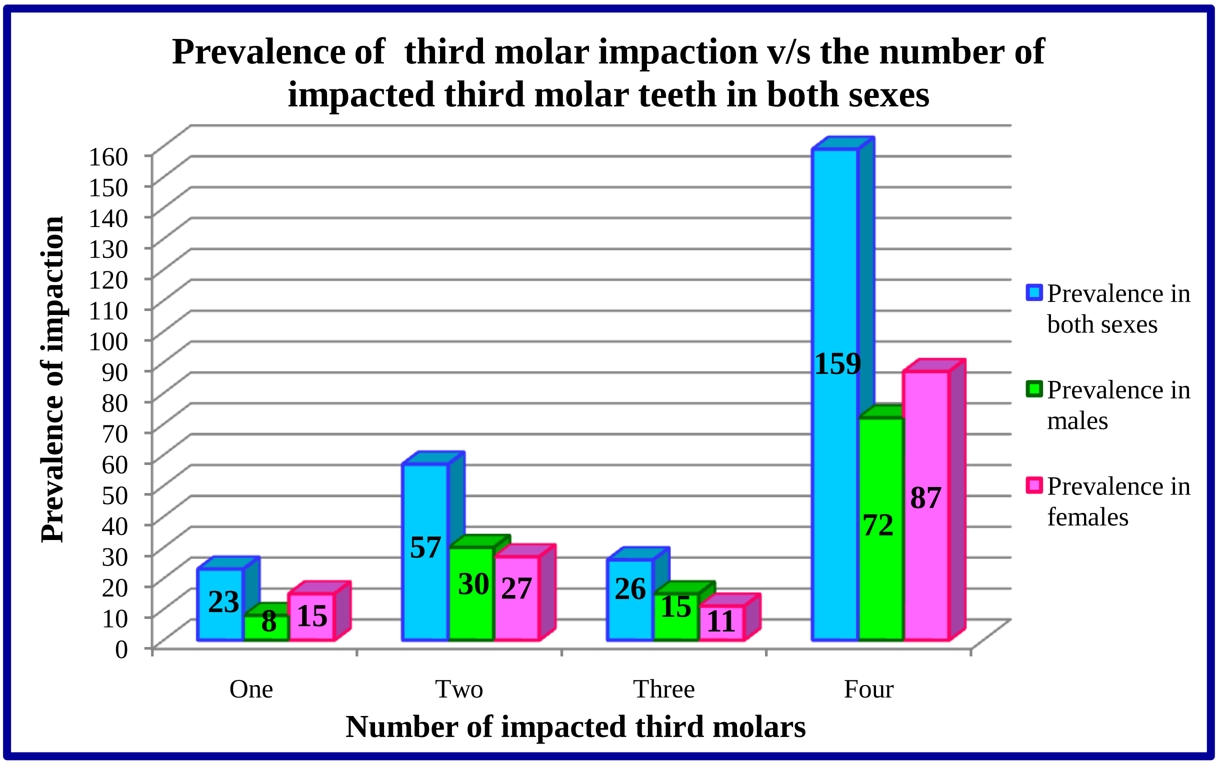


Figure 28: Prevalence of the number of impacted third molar teeth in relation to sex

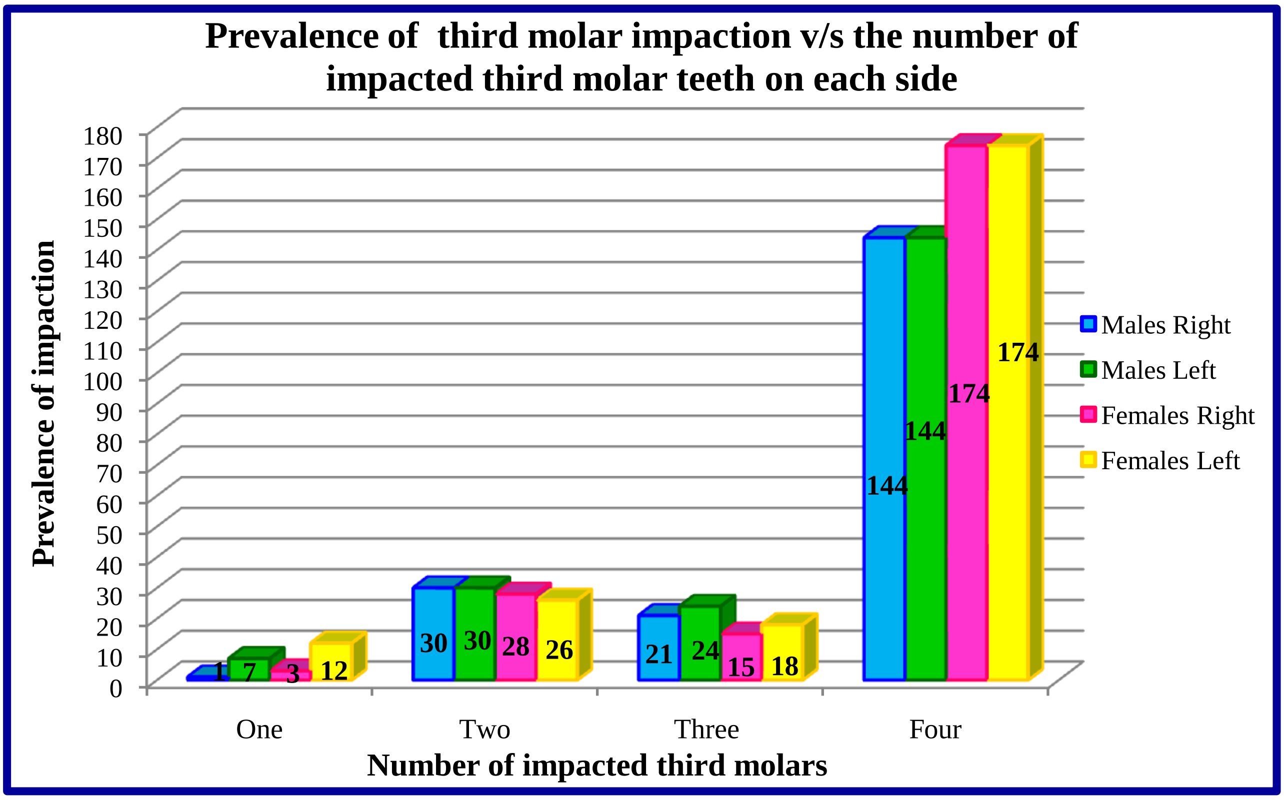


Figure 29: Prevalence of the number of impacted third molar teeth in relation to side

4.3. DISTRIBUTION OF IMPACTED TEETH IN THE MANDIBLE AND MAXILLA

The proportion of impacted mandibular third molars was significantly higher than the impacted maxillary third molar in both sexes (P-value = 0.000) (Table 12). Impacted third molar were 0.3 times more prevalent in the mandible than in the maxilla, with a ratio of 1.3: 1.0, [481:370] respectively (Figure 30). Despite the absence of statistically significant correlations between sex and mandibular and maxillary third molar impaction (P-value = 0.379 and 0.433, respectively), both mandibular and maxillary third molar impaction was recorded to be more prevalent in females than males. The prevalence of these were: a) Mandible: [Females :$\frac{253}{481}$; (52.6%) and Males: $\frac{228}{481}$; (47.4%)]and b) Maxilla:[Females: $\frac{201}{370}$; (54.3%) and Males: $\frac{169}{370}$; (45.7%)] (Table 12 & Figure 30). Third molar impaction was most prevalent of the left side of the mandible and maxilla in both sexes (Table 13). However, no statistically significant correlation between side and impacted mandibular and maxillary third molars in both sexes was recorded (Table 13).

Table 12: Distribution of impaction in the mandible and maxilla in relation to sex (in %)

Area of jaw	Prevalence (in %)			P-value	
	Males	Females	Total	Sex	Mandible v/s Maxilla
Mandible	47.4	52.6	56.5	**0.379**	0.000
Maxilla	45.7	54.3	43.5	**0.433**	

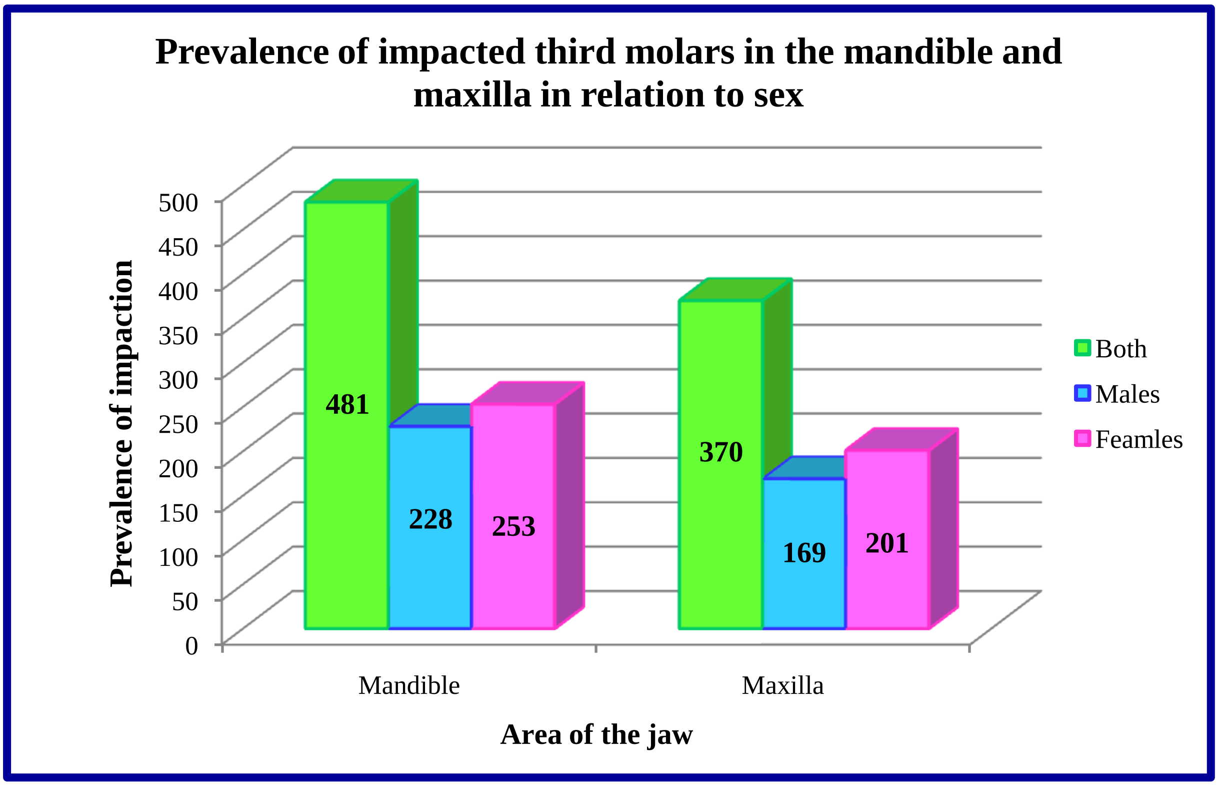


Figure 30: Prevalence of impacted third molars in different regions of the jaw for both sexes

Table 13: Distribution of impaction in the mandible and maxilla in relation to side

Area of jaw	Prevalence						P-value	
	Male		Female		Both		Sex	
	Right	Left	Right	Left	Right	Left	Right	Left
Mandible	112 (57.7%)	116 (57.1%)	126 (56.8%)	127 (54.7%)	238 (57.2%)	243 (55.9%)	**0.990**	**0.124**
Maxilla	82 (42.3%)	87 (42.9%)	96 (43.2%)	105 (45.3%)	178 (42.8%)	192 (44.1%)	**0.195**	**0.640**
Total	194 (48.9%)	203 (51.1%)	222 (48.9%)	232 (51.1%)	416 (48.9%)	435 (51.1%)	**0.889**	**0.901**

4.4. PREVALENCE OF ANGULATION

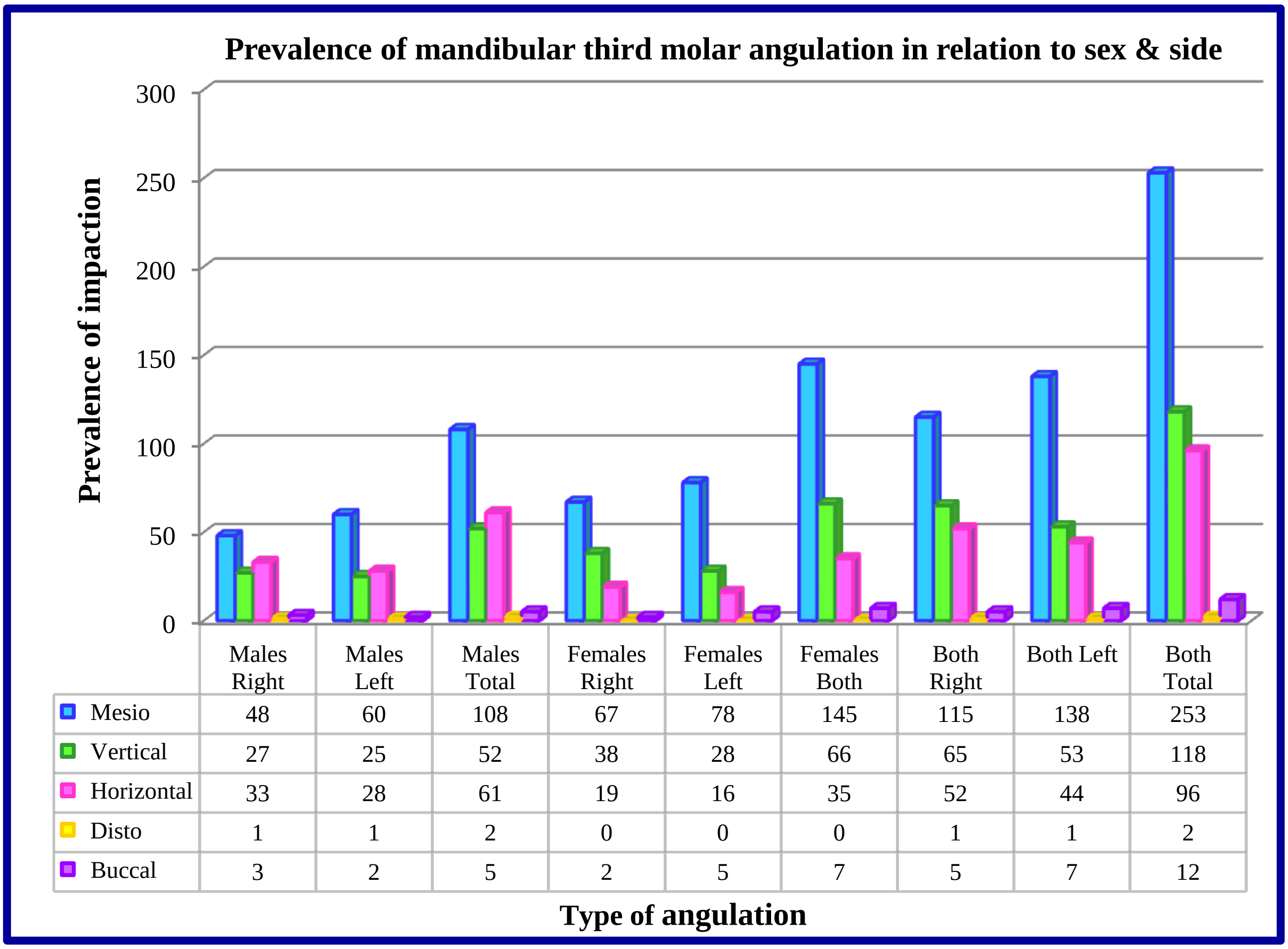
The type of angulation for the impacted third molars was classified according to Winter's Classification Scheme (1926).

4.4.1. Prevalence of mandibular third molar angulation

The most common type of angulation for impacted mandibular third molars in both sexes was mesio-angulation (tilted towards the front of the mouth), followed by vertical angulation (parallel to the adjacent second molar), with the least prevalent being disto angulation (tilted towards the posterior end of the mouth) (Table 14 and Figure 31). The prevalence for the aforementioned was: a) $\frac{253}{481}$ [52.6%]; b) $\frac{118}{481}$ [24.5%] and c) $\frac{2}{481}$ [0.4%], respectively (Table 14 and Figure 31). For the correlation with age, only the type of angulation for the left side of the mandible was statistically significant (P-value = 0.006) (Table 14).

Table 14: Prevalence of mandibular third molar angulation according to Winter's classification (in %)

Type of Impaction	Prevalence (in %)							P-Values			
	Males			Females			Both	Sex		Age	
	Right	Left	Total	Right	Left	Total	Total	Right	Left	Right	Left
Mesio-angulation (Plate 9)	21.1	26.3	**47.4**	26.5	30.8	**57.3**	**52.6**	0.099	0.124	0.077	0.006
Vertical angulation (Plate 10)	11.8	11.0	**22.8**	15.0	11.1	**26.1**	**24.5**				
Horizontal angulation (Plate 11)	14.5	12.3	**26.8**	7.5	6.3	**13.8**	**20.0**				
Buccal angulation (Plate 12)	1.3	0.9	**2.2**	0.8	2.0	**2.8**	**2.5**				
Disto angulation (Plate 13)	0.4	0.4	**0.8**	0.0	0.0	**0.0**	**0.4**				



	Males Right	Males Left	Males Total	Females Right	Females Left	Females Both	Both Right	Both Left	Both Total
Mesio	48	60	108	67	78	145	115	138	253
Vertical	27	25	52	38	28	66	65	53	118
Horizontal	33	28	61	19	16	35	52	44	96
Disto	1	1	2	0	0	0	1	1	2
Buccal	3	2	5	2	5	7	5	7	12

Figure 31: Prevalence of impacted third molars angulation in the mandible

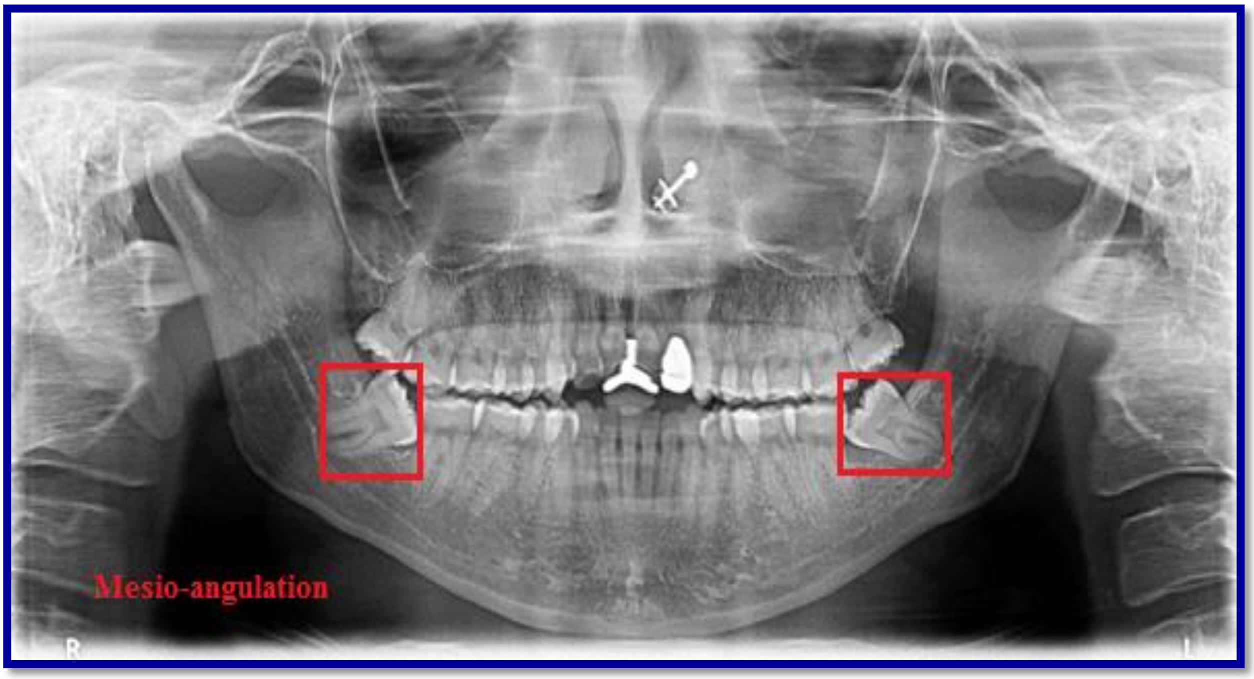


Plate 9: Mesio-angulation impaction of the mandibular third molars

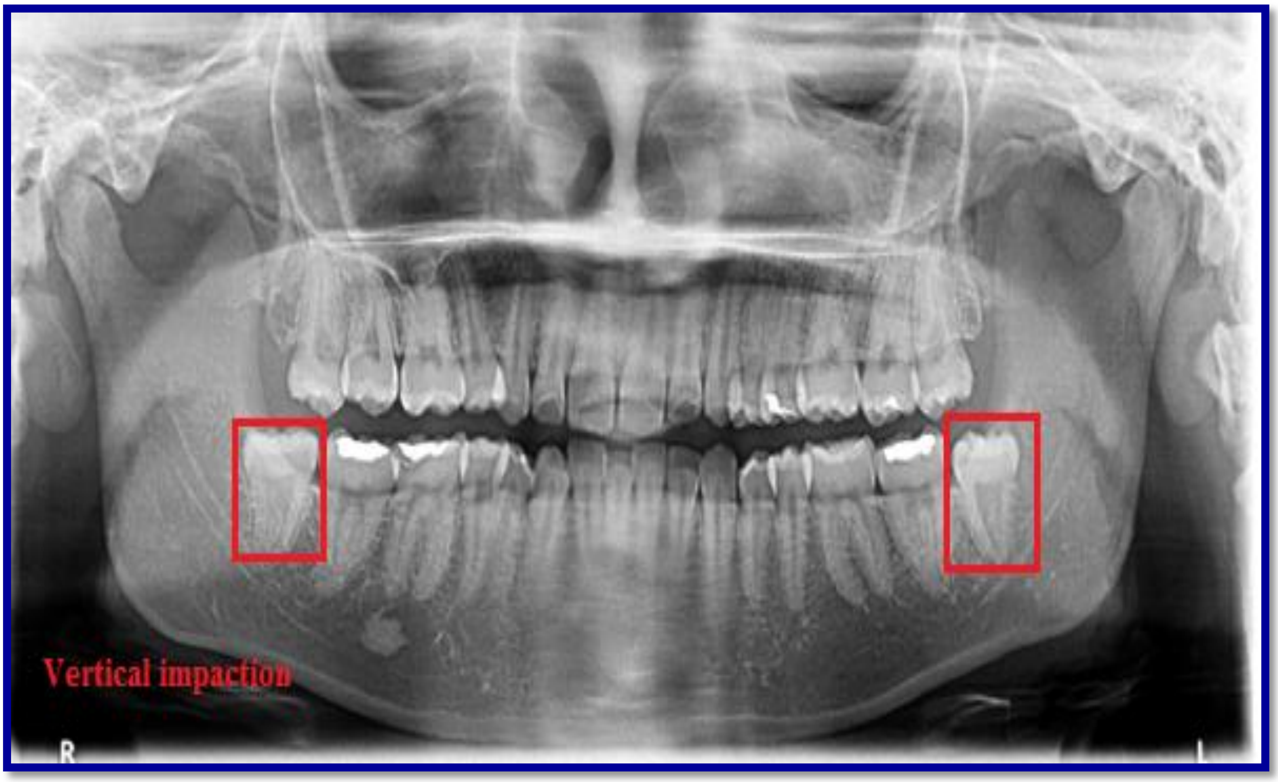


Plate 10: Vertical impaction of the mandibular third molars

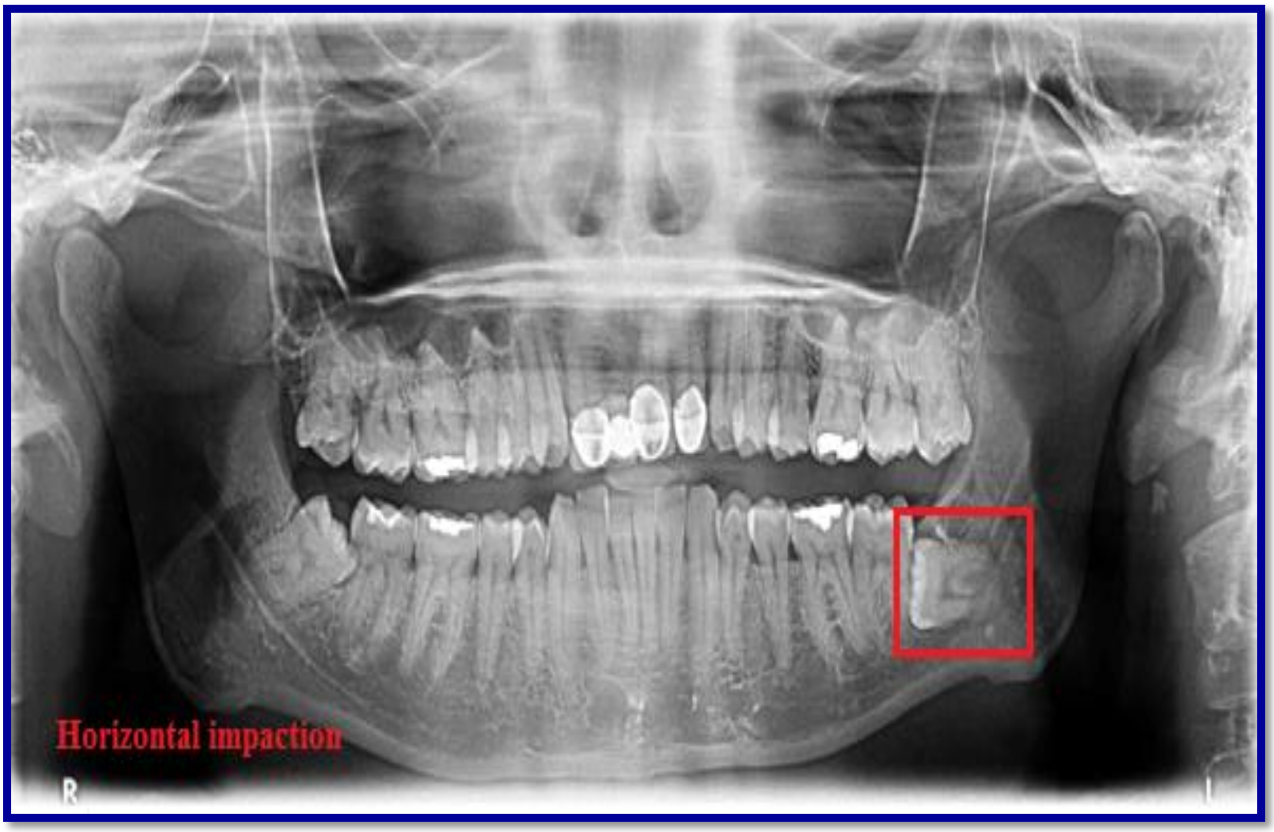


Plate 11: Horizontal impaction of the mandibular third molars

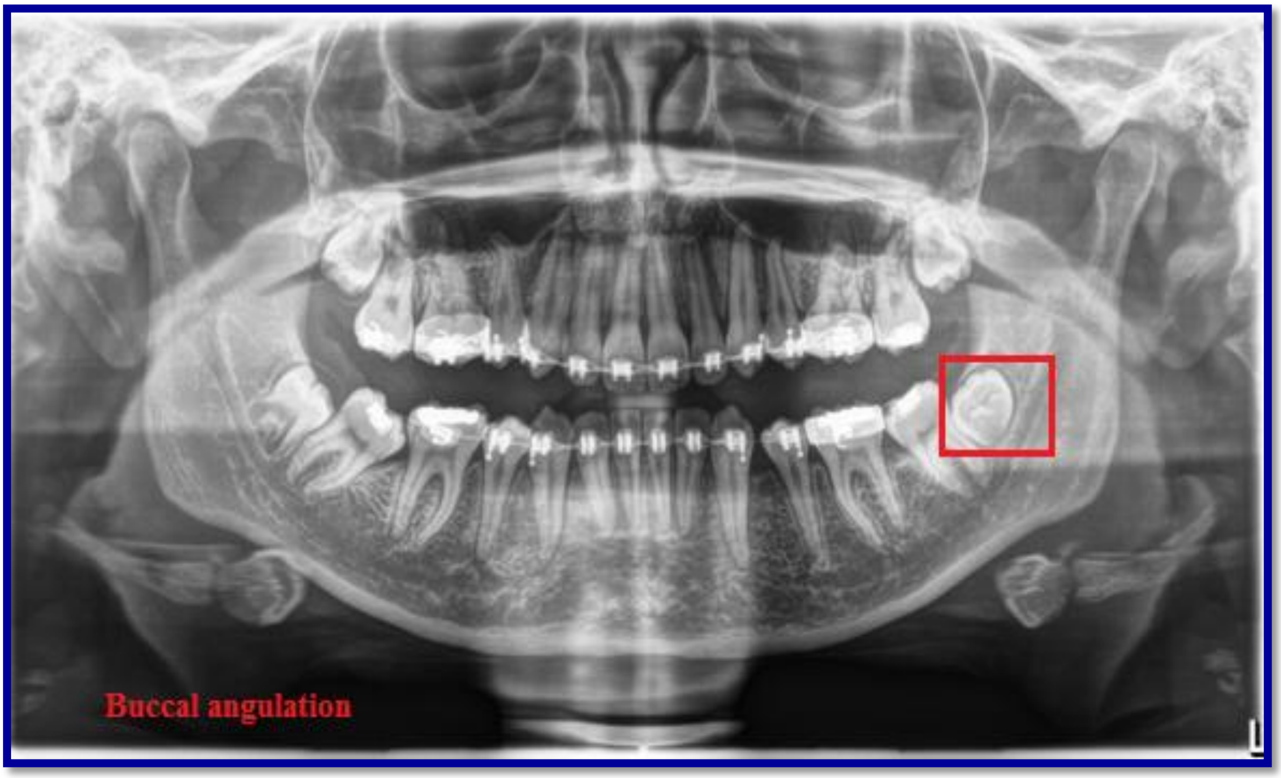


Plate 12: Buccal impaction of the mandibular third molars

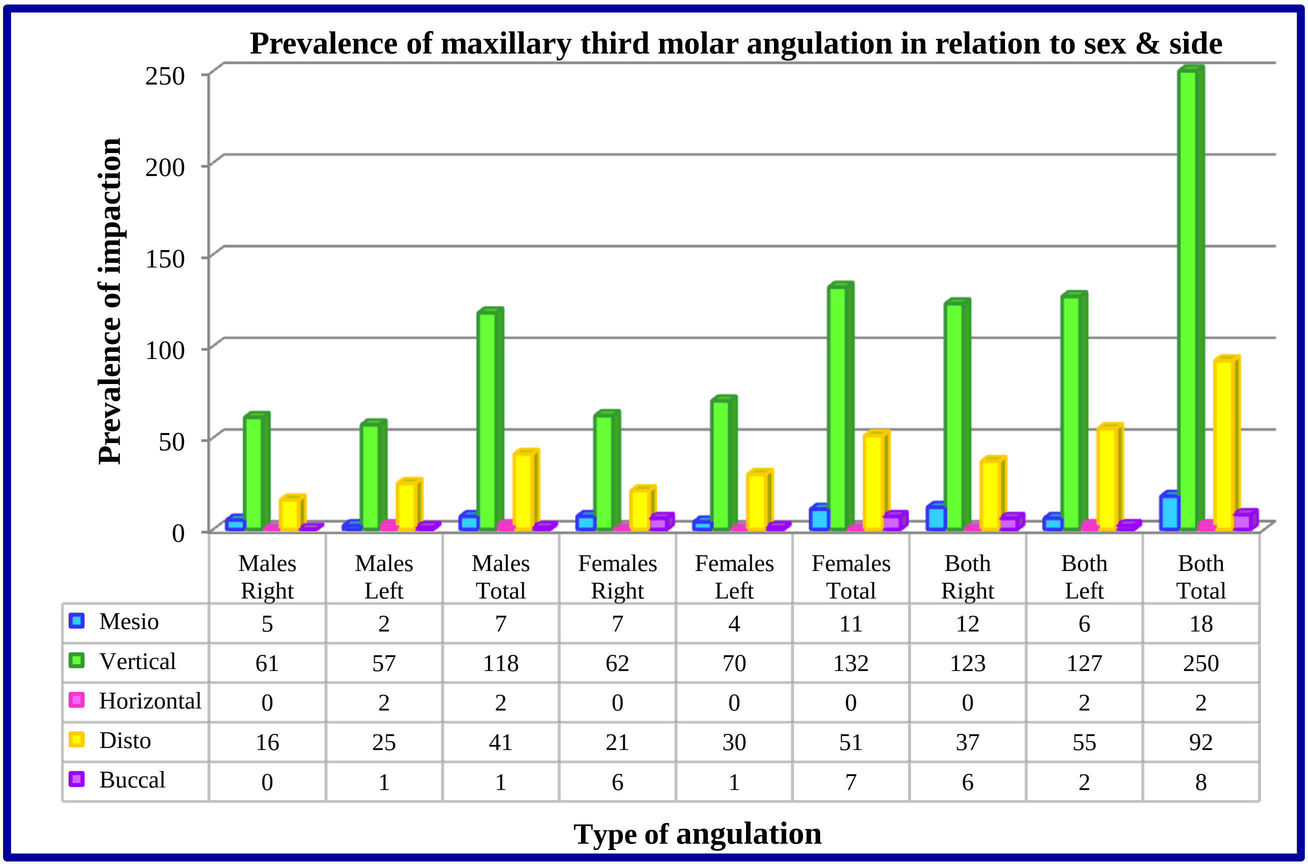
Plate 13: Disto-angulation impaction of the mandibular third molars

4.4.2. Prevalence of maxillary third molar angulation

The most prevalent type of angulation for impacted maxillary third molars in both males and females was vertical angulation, followed by disto angulation, with the least prevalent being horizontal angulation (Table 1). The prevalence for the aforementioned was: a) $\frac{250}{370}$ [67.6%]; b) $\frac{92}{370}$ [24.9%] and c) $\frac{2}{370}$ [0.5%], respectively (Table 1). A statistically significant relationship between the type of impaction the maxilla and age was recorded (P-value = 0.000) (Table 1).

Table 15: Prevalence of maxillary third molar angulation according to Winter's classification (in %)

Type of Impaction	Prevalence (in %)							P-Values			
	Males			Females			Both	Sex		Age	
	Right	Left	Total	Right	Left	Total	Total	Right	Left	Right	Left
Vertical angulation (Plate 14)	36.1	33.7	**69.8**	30.8	34.8	**65.6**	**67.6**	**0.195**	**0.640**	**0.000**	**0.000**
Disto angulation (Plate 15)	9.5	14.8	**24.3**	10.4	14.9	**25.3**	**24.9**				
Mesio-angulation (Plate 16)	3.0	1.2	**4.2**	3.5	2.0	**5.5**	**4.9**				
Buccal angulation (Plate 17)	0.0	0.6	**0.6**	3.0	0.5	**3.5**	**2.2**				
Horizontal angulation (Plate 18)	0.0	1.2	**1.2**	0.0	0.0	**0.0**	**0.5**				



	Males Right	Males Left	Males Total	Females Right	Females Left	Females Total	Both Right	Both Left	Both Total
Mesio	5	2	7	7	4	11	12	6	18
Vertical	61	57	118	62	70	132	123	127	250
Horizontal	0	2	2	0	0	0	0	2	2
Disto	16	25	41	21	30	51	37	55	92
Buccal	0	1	1	6	1	7	6	2	8

Figure 32: Prevalence of impacted third molars angulation in the maxilla

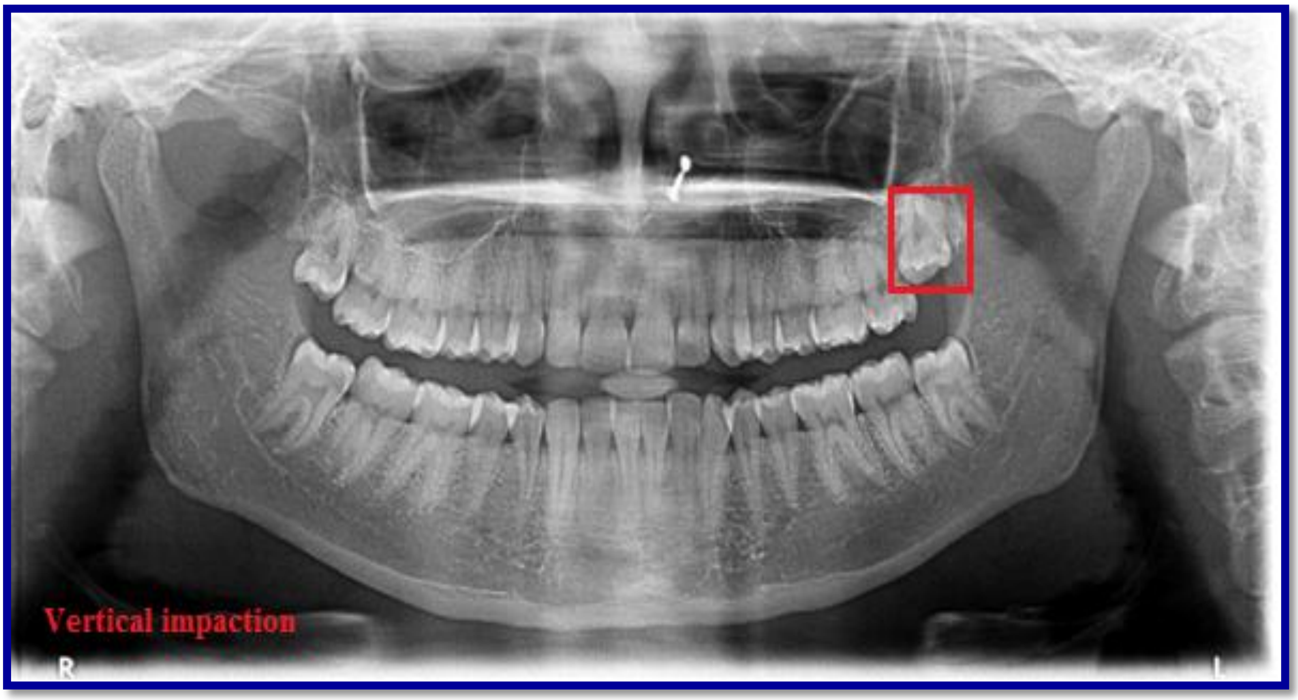


Plate 14: Vertical angulation impaction of the maxillary third molars

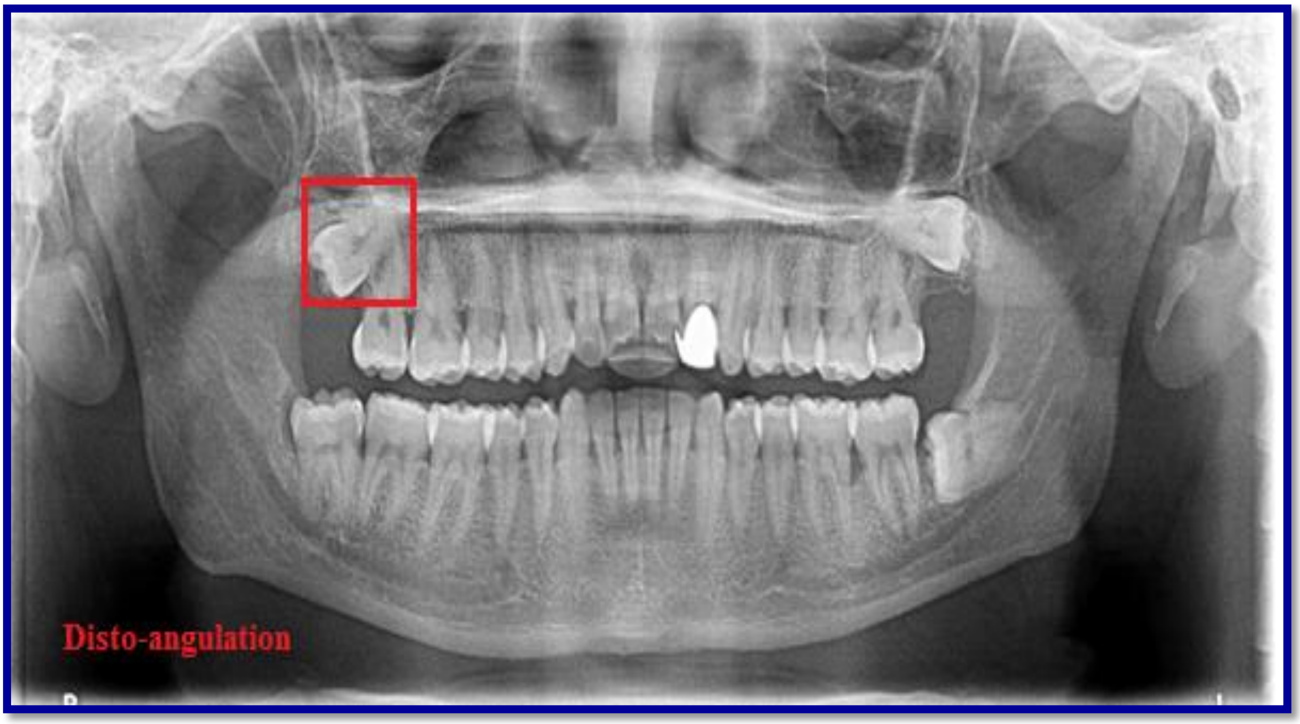


Plate 15: Disto-angulation impaction of the maxillary third molars

Plate 16: Mesio-angulation impaction of the maxillary third molars

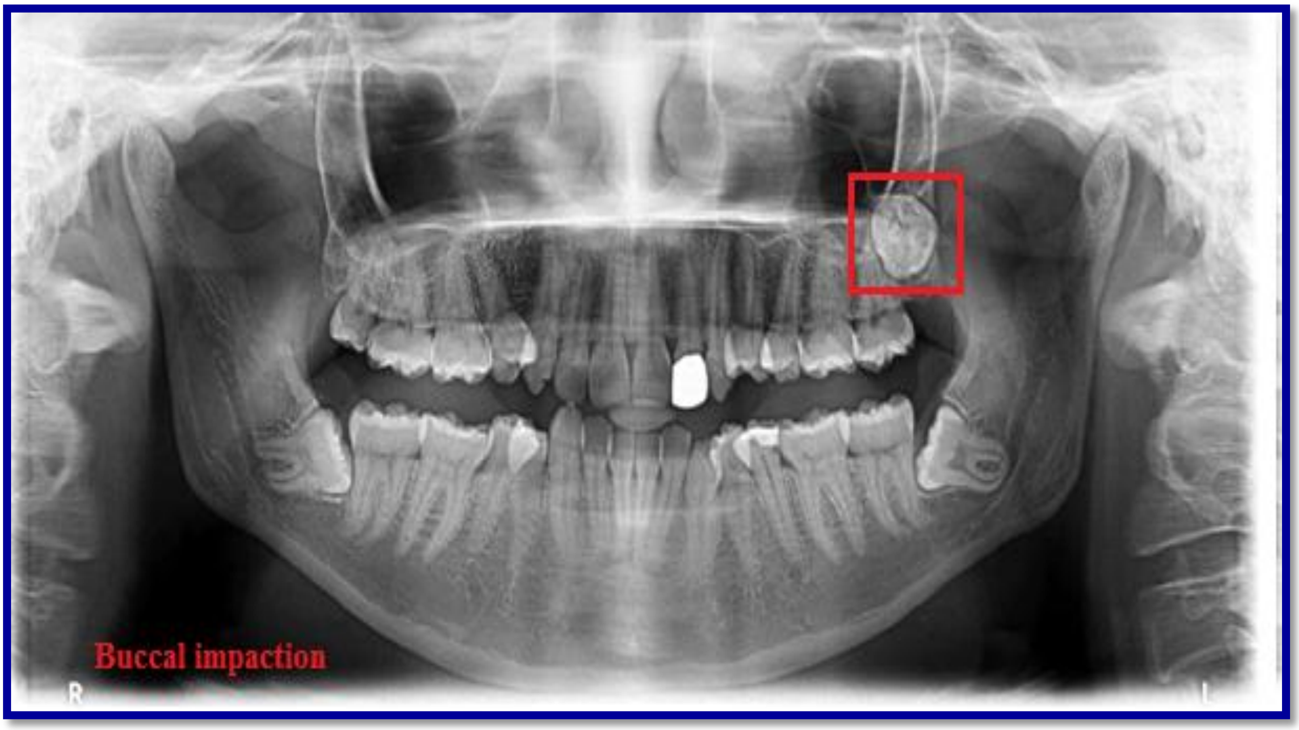


Plate 17: Buccal impaction of the maxillary third molars

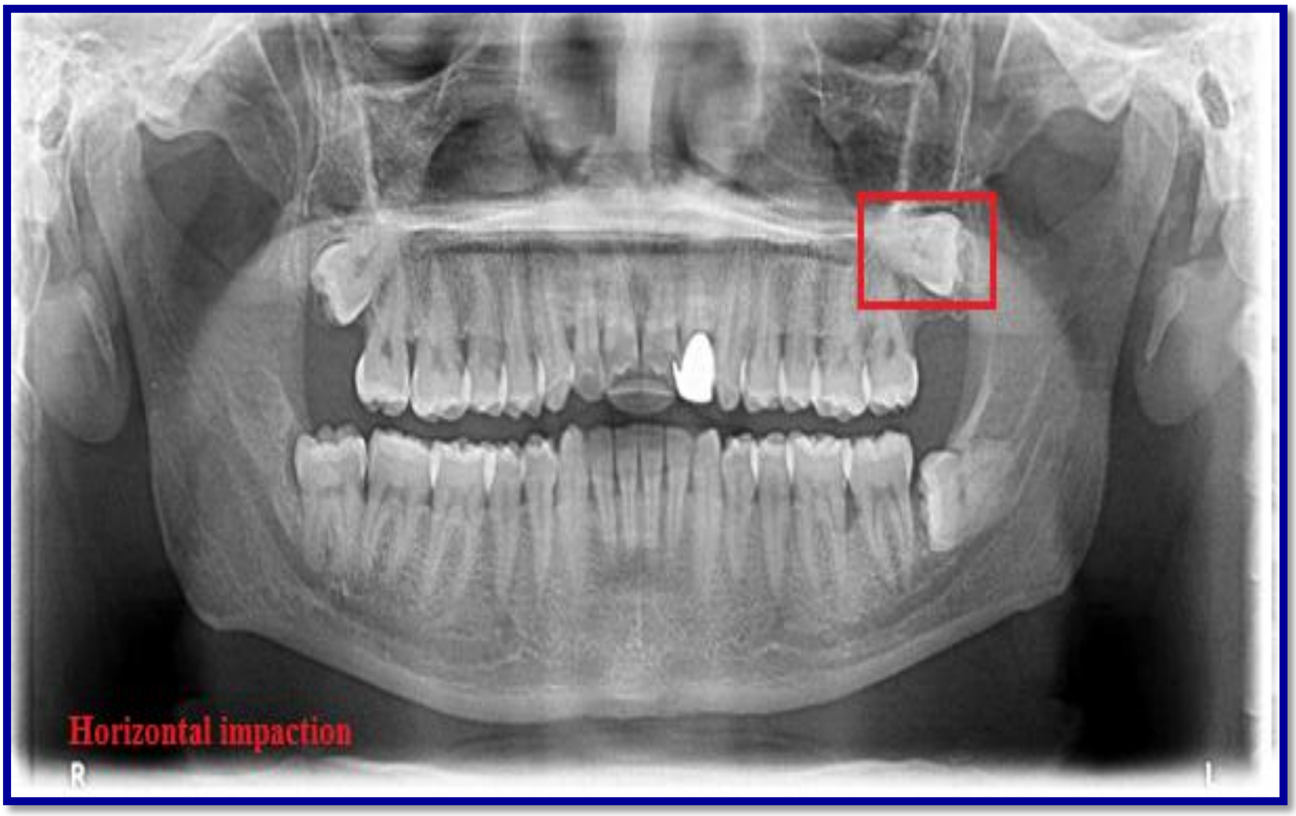


Plate 18: Horizontal angulation impaction of the maxillary third molars

4.5. PREVALENCE OF THE LEVEL OF IMPACTION IN THE MANDIBLE AND MAXILLA

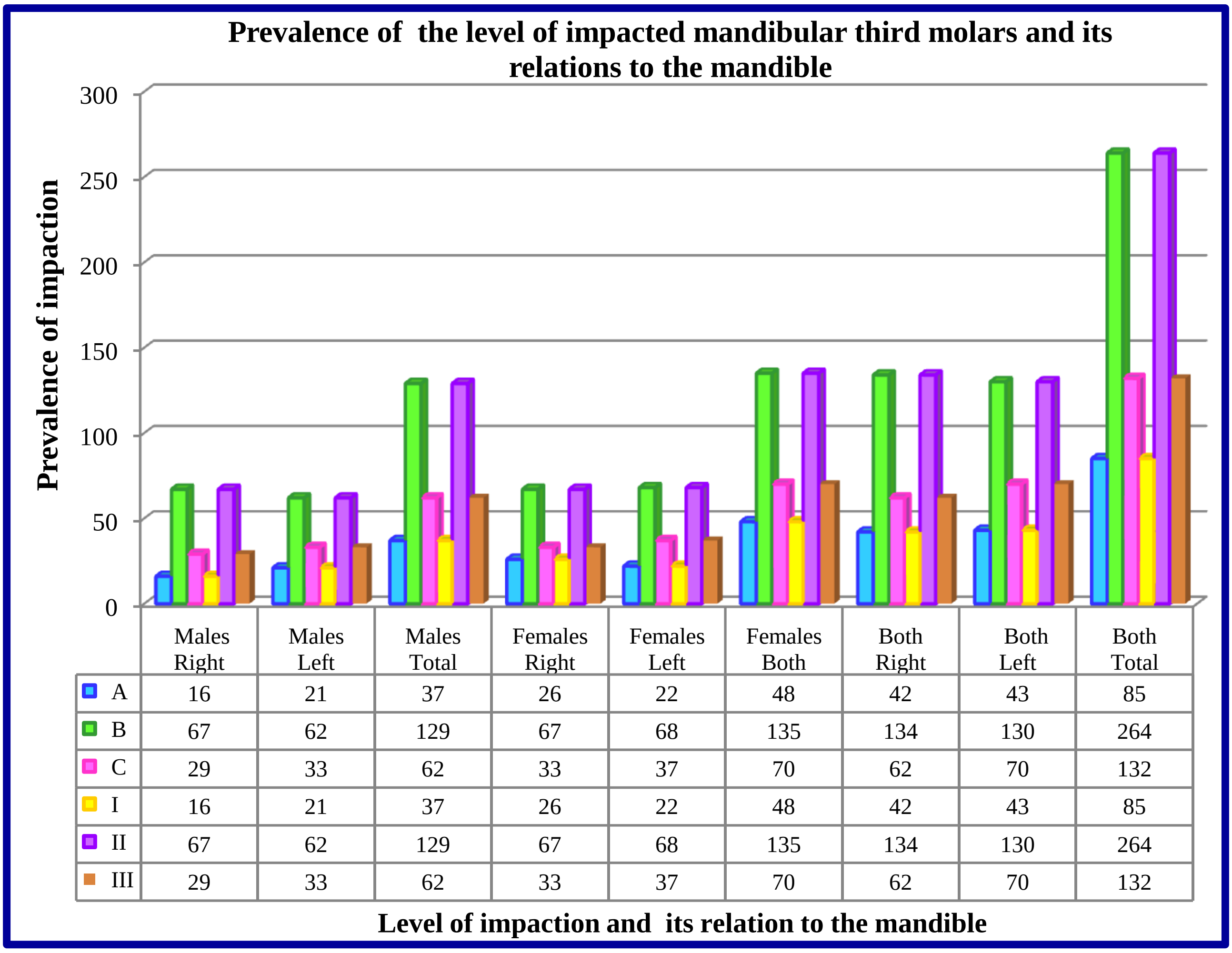
The level of impaction is determined by the depth of the impacted third molar in relation to the occlusal plane along the distance from mandibular ramus to the posterior surface of the adjacent second molar.

4.5.1. Depth of the mandibular third molar impaction and its relations to mandible

According to the Pell and Gregory classification scheme (1933), this study recorded class IIB to be the most prevalent type of mandibular third molar impaction, followed by class IIIC, with the least prevalent class being IA, with a prevalence of a) $\frac{264}{481}$ [67.6%]; b) $\frac{134}{481}$ [24.9%] and c) $\frac{86}{481}$ [17.7%], respectively (Table 16 and Figure 33). A statistically significant relationship was recorded between each parameter and age (P-value = 0.000) (Table 16).

Table 16: Prevalence of mandibular third molar impaction according to Pell and Gregory's classification (in %)

Classification	Class	Prevalence (in %)							P-Value			
		Males			Females			Both	Sex		Age	
		Right	Left	Total	Right	Left	Total		Right	Left	Right	Left
Level of Impaction (Plate 19 – 21)	A	3.3	4.4	**8.7**	5.4	4.6	**9.0**	**17.7**	**0.545**	**0.782**	**0.000**	**0.000**
	B	13.9	12.9	**27.8**	13.9	14.1	**27.0**	**54.8**				
	C	6.0	6.9	**12.9**	6.9	7.7	**14.6**	**27.5**				
Relation to mandible (Plate 22 – 24)	I	3.3	4.4	**8.7**	5.4	4.6	**9.0**	**17.7**	**0.596**	**0.790**	**0.000**	**0.000**
	II	13.9	12.9	**27.8**	13.9	14.1	**27.0**	**54.8**				
	III	6.0	6.9	**12.9**	6.9	7.7	**14.6**	**27.5**				



	Males Right	Males Left	Males Total	Females Right	Females Left	Females Both	Both Right	Both Left	Both Total
A	16	21	37	26	22	48	42	43	85
B	67	62	129	67	68	135	134	130	264
C	29	33	62	33	37	70	62	70	132
I	16	21	37	26	22	48	42	43	85
II	67	62	129	67	68	135	134	130	264
III	29	33	62	33	37	70	62	70	132

Figure 33: Prevalence of the level of impacted mandibular third molars and its relations to the mandible in both sexes and side

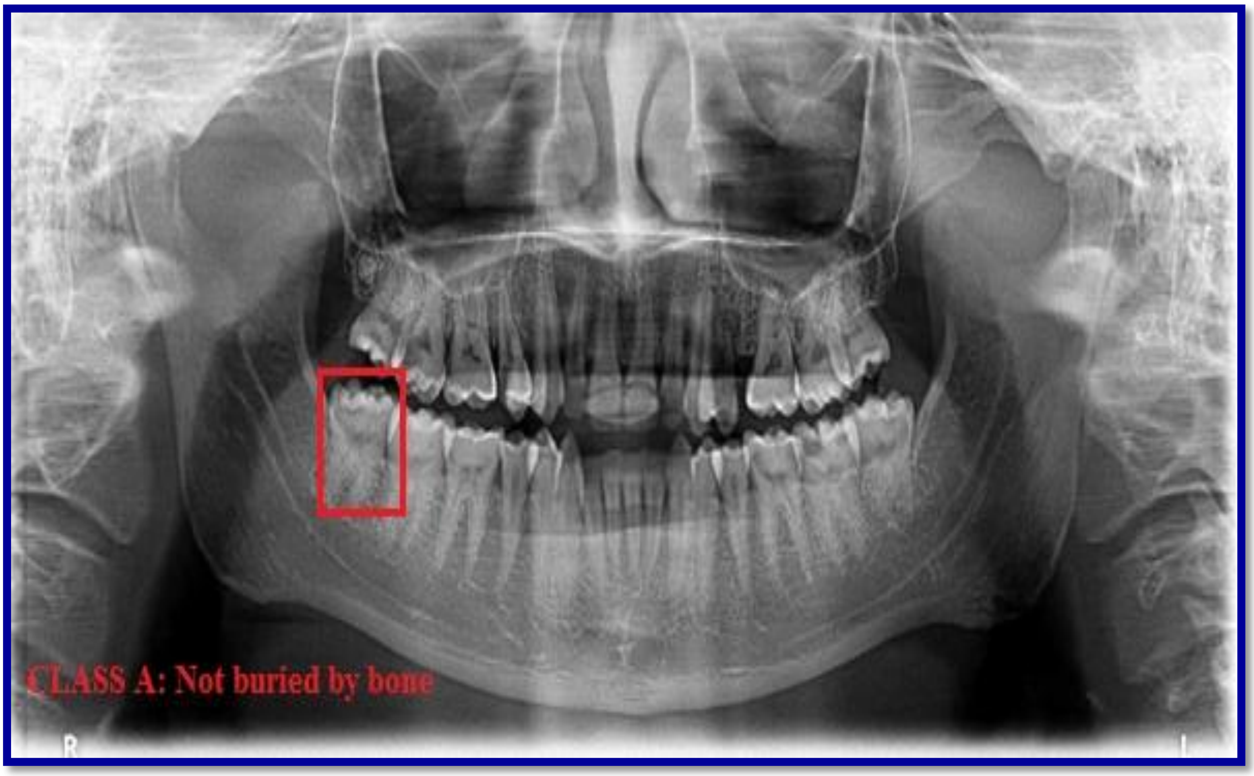


Plate 19: Class A – Mandibular third molar impaction

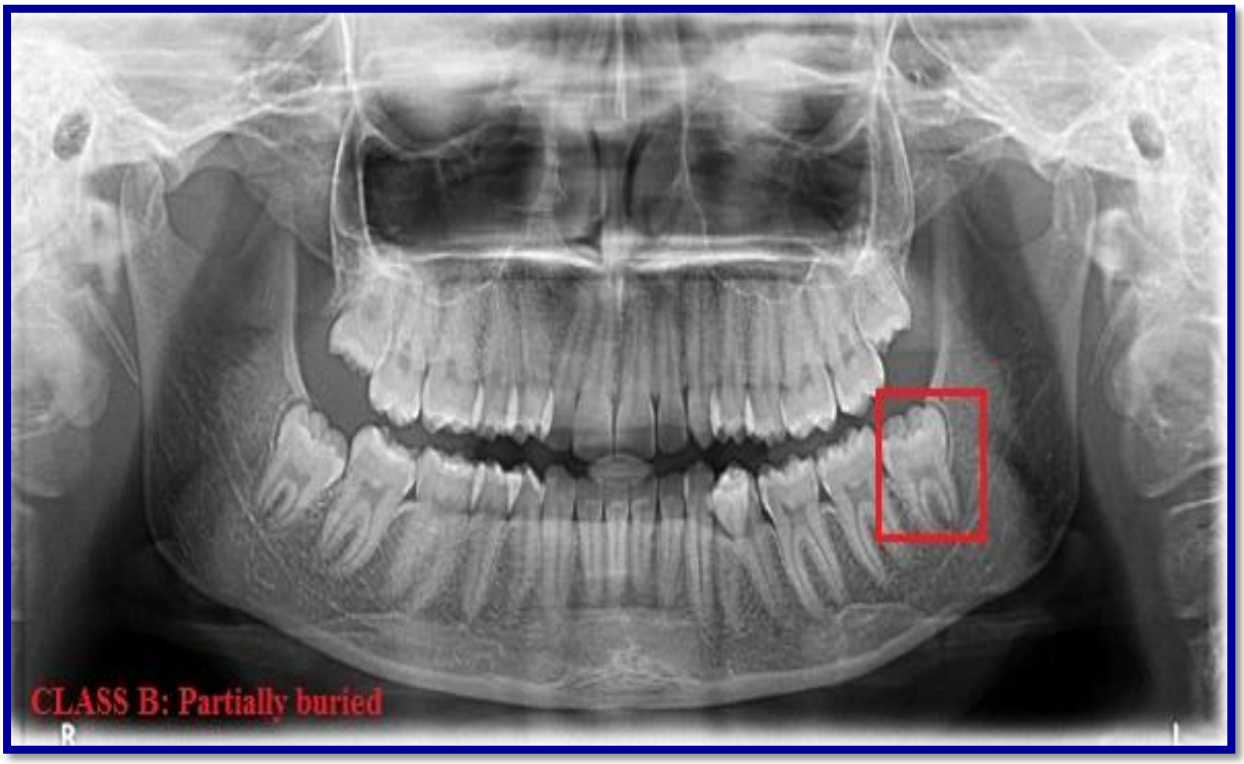


Plate 20: Class B – Mandibular third molar impaction

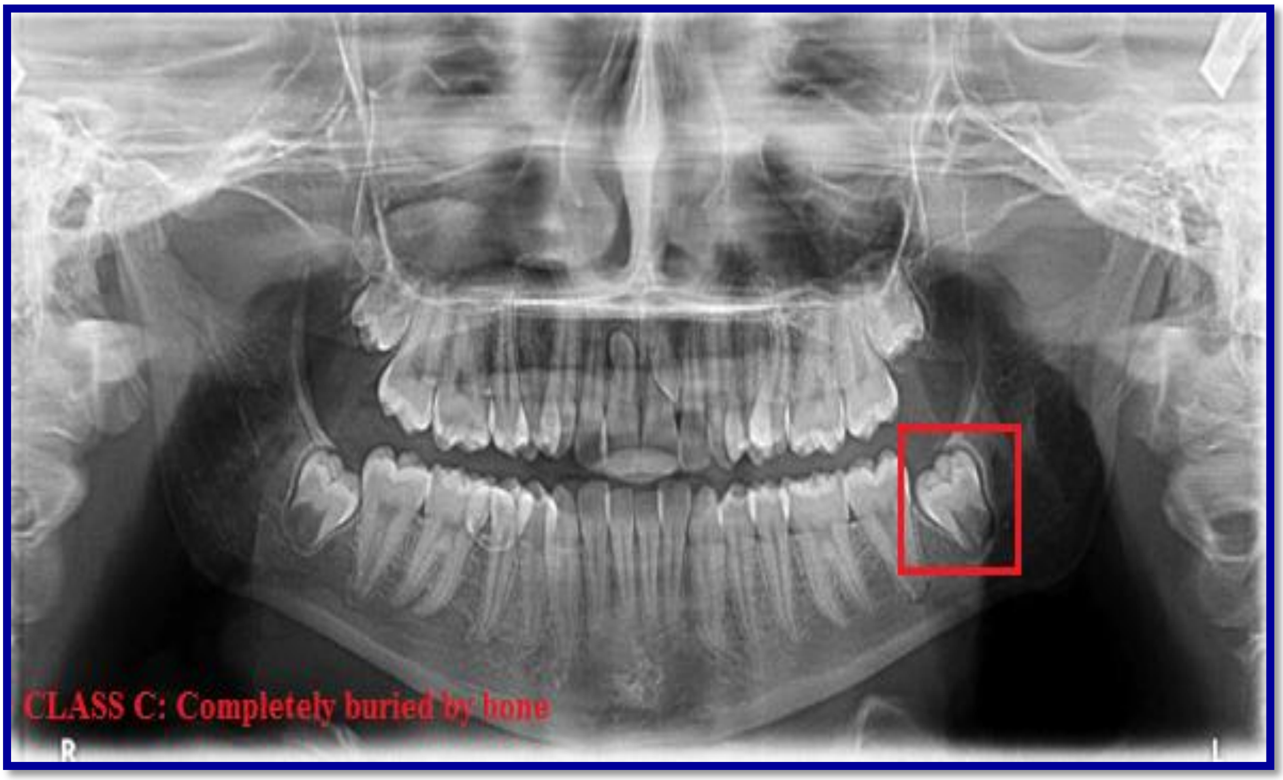


Plate 21: Class C – Mandibular third molar impaction

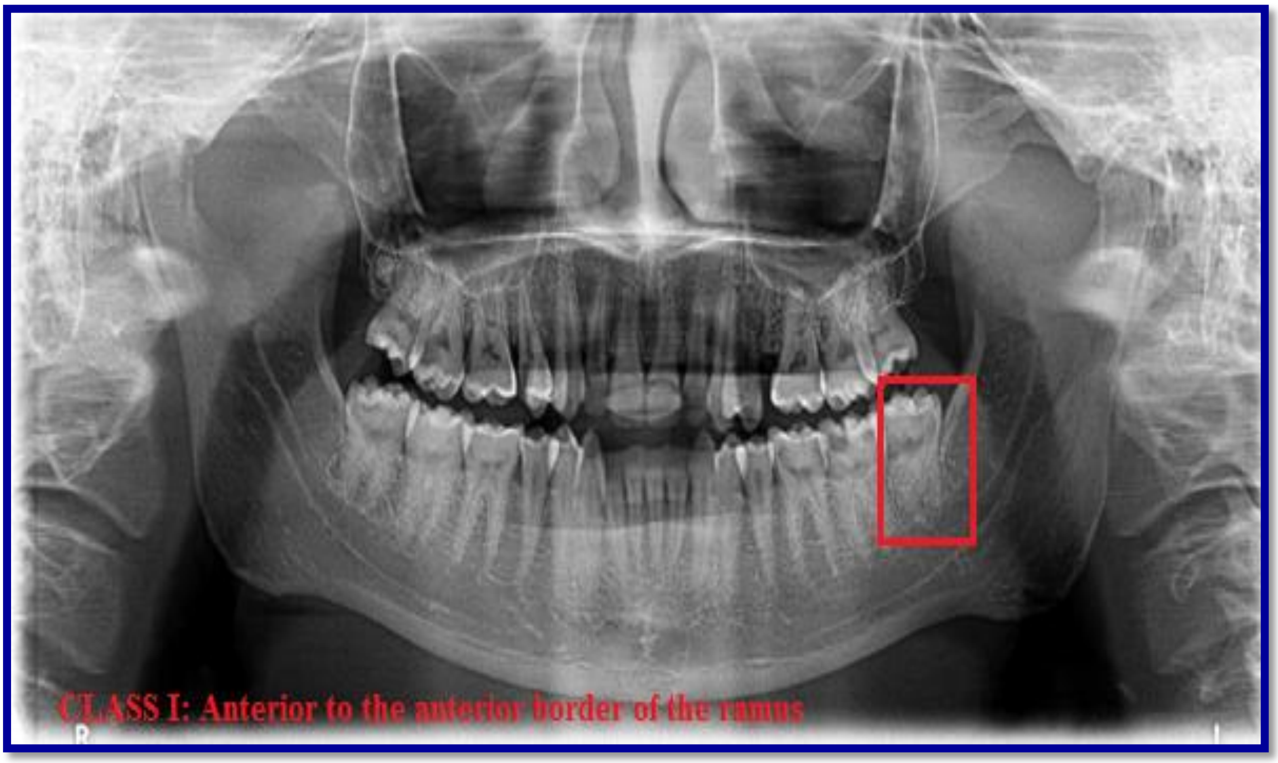


Plate 22: Class I– Mandibular third molar impaction

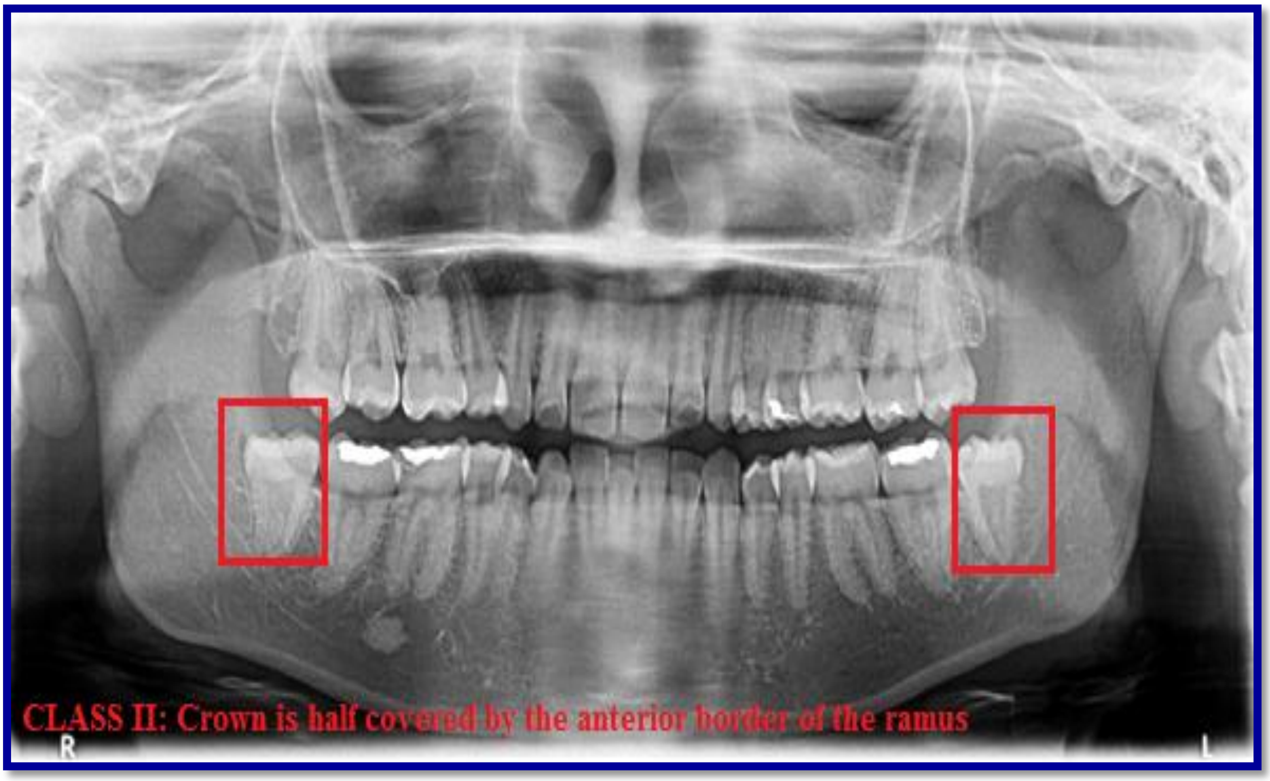


Plate 23: Class II– Mandibular third molar impaction

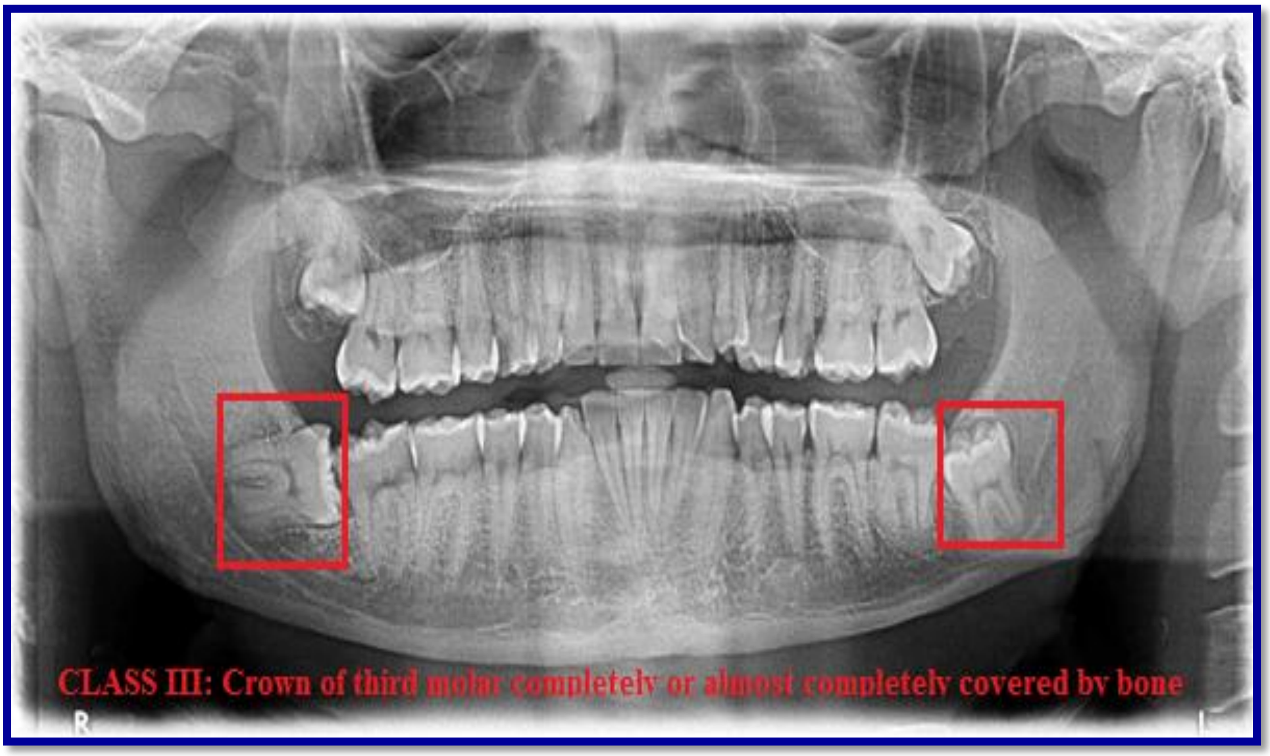


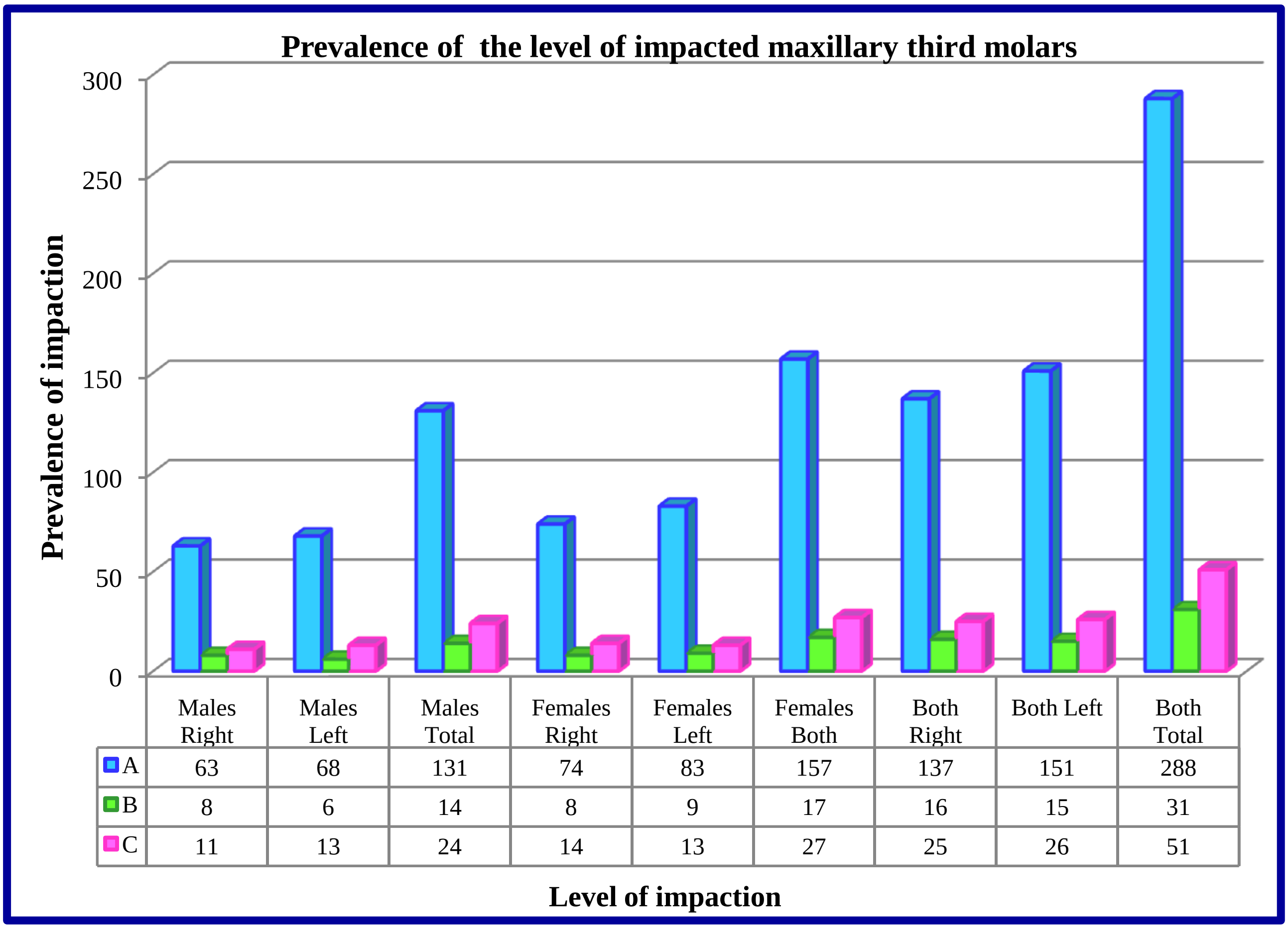
Plate 24: Class III– Mandibular third molar impaction

4.5.2. Depth of maxillary third molar impaction

Class A [$\frac{288}{370}$; (77.8%)] was recorded to be the most common type of maxillary third molar impaction, followed by class C [$\frac{51}{370}$; (13.8%)] and class B [$\frac{31}{370}$; (8.4%)], respectively (Table 17 and Figure 34). No statistically significant relationship was recorded between the class of impaction and sex. However, for the correlation with age, the level of impaction was statistically significant (P-value = 0.000)

Table 17: Prevalence of maxillary third molar impaction according to Pell and Gregory's classification (in %)

Classification	Class	Prevalence (in %)							P-Value			
		Males			Females			Both	Sex		Age	
		Right	Left	Total	Right	Left	Total		Right	Left	Right	Left
Level of Impaction (Plate 25-27)	A	17.0	20.0	**37.0**	18.4	22.4	**40.8**	**77.8**	**0.968**	**0.797**	**0.000**	**0.000**
	B	2.2	2.2	**4.4**	1.6	2.4	**4.0**	**8.4**				
	C	3.0	3.8	**6.8**	3.5	3.5	**7.0**	**13.8**				



	Males Right	Males Left	Males Total	Females Right	Females Left	Females Both	Both Right	Both Left	Both Total
A	63	68	131	74	83	157	137	151	288
B	8	6	14	8	9	17	16	15	31
C	11	13	24	14	13	27	25	26	51

Figure 34: Prevalence of the level of impacted maxillary third molars in both sexes and side

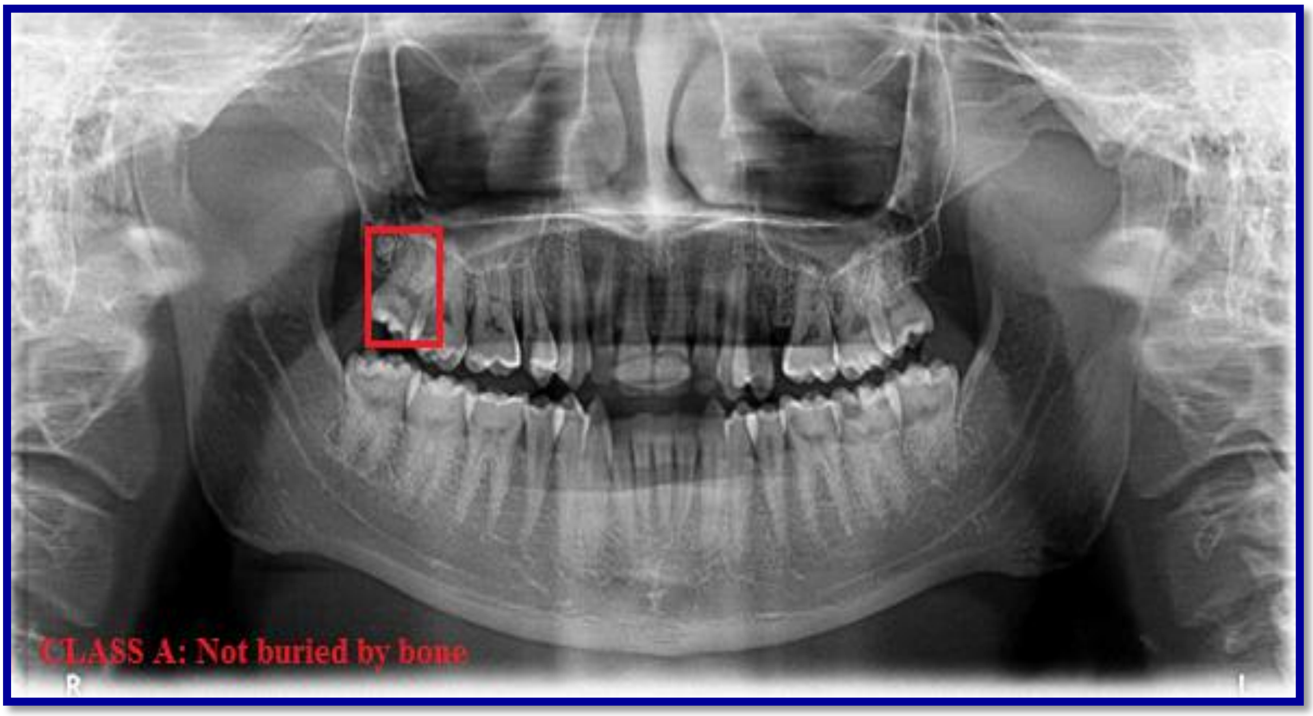


Plate 25: Class A: Maxillary third molar impaction

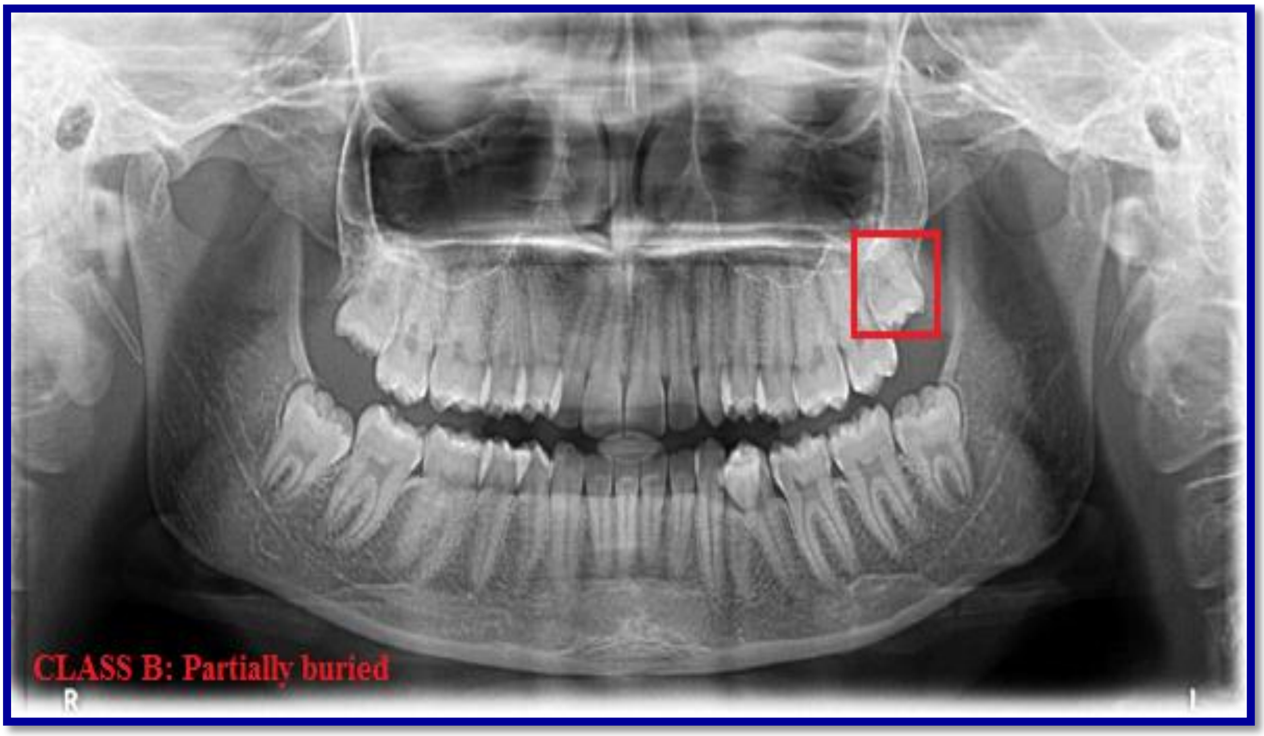


Plate 26: Class B: Maxillary third molar impaction

Plate 27: Class C: Maxillary third molar impaction

4.6. SEX DETERMINATION

A higher prevalence of impacted third molars was recorded in females, with an prevalence of 53.2% $\left[\frac{141}{265}\right]$, in comparison to males who had an prevalence of 46.8% $\left[\frac{124}{265}\right]$ (Table 18 and Figure 35). A male to female ratio of 1:1.3 [124:141] was recorded in this study.

Table 18: Prevalence of impacted third molars in males and females (in %)

	Prevalence of impacted third molars (in %)		
	Males	**Females**	**Total**
Impaction	46.8	53.2	77.9

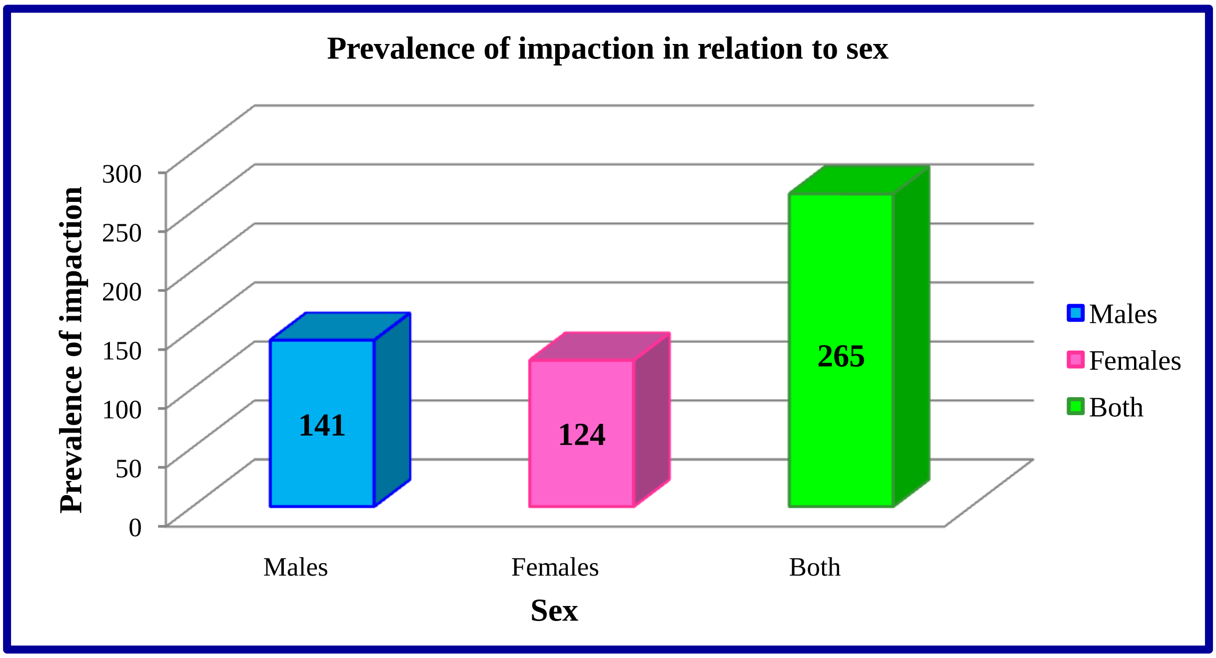


Figure 35: Prevalence of impacted third molars in both sexes

4.7. AGE DISTRIBUTION

Majority of the third molar impactions was found in the 20-25 year age interval, as a prevalence of 36.6% $\left[\frac{97}{265}\right]$ was recorded. Females had a greater prevalence than males in both the 16-19 $\left[\frac{50}{94}\right]$ and 20-25$\left[\frac{54}{97}\right]$ year age intervals; however for the 26-30$\left[\frac{37}{74}\right]$ year age interval the prevalence of the impacted third molar was equivalent in both sexes (Table 19).

Table 19: Prevalence of impacted third molars in different age categories

Age Group (Years)	**Prevalence of impacted third molars**			
	Males	**Females**	**Total**	**Total (in %)**
16 – 19	44	50	94	35.5
20 – 25	43	54	97	36.6
26 – 30	37	37	74	27.9

4.8. ETHNIC DISTRIBUTION

4.8.1. Prevalence of impaction

In this study, 83.7% $\left[\frac{222}{265}\right]$ of impacted third molars belonged to the Indian ethnic group, followed by the Black [$\frac{35}{265}$; (13.2%)]; Coloured [$\frac{6}{265}$; (2.3%)] and White [$\frac{2}{265}$; (0.8%)], respectively (Table 20 and Figure 36).

Table 20: Ethnic distribution of patients with impacted third molars (in %)

Ethnic Group	Prevalence of impaction (in %)		
	Male	Female	Total
Black	7.5	5.7	13.2
Coloured	1.1	1.1	2.3
Indian	38.1	45.7	83.7
White	0.0	0.8	0.8

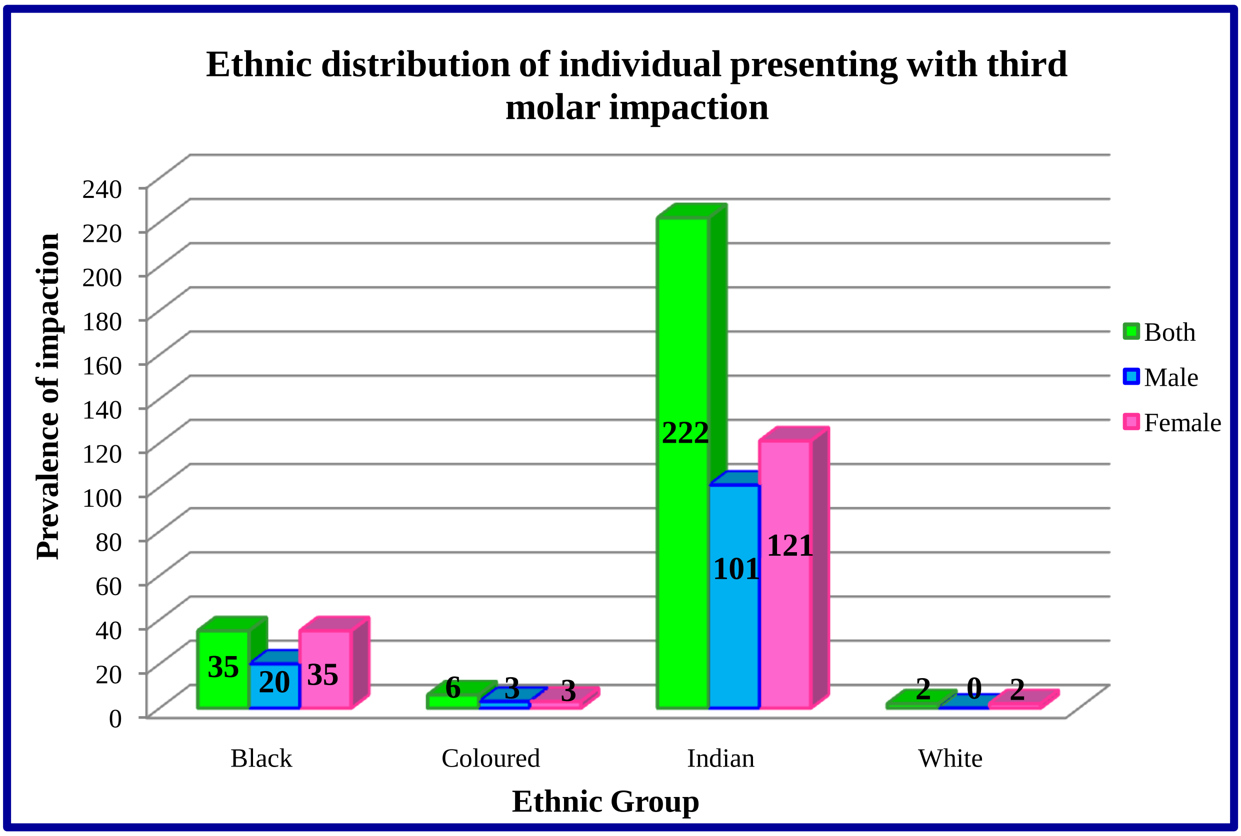


Figure 36: Ethnic distribution of the patients with impacted third molars

4.8.2. Prevalence of impaction in the mandible and maxilla

The prevalence of impacted third molars was higher in the mandible than maxilla for all ethnic groups (Black; Indian; Coloured), excluding the White group who presented with equal prevalence of impacted third molars in the mandible and maxilla. The prevalence of these were: (Table 21)

a) **Black** : **Mandible:** [$\frac{66}{851}$; (7.8%)] and **Maxilla** [$\frac{48}{851}$; (5.6%)]

b) **Coloured** : **Mandible**: [$\frac{11}{851}$; (1.3%)] and **Maxilla** [$\frac{9}{851}$; (1.0%)]

c) **Indian** : **Mandible**: [$\frac{400}{851}$; (47.0%)] and **Maxilla** [$\frac{309}{851}$; (36.3%)]

d) **White** : **Mandible**: [$\frac{4}{851}$; (0.5%)] and **Maxilla** [$\frac{4}{851}$; (0.5%)]

Table 21: Ethnic distribution of impacted third molars in the mandible & maxilla

Ethnic Group	Prevalence of impaction		
	Mandible	**Maxilla**	**Total**
Black	66 (7.8%)	48 (5.6%)	114 (13.4%)
Coloured	11 (1.3%)	9 (1.0%)	20 (2.4%)
Indian	400 (47.0%)	309 (36.3%)	709 (83.3%)
White	4 (0.5%)	4 (0.5%)	8 (0.9%)
Total	481 (56.5%)	370 (43.5%)	851 (100%)

4.8.2.1. Prevalence of impaction in the mandible and maxilla in relation to sex

There was wide variation in the prevalence of impacted mandibular and maxillary third molars when correlated to sex. For the Black population, males presented with a higher prevalence of impacted third molars than females in both the mandible and maxilla, whereas in the Indian population, impacted third molars was more prevalent in females than males (Table 22). For the Coloured group, females [$\frac{6}{851}$; (0.7%)] had a slightly higher prevalence of impacted third molars in the mandible than males [$\frac{5}{851}$; (0.6%)] however, in the maxilla males [$\frac{5}{851}$; (0.6%)] exhibited a slightly higher prevalence of impaction than females [$\frac{4}{851}$; (0.5%)]. In the White group, no correlation with sex could be made as no White males were sampled in this study.

Table 22: Ethnic distribution of impacted third molars in the mandible & maxilla with sex

Ethnic Group	Prevalence of impaction			
	Mandible		Maxilla	
	Male	Female	Male	Female
Black	38 (4.5%)	28 (3.3%)	29 (3.4%)	19 (2.2%)
Coloured	5 (0.6%)	6 (0.7%)	5 (0.6%)	4 (0.5%)
Indian	185 (21.7%)	215 (25.2%)	135 (15.9%)	174 (20.4%)
White	0 (0.0%)	4 (0.5%)	0 (0.0%)	4 (0.5%)

The relationship between impacted mandibular and maxillary third molars in each ethnic group can be seen in Figure 37. The prevalence in each ethnic group were:

a) **Black** : **Mandible** [Males: $\frac{38}{66}$; (57.6%) and Females: $\frac{28}{66}$; (42.4%)]

: **Maxilla** [Males: $\frac{29}{48}$; (60.4%) and Females: $\frac{19}{48}$; (39.6%)]

b) **Coloured** : **Mandible** [Males: $\frac{5}{11}$; (45.5%) and Females: $\frac{6}{11}$; (54.5%)]

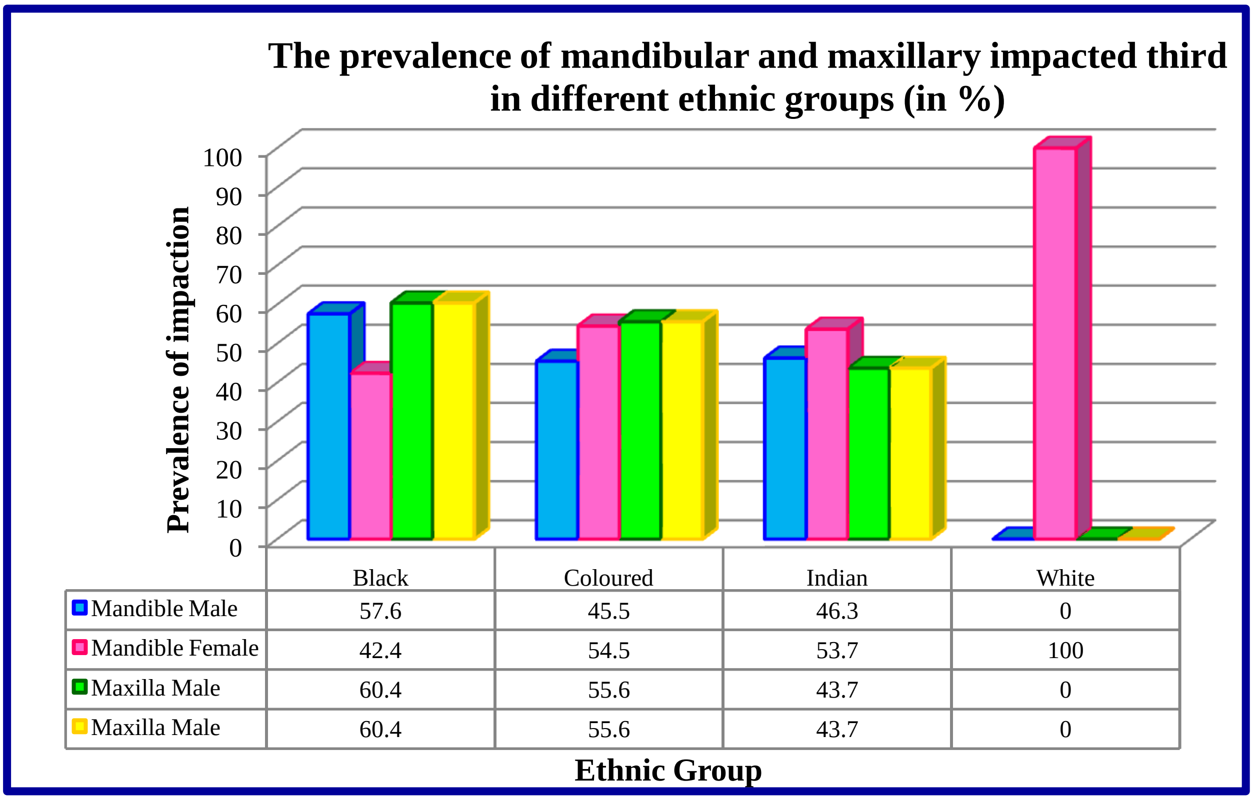
: **Maxilla** [Males: $\frac{5}{9}$; (55.6%) and Females: $\frac{4}{9}$; (44.4%)]

c) **Indian** : **Mandible** [Males: $\frac{185}{400}$; (46.3%) and Females: $\frac{215}{400}$; (53.7%)]

: **Maxilla** [Males: $\frac{135}{309}$; (43.7%) and Females: $\frac{174}{309}$; (56.3%)]

d) **White** : **Mandible** [Males: $\frac{0}{4}$; (0.0%) and Females: $\frac{4}{4}$; (100%)]

: **Maxilla** [Males: $\frac{0}{4}$; (0.0%) and Females: $\frac{4}{4}$; (100%)]



	Black	Coloured	Indian	White
Mandible Male	57.6	45.5	46.3	0
Mandible Female	42.4	54.5	53.7	100
Maxilla Male	60.4	55.6	43.7	0
Maxilla Male	60.4	55.6	43.7	0

Figure 37: Distribution of impacted mandibular and maxillary third molars in each ethnic group

4.9. MORPHOMETRIC ANALYSIS OF THE MANDIBLE

The results depicted in Table 23 shows significant differences in all linear measurements between males than females. The length of the male mandibular ramus was significantly longer than the female, on both sides of the mandible (P-value = 0.000). However, there was no significant difference in the width of the mandibular ramus between the two sexes (Table 23). On the other hand, only the relationship between the length of the right mandibular body and sex displayed a statistically significant difference (P-value = 0.040) (Table 23). The correlation between all morphometric parameters and race showed a statistically significant relationship (Table 23).

Table 23: Morphometric analysis of the mandible with gender distribution (mm)

Parameters	Side	Measurements (in mm)			P-value		
		Males	Females	Both	Sex	Age	Race
Length of ramus	Right	59.6	53.9	**56.5**	**0.000**	0.111	**0.015**
Length of ramus	Left	60.1	54.3	**57.0**	**0.000**	0.153	**0.034**
Width of ramus	Right	36.0	35.5	**35.8**	0.625	0.537	**0.001**
Width of ramus	Left	35.1	34.2	**34.6**	0.414	0.479	**0.002**
Length of body	Right	86.5	83.0	**84.6**	**0.040**	0.799	**0.000**
Length of body	Left	83.3	81.0	**82.0**	0.147	0.0735	**0.000**

For all age intervals the morphometric parameters of the mandible were greater in males than females with the exception of the 16 – 19 year group that displayed a wider mandibular ramus in females. The general trend observed in this study for both males and females was that as the age of the individual increased, the size of the mandible also increased, however a slight decrease was noted for the width of the ramus in females and the length of the body in males (Table 24).

Table 24: Morphometric analysis of the mandible for various age groups (mm)

Parameter	Side	Measurements (in mm)					
		Males			Females		
		16 - 19	20 – 25	26 – 30	16 – 19	20 - 25	26 – 30
Length of ramus	**Right**	57.5	60.4	61.1	54.1	52.7	55.3
Length of ramus	**Left**	57.4	61.7	61.4	54.4	53.8	54.8
Length of ramus	**Both**	**57.5**	**61.1**	**61.3**	**54.3**	**53.3**	**55.1**
Width of ramus	**Right**	35.6	35.5	37.1	36.1	35.1	35.4
Width of ramus	**Left**	34.3	35.1	36.0	36.6	34.1	33.9
Width of ramus	**Both**	**35.0**	**35.3**	**36.6**	**36.4**	**34.6**	**34.7**
Length of body	**Right**	87.1	86.1	86.3	82.3	82.9	84.0
Length of body	**Left**	83.8	82.7	83.4	80.1	80.7	82.4
Length of body	**Both**	**85.5**	**84.4**	**84.9**	**81.2**	**81.8**	**83.2**

CHAPTER FIVE

DISCUSSION

5.1. BRIEF OVERVIEW

Tooth impaction is a pathological condition in which a tooth is completely or partially unerupted and positioned against another tooth, bone or soft tissue, so that further eruption is unlikely to occur (Ramamurthy *et al*., 2012). There is considerable variability with regard to the prevalence and distribution of impacted teeth in different regions of the jaw (Chu *et al.*, 2003). There are many factors affecting the prevalence, which include the selected age group, the time of eruption, genetics, dietary habits and the radiographic criteria for development and eruption (Chu *et al*., 2003 and Omar, 2008).

5.2. SAMPLE

340 digital panoramic radiographs of patients that met the inclusion criteria were utilized in this study. Of this 340, 265 patients (124 males; 141 females) presented with at least one impacted third molar tooth. In this study, only 10% of digital panoramic radiographs were obtained from the Public Sector as the instrumentation (Panoramic X-ray Machine) was inoperational and a high number of digital radiographs lacked the demographic data (sex, age and ethnic group) required for this study. In addition, at the time of this write up, King Edward Hospital was still awaiting the Digital Kodak Software. This researcher had no alternative but to amend the protocol and seek digital panoramic radiographs from Private Practices within the Durban Region due to time constraints.

5.3. PREVALENCE OF IMPACTED THIRD MOLARS

5.3.1. Gross Prevalence

Third molar impaction is a common problem affecting a large proportion of the world's population. In this study, the prevalence of impacted third molar in the Greater Durban Metropolitan area of KwaZulu-Natal in South Africa was estimated at 77.9%$\left[\frac{265}{340}\right]$, which differs significantly when compared to the calculated weighted mean of 31.3% in a comparable series of studies (Table 25). When compared to individual studies however similarities where noted in that Elsey and Rock. (2000) reported a 73.0% prevalence of impacted third molars among the young European population (Juodzbalys and Daugela, 2013). On the other hand, the prevalence recorded in this study was higher than that reported by Sandhu and Kapila (1982); Chu *et al.* (2003); Quek *et al.*, (2003) and Hashemipour *et al*. (2013) (Table 25). Majority of the panoramic radiographs in this study was obtained from Private Practices, therefore this may be a contributing factor for the high prevalence of impacted third molars recorded, as most commonly only patients who present with a dental problem consults a Dental Practitioner. Additionally, literature states that the discrepancy in the prevalence of the impacted third molars may be due to genetic or racial differences, which are two of the most important factors contributing to tooth impaction (Hashemipour *et al*., 2013). In addition, Syed *et al* (2013) stated that another contributing factor to impacted third molars is the relative jaw size in relation to the cumulative teeth size, this may result from the difference in dietary habits as this varies from one region to another (Omar, 2009 and Syed *et al.*, 2013).

Table 25: Prevalence of impacted third molars in different population groups

Authors	Year	Population	Sample Size	Prevalence of impacted third molars (%)
Sandhu and Kapila	1982	Indian	1015	26.0
Hattab *et al.*	1995	Jordanaian	232	33.0
Elsey and Rock	2000	European	-	73.0
Chu *et al.*	2003	Hong Kong Chinese	7486	27.8
Quek *et al.*	2003	Singaporean	1000	68.6
Omar	2008	Hawler	1150	43.8
Ramamurthy *et al.*	2012	Indian	1005	41.3
Tsabedze	2012	South African	1215	17.0
Hashemipour *et al.*	2013	Irani	2300	44.3
Sabra and Soliman	2013	Saudi Arabian	113	67.9
Syed *et al.*	2013	Saudi Arabian	3800	18.7
Weighted mean				**31.3**
Present Study	**2014**	**South African**	**340**	**77. 9**

5.3.2. Prevalence of third molar impaction in relation to age range sampled

This study analysed radiographs of patients aged between 16 -30 years, which compares with previous studies conducted by Omar, (2008) and Sabra and Solimon, (2013), who recorded the prevalence of the impacted third molars to be 43.8% and 67.9%, respectively in a similar age group (Table 26). In contrast to this study, previous authors analyzed radiographs of patients older than 30 years (Chu *et al*., 2003; Tsabedze, 2012; Hashemipour *et al*., 2013 and

Syed *et al*., 2013) (Table 26). These authors found a lower prevalence of impacted third molar teeth, with a prevalence of 27.8%; 17.0%; 44.3% and 18.9%, respectively. In general, because the third molar teeth erupts between 17-21 years (Juodzbalys and Daugela, 2013), there is a higher prevalence in the under 30 year population group, as in this study. Age is thus an apparently important factor in determining prevalence as the prevalence of impaction decreases in frequency with an increase in age (Chu *et al*., 2003 and Syed *et al*., 2013).

Table 26: Prevalence of impacted third molars in different population groups

Authors	Year	Population	Prevalence of impacted third molars (%)	Age range
Chu *et al.*	2003	Hong KongChinese	27.8	17 – 89
Quek *et al.*	2003	Singaporean	68.6	20 – 40
Omar	2008	Hawler	43.8	17 – 30
Tsabedze	2012	South African	17.0	17 – 51
Hashemipour *et al.*	2013	Iranian	44.3	19 – 55
Sabra and Soliman	2013	Saudi Arabian	67.9	18 – 26
Syed *et al.*	2013	Saudi Arabian	18.7	18 – 45
Present Study	**2014**	**South African**	**77. 9**	**16 – 30**

From Table 26, it is noted that the prevalence of impacted third molars is influenced by the age of the population sampled. Sabra and Soliman (2013), for example, reported a 67.9% prevalence among the 18-26 year old Saudi Arabian population, whereas Syed *et al*. (2013) recorded a 18.7% prevalence of impacted third molars in the 18-45 year old in the same population. Similarly, the present study recorded a prevalence of 77.9% of impacted third molars among the 16 -30 year age group, whereas Tsabedze reported a 17.0% prevalence among a 17 – 51 year age group. Another possible explanation from literature for the wide variation in prevalence could be that the dietary habits of individuals differ in different regions that have the same ancestral population group (Syed *et al.*, 2013).

5.4. DISTRIBUTION OF IMPACTED TEETH IN THE MANDIBLE AND MAXILLA

5.4.1. Gross Prevalence

The prevalence of the impacted third molar teeth in this study is higher in the mandible as compared to the maxilla, with a prevalence of 56.5% and 43.5%, respectively (Table 27). This result concurs with some previous studies (Sandhu and Kapila, 1982; Chu *et al*., 2003 and Omar, 2008). The prevalence of impacted third molar in the maxilla in the current study compared positively with a statistically significant calculated weighted mean of 20.8% (Table 27). However, in other studies, Kramer and William (1970) and Kruger, (1984) recorded the prevalence of the impacted maxillary third molars to be more frequently impacted than mandibular third molar teeth (Table 27). The ratio of the mandibular to maxillary third molar impaction is 1.3: 1. In contrast, Syed *et al*. (2013) recorded a higher ratio of 2.68: 1 in a Saudi Arabian population. There is a paucity of literature regarding this occurrence, and most studies attribute the population-specific difference in the prevalence of impaction to genetic and dietary differences (Omar, 2009; Syed *et al*., 2013 and Ramamurthy *et al.,* 2013)

Table 27: Distribution of impacted third molars in the mandible and maxilla

Authors	Year	Population	Sample size	Prevalence of impacted third molar (%)	
				Mandible	Maxilla
Kramer	1970	American	-	33.47	58.87
Sandhu and Kapila	1982	Indian	1015	63.21	36.79
Kruger	1984	-	-	37.44	62.57
Chu *et al.*	2003	Hong Kong Chinese	7486	82.50	15.60
Omar	2008	Hawler	1150	59.04	39.42
Hashemipour *et al.*	2013	Iranian	1215	54.90	28.80
Syed *et al.*	2013	Saudi Arabian	3800	49.40	18.40
Weighted mean				**68.50**	**20.80**
Present Study	**2014**	**South African**	**340**	**56.50**	**43.40**

5.4.2. Aetiology of the prevalence of mandibular and maxillary third molar impaction

A number of theories have been purposed to explain the higher prevalence of impacted third molar teeth in the mandible than the maxilla. Broadbent (1943) proposed that mandibular third molar impaction occurs when the mandible fails to achieve its full growth potential. Ricketts (1979), on the other hand believed that impacted third molar teeth is related to the arcial growth of the mandible as he explained that the retromolar space (a space between the second molar and the anterior border of the ramus) was created for normal development of third molars by a mesial (forward) direction of tooth eruption instead of the resorption at the anterior border of the ramus. Popescu and Popoviou (2008) offered the view that growth in the mandible is said to be one of the causes of impacted mandibular third molars, that is, as the third molars develop within the retromolar space, reduced skeletal growth leads to small retromolar space hence insufficient room for normal eruption of the mandibular third molars. Furthermore, the authors stated that maxillary third molar are less frequently impacted in comparison to mandibular third molars, as the obstacle of impaction is not a bone but rather a soft tissue blockage (gum tissue). Lakhani *et al.* (2011) concur with Popescu and Popoviou (2008), as they recorded that the ramus of the mandible increased in size by resorption at the anterior surface and deposition at the posterior surface, therefore if resorption at the anterior surface is restricted, the mandibular third molars have insufficient space to erupt. Another theory by Miloro *et al.* (2012) states that the failure of the third molar to rotate (from the horizontal original growth angle to a mesio-angular, then to a vertical position) and erupt into a vertical position involves the relation of the bony mandibular arch length to the total of the mesiodistal widths of the teeth in the arch, as there is insufficient spaces between the alveolar process and the anterior border of the mandibular ramus to allow the third molar to erupt in its normal position. In addition, Miloro *et al.* (2012) noted that patients with impacted teeth have larger-sized teeth than those without impaction.

5.4.3. Impacted third molars in the mandible and maxilla in relation to sex

The prevalence of the impacted mandibular third molars has a higher frequency in both males (57.4%) and females (55.7%), as compared to the impacted maxillary third molars, which has a prevalence of 42.6% and 44.3% in males and females in this study. These findings concur with Quek *et al.* (2003) and Syed *et al*. (2013), who concluded that mandibular third molar impaction is more prevalent in both males and females (Table 28). In this study, the impacted maxillary third molar teeth showed a higher prevalence in females (44.3%) as compared to males (42.6%). Contrary to this expectation, the impacted mandibular third molar showed a higher frequency in males (57.4%) than females (55.7%). These results of this study collaborated with Quek *et al.* (2003) and Syed *et al*. (2013) (Table 28). There is paucity in the literature regarding these findings. Indira *et al.* (2012) stated that male bones are usually larger and stronger than females. Therefore, the present study postulates that the size of the maxilla plays an essential role in the prevalence of impaction as females generally have a smaller maxilla than males, consequently resulting in insufficient room for the eruption of third molars. In addition, Behbehani and Artun (2006) found that a small mandibular plane [a line parallel to the lower border of the mandible (Jamieson. 1940)] and gonial angle [formed by a tangent to the lower border of the mandible to a tangent touching the posterior border of the ramus at the two points (Jensen and Palling. 1954)] increases the frequency of mandibular third molar impaction. Chloe *et al.* (2013) recorded a significantly larger gonial (mandibular) angle in females than males, therefore the current study proposes that mandibular third molar impaction is more prevalent in males than females due to a smaller gonial angle.

Table 28: Distribution of impacted mandibular & maxillary third molars in males and females

Authors	Year	Population	Prevalence of impacted third molar (%)			
			Mandible		Maxilla	
			Males	Females	Males	Females
Quek *et al.*	2003	Singapore Chinese	472.0	607.0	102.0	204.0
			82.2%	74.8%	17.8%	25.2%
Syed *et al.*	2013	Saudi Arabian	299.0	53.0	108.0	23.0
			49.5%	48.6%	17.9%	21.1%
Present Study	**2014**	**South African**	**228.0**	**253.0**	**169.0**	**201.0**
			57.4%	**55.7%**	**42.6%**	**44.3%**

5.5. PREVALENCE OF ANGULATION

5.5.1.1. Gross prevalence of mandibular third molar angulation

In the present study, the most prevalent pattern of impacted mandibular third molars is mesio-angulation (52.4%), followed by vertical angulation impaction (24.5%), with the least prevalent being disto-angulation impaction (0.8%). This study concurs with the findings of Tsabedze, (2012), who reported mesio-angulation being the most prevalent type of impaction in the Limpopo Province (South Africa), with a prevalence of 51.9%. The current study postulates that this result could be due to a reduced jaw size among South Africans due to a common South African diet.

Likewise, the results of this study confirms previous studies conducted by Chaparro-Avendano *et al.* (2005); Biswari *et al*. (2010); Khan *et al*. (2010); Sabra and Soliman, (2013) and Syed *et al*. (2013), all of who reported that mesio-angulation is the most pervasive type of impaction in the Spanish; Indian; Pakistan and Saudi Arabian population, respectively (Table 29 – Pg 97). Consequently, these findings may correlate with the present study due to the high frequency of the Indian ethnic group.

However, the current study differed from Bataineh *et al*. (2002); Sasano *et al*. (2003) and Almendros-Marques *et al*. (2008). They had recorded vertical impaction as the most frequent pattern of the mandibular third molar impaction (Table 29 – Pg 97).

Numerous theories have been postulated in the previous literature to explain the development of impacted mandibular third molars (Judzbalys and Daugela, 2013). Miloro *et al.* (2012) for instance, stated that the change in orientation of the occlusal surface from a straight mesial direction (towards the front of the mouth) to a straight vertical direction (parallel to the adjacent second molar) occurs primarily during root formation, and that it maybe during this time, that the tooth rotates from a horizontal to mesioangular to a vertical position.

In addition, a study group at Queen's University, known as the Belfast group, proposed that the differential root growth between the mesial and distal roots causes the root to either stay mesial or move to a vertical position depending on the amount of root development (Syed *et al*., 2013). The aforementioned under development of the mesial root causes mesio-angulation impaction, while the overdevelopment of the same root results in over-rotation of the third molar into a distoangular impaction (Miloro *et al.*, 2012 and Syed *et al*., 2013). However, overdevelopment of the distal root, frequently with a mesial curve, is responsible for horizontal impaction (Figure 38) (Miloro *et al*., 2012).

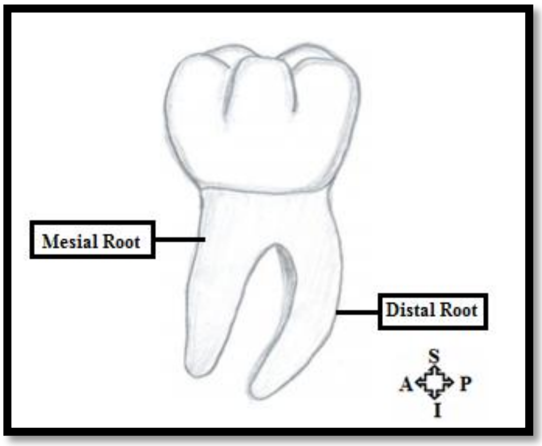


Figure 38: Mesial curve of the distal root (Adapted from Bansal and Ajwani)

Hashemipour *et al*. (2013) also stated that mesio-angulation is the most common type of impaction due to late development, maturation, path of eruption and lack of space in the mandible at the later ages. In addition, the type and prevalence of angulation differs from one population group to another and this could be due to genetic, racial and dietary differences (Omar, 2009).

Contrary to the results of this study, the majority of the Hong Kong Chinese population presented with horizontal impaction (47.5%), followed by mesio-angulation impaction (36.4%) (Chu *et al*.,2003). Quek *et al.* (2003) recorded similar results to the current study (Table 29). Thus, population specific variations exist; in addition, the findings may also be explained by authors using different methods of classification to identify the type of angulation, as well as difference inherent in population groups (Hashemipour *et al*., 2013).

Table 29: Prevalence of mandibular third molar angulation according to Winter's classification

Author	Year	Population	Highest Prevalence of angulation	
			Type	Percentage
Bataineh *et al.*	2002	Jordanian	Vertical angulation	61.4
Sasano *et al.*	2003	-	Vertical angulation	46.0
Chu *et al.*	2003	Hong Kong Chinese	Horizontal angulation	47.5
Quek *et al.*	2003	Singapore Chinese	Mesio-angulation	59.5
Almendros- Marques *et al.*	2006	Spanish	Vertical angulation	47.9
Biswari *et al.*	2010	Indian	Mesio-angulation	44.4
Khan *et al.*	2010	Pakistani	Mesio-angulation	48.0
Tsabedze	2012	South African	Mesio-angulation	51.9
Sabra and Soliman	2013	Saudi Arabian	Mesio-angulation	64.3
Syed *et al.*	2013	Saudi Arabian	Mesio-angulation	50.8
Present Study	**2014**	**South African**	**Mesio-angulation**	**52.4**

5.5.1.2. Prevalence of mandibular third molar angulation in relation to sex

The mesio-angulation pattern of impaction is most prevalent in both males (47.3 %) and females (57.3%), with a higher prevalence seen in the latter, followed by vertical angulation in females (26.1%) and horizontal angulation in males (26.8%) (Table 30). These results are consistent with Ramamurthy *et al.* (2013) (Table 30). Similarly, Quek *et al*. (2003) reported that mesio-angulation is the most prevalent type of impaction with a prevalence of 60.6%

and58.6% in males and females, respectively. However, in constrast, they recorded that horizontal angulation is the second most prevalent in both males and females (Table 30). Ramamurthy *et al.* (2013) confirmed these findings in an Indian population. This may result when the dental development of the tooth lags behind the skeletal growth and maturation of the jaw, resulting in an increased prevalence of impaction, which results in a decreased influence of the tooth on the growth pattern and resorption of the mandible (Miloro *et al*,.2012). In addition, previous authors stated that this may be due to differential root growth among different population groups which is due to dietary, genetic and racial difference (Omar, 2009 and Miloro *et al.*, 2012).

Table 30: Prevalence of impacted mandibular third molar angulation in males and females

Angulation	Quek *et al.* (2003)		Ramamurthy *et al.* (2013)		Present Study (2014)	
	Singapore Chinese		Indian		South African	
	Males	Females	Males	Females	Males	Females
Mesio-angulation	60.6%	58.6%	16.3%	12.3%	**47.4%**	**57.3%**
Horizontal	21.8%	14.3%	7.3%	1.9%	**26.8%**	**13.8%**
Vertical	6.4%	12.0%	2.3%	4.9%	**22.8%**	**26.1%**
Disto-angulation	6.1%	12.7%	0.0	0.9%	**0.8%**	**0.0%**
Other	1.7%	0.7%	-	-	**2.2%**	**2.8%**

5.5.2.1. Gross prevalence of maxillary third molar angulation

Vertical impaction (67.7%) is recorded to be the most prevalent type of impaction in the maxilla according to Winter's (1926) Classification Scheme. This is in keeping with Hashemipour *et al*. (2013) and Syed *et al*. (2013), who recorded prevalence of 45.3% and 52.0%, respectively.

However, Kruger *et al.* (2001) recorded that mesio-angulation was the most prevalent pattern of maxillary third molar impaction (Hashemipour *et al*., 2013). On the other hand, earlier studies conducted by Fonseca (1956) and Leita (1986) recorded that disto-angulation was the most frequent type of maxillary third molar impaction, viz. in 75.5% and 58.5% of cases respectively (Clovis *et al*., 2006). The discrepancy in findings reported by the afore-mentioned authors may be due to the methods of classification used to identify the type of angulation as some authors adapt the Winter's classification scheme, viz. Quek *et al.* (2003) (Hashemipour *et al*., 2013). In addition, Popescu and Popovioiu (2008) stated that malposition is commonly favoured by insufficient alveolar space necessary for the third molar to develop or erupt. Artun *et al*. (2005) stated that maxillary third molars generally assume different degrees of distal angulation during the primary phases of development and mesial inclination is rarely observed. As the third molar tooth germs, which have predecessors, develop from backward extension of dental lamina, at first there is insufficient space in the jaw to accommodate these germs, so in the upper jaw the molar tooth germ first develops with their occlusional surface distally and then swings into position only when the maxilla has developed sufficiently to provide room for the movement (Ragini *et al*. 2003). During the period of root development a vertical position is therefore essential for normal eruption to occur. Therefore, the current study also proposes that differential root growth plays a role in the angulation of the impacted maxillary third molar as there is insufficient room for the root and tooth to rotate to the vertical position.

5.5.2.2. Prevalence of maxillary third molar angulation in relation to sex

The current study found vertical angulation the most prevalent type of impaction in both males and females with a prevalence of 69.8% and 65.7%, respectively, with the least prevalent pattern in both sexes being horizontal angulation, viz. 1.2% in males and 0.0% in females. Vertical impaction results when late eruption and maturation occurs therefore there is a lack of eruptive force, as the unerupted tooth is usually covered by soft tissue or very slightly by bone. Literature reports are insufficient to correlate the sex difference in the pattern of maxillary third molar impaction (Ramamurthy *et al*., 2012).

5.6. PREVALENCE OF THE LEVEL OF IMPACTION IN THE MANDIBLE AND MAXILLA

5.6.1. Level of mandibular third molar impaction and its relations to the mandible

According to the Pell and Gregory classification scheme, this study recorded class IIB (partially erupted) to be the most prevalent type of mandibular third molar impaction, followed by class IIIC (completely covered by bone) and the least prevalent class is IA (not buried by bone), with a prevalence of 54.8%, 27.5% and 17.7%, respectively (Table 31). This concurs with Quek *et al*. (2003), as they reported class B to be most prevalent in 85% of the cases and, class A (5%) as the least prevalent in the Singaporean Chinese population (Table 31). Similarly, Almendros-Marques *et al*. (2008) and Blondeau and Daniel (2007) reported that the highest prevalence of impacted third molars belonged to class IIB in the Spanish and Canadian population, respectively (Khan *et al*., 2010).

On the other hand, the result in this study were different to that of Obiechina *et al.* (2001) who recorded the most prevalent class of mandibular third molar impaction to be IIA (31%), which is similar to Monaco *et al.* (2004), who also classified class A (56.2%) and class II (63%) to be the most common type of mandibular third molar impaction in the Italian population. The findings of Jaffar and Tin (2009); Khan *et al.* (2010) and Hashemipour *et al.* (2013) were in accordance with Obiechina *et al.* (2001) and Monaco *et al.* (2004), as they reported class IIA most prevalent, which was different from the present findings (Table 31).

Table 31: Prevalence of mandibular third molar impaction according to Pell and Gregory's classification

Author	Year	Population	Highest prevalence of impaction	
			Type	Percentage
Obiechina *et al.*	2001	Nigerian	II A	31.0
Quek *et al.*	2003	Singapore Chinese	B	85.0
Manaco *et al.*	2004	Italian	II A	56.2/63.0
Jaffar and Tin	2003	Malaysian	II A	45.7
Khan *et al.*	2006	Pakistani	II A	32.3
Present Study	**2014**	**South African**	**II B**	**54.8**

It is postulated that a reduced retromolar space leads to insufficient room for the third molar to erupt into its normal anatomical position, due to a blockages by the adjacent second molar and the anterior border of the ramus of the mandible. However, there are no theories in literature explaining this occurrence except for Mendelian theory, which states that the abrasive nature of the Stone Age diet had the effect of producing extensive wear creating enough room to accommodate the third molars (Tsabedze, 2012). In addition, it is theorized here that the activity of chewing could have stimulated greater jaw size and development therefore providing more space for the third molars to erupt (Kaifu *et al.* 2003 and Tsabedze, 2012). Literature further states that dietary differences between the population groups, such as fibrous diets promote jaw growth as circumferential abrasion of teeth provides space for the third molars to erupt (Khan *et al*., 2010). Khan *et al.* (2010) further suggested that racial and genetics differences may also account for the variation in the level of impaction from one population to another. Syed *et al.* (2013) also stated that disparity of the jaw size to the tooth size further relates to dietary habits, which varies from one region to another.

5.6.2. Level of maxillary third molar impaction

This study found class A (77.8%) to be the most common type of maxillary third molar impaction, followed by class C (13.8%) and the least prevalent being class B (8.4%) (Table 32). These findings confirmed that of Hugoson and Kugelberg. (1988), recording class A as the most frequent class of maxillary third molar impaction using the Pell and Gregory's classification scheme. Hashemipour *et al*. (2013) reported similar results to the present study, with the highest prevalence being class A (80.9%). However, they recorded class B (10.9%) as the second most prevalent, with class C (8.2%) being the least frequent type of third molar impaction (Table 32). Whereas, Quek *et al.* (2003) reported class B to be the most common type of maxillary third molar impaction, with a prevalence of 59.0%, followed by class C (39.0%) and class A (3.0%) with was contrary to this study (Table 32).

Table 32: Prevalence of maxillary third molar impaction according to Pell and Gregory's classification

Author	Year	Population	Prevalence of impaction (%)		
			Class A	Class B	Class C
Quek *et al.*	2003	Singapore Chinese	3.0	59.0	39.0
Hashemipour *et al.*	2013	Iranian	80.9	10.9	8.2
Present Study	**2014**	**South African**	**77.8**	**8.4**	**13.8**

Regarding the discrepancy in the findings for the level of impaction of the mandible, Omar (2008) stated that the prevalence of impaction has increased in recent years due to the decrease in the functional activity of the jaws, which lead to a reduced jaw size and subsequently insufficiently space for the third molars to erupt to its normal functioning position. This was similar to the explanation provided by Khan *et al*. (2010) and Syed *et al.* (2013). The consumption of a soft food diet may be a contributing factor to the high prevalence recorded in this study, as it requires less functional activity of the jaw, which results in a reduced jaw size. In addition, a lack of compensatory periosteal apposition at the posterior outline of the maxillary tuberosities could prevent eruption of the maxillary third molars and since it is the last tooth to erupt it has to adapt to the existing space which is limited by the adjacent second molar, maxillary sinus and pterygoid fossae (Radhika *et al*., 2013). Omar (2009) further stated that the prevalence of impaction may differ from one population group to another as the growth of the jaw may be influenced by genetically inherited factors, lack of proper dental care, and dietary habits (Omar, 2008).

5.7. SEX DETERMINATION

5.7.1. The relationship between third molar impaction and sex

This study recorded a higher prevalence of impacted third molar teeth in females (53.2%) in comparison to males (46.8%), which is in agreement with Sandhu and Kapila (1982) [44.3% males; 55.7% females]; Omar (2008) [49.0% males; 51.0% females] and Hashemipour *et al*. (2013) [35.1% males; 64.9% females] (Table 33). The prevalence of the impacted third molars in females compare favourably with a weighted mean of 52.0% extracted from the literature (Table 33).

Hellman (1988) suggested that the jaws of females stop growing as soon as the third molars begin to erupt, whereas in males the growth of the jaws continues beyond the eruption of the third molars. Therefore the prevalence of third molar impaction is more frequent in females than males (Omar, 2008 and Ramamurthy *et al*., 2012). Juodzbalys and Daugela (2013) agreed with Hellman (1988) stating that the mandibular third molar teeth in males erupts approximately 3 to 6 months before females, consequently resulting in a higher prevalence of impacted mandibular third molar in females.

However, Tsabedze (2012) recorded a higher prevalence in males than females, with a male to female ratio of 1.6:1, whereas the ratio in the current study is 1:1.1. Ramamurthy *et al.* (2012) also recorded a higher prevalence of impacted third molars in males (51.3%) as compared to females (48.7%), which disagreed with the finding of this study.

Table 33: Prevalence of impacted third molars in males and females

Authors	Year	Sample size	Population	Prevalence of impacted third molars (%)	
				Males	Females
Sandhu and Kapila	1982	1015	Indian	44.3	55.7
Omar	2008	1150	Hawler	49.1	51.0
Ramamurthy *et al.*	2012	1005	Indian	51.3	48.7
Tsabedze	2012	1215	South African	64.1	35.9
Hashemipour *et al.*	2013	3800	Iranian	35.1	64.9
Syed *et al.*	2013	2300	Saudi Arabian	48.6	49.5
WEIGTHED MEAN				**47.3**	**52.0**
Present Study	**2014**	**340**	**South African**	**46.8**	**53.2**

5.8. AGE DISTRIBUTION

A higher prevalence of impacted third molars was recorded amongst young adults. In the present study, majority of the third molars impactions belonged to the age interval of 20 - 25 years, which is similar to the findings of Syed *et al.* (2013). A prevalence of 36.6% was reported for the 20 - 25 age intervals. These findings were in agreement with studies conducted by Sandhu and Kapila (1982); Omar (2008) and Tzabedze (2012), who found individuals between 21 - 25 years as having the highest prevalence of impacted third molars (Table 34). Similarly, Syed *et al.* (2013) recorded the highest prevalence of third molar impaction in the 20 - 25 year interval, with a prevalence of 64.5%. However, Chu *et al.*

(2003) and Khan *et al.* (2010) recorded the highest prevalence of impacted third molar in individuals between 20 - 29 years old (Table 34).

Table 34: Highest prevalent age group for impacted third molar

Author	Year	Population	Prevalence (%)	Age intervals
Sandhu and Kapila	1982	Indian	51.2	21 – 25
Chu *et al.*	2003	Hong Kong Chinese	55.1	20 – 29
Omar	2008	Hawler	48.9	21 – 25
Khan *et al.*	2010	Pakistani	57.4	21 – 30
Tsabadze	2012	South African	33.1	21 – 25
Sabra and Soliman	2013	Saudi Arabian	57.4	21 – 23
Syed *et al.*	2013	Saudi Arabian	64.5	20 – 25
Present Study	**2014**	**South African**	**36.6**	**20 – 25**

It has been shown that as the age increases there is a decrease in the prevalence of third molar impaction (Chu *et al*., 2003) and Syed *et al*., 2013). Furthermore, Biswari *et al*. (2010) stated that impacted mandibular third molars are most prevalent in young adults, with an estimation that one in every eleven mandibular third molar teeth , aged between 15 – 35 years are impacted. However, in older adults one out of every forty six mandibular third molars are impacted (Biswari *et al*., 2010).

Furthermore, this study found that females between 20 – 25 years presented with a higher prevalence of impacted third molars than in males (Table 35). In contrast, Tsabedze (2012) recorded that males between 21 – 25 years presented more frequently with impacted mandibular third molars than females (Table 35). This may be due to population-specific differences which vary from one region to another within the same country. In addition, these results may be influenced by the number of individuals sampled among the different gender groups.

Table 35: Highest prevalent age group for impacted third molar in males and females

Author	Year	Population	Sample size		Prevalence (%)		Age group
			Male	Female	Males	Females	
Tsabedze	2012	South African	132	74	61.8	38.2	21 – 25
Present Study	**2014**	**South African**	**124**	**141**	**44.3**	**55.7**	**20 – 25**

5.9. ETHNIC DISTRIBUTION

This study comprises of 56 Black, 8 Coloured, 274 Indian and 2 White patients, of this 35 Black, Coloured, 222 Indian and both White patients presented with at least one impacted third molar. This may raise the question as to why there is an uneven distribution of ethnic groups sampled. This is due to the availability of digital panoramic radiograph in the Durban region. As previous mentioned, a majority of the digital panoramic radiographs in this was obtained from the Private Sector (90%) due to the inability to access the radiographs from the Public Sector (Pg. 86). As a result, socio-economic factors come into play as only patients that can afford dental treatment would visit a Dental Practitioner. Therefore, the access to oral health care facilities was a significant limitation of this study consequently the ethnic distribution of this study was affected. Due to this uneven ethnic group distribution a statistically comparison cannot be made between ethnic groups. In addition, only the Indian population can be compared to previous studies as the sample size for the other ethnic groups (Black, Coloured and White) is too small to make a comparison with literature. Additionally, Tsabedze (2012) did not report of the ethnic distribution of his sample in the Limpopo Province of South Africa therefore no comparison on ethnic distribution could be made between these two studies.

5.9.1. Gross prevalence of impacted third molars

This study compared the Indian population from Durban to the Indian population of India. The present study recorded an 83.7% prevalence of impacted third molar in the Indian population of Durban, which was significantly higher than the prevalence recorded among the Indian population of India as Sandhu and Kapila (1982) and Ramamurthy *et al.* (2012) reported prevalence of 26.0% and 41.3% respectively (Table 36). This discrepancy may be due to the type of food consumed and dietary habits which differ from one population group to another (Omar, 2009). In addition the sample size of the current study was smaller than the studies conducted in India, thus may be a contributing factor to the high prevalence recorded in this study (Table 36).

Table 36: Comparison between the prevalence of impacted third molars in two populations

Authors	Year	Population	Sample Size	Prevalence of impacted third molars (%)
Sandhu and Kapila	1982	Indian	1015	26.0
Ramamurthy *et al.*	2012	Indian	1005	41.3
Present Study	**2014**	**South African (Indian)**	**274**	**83.7**

5.9.2. Gross prevalence of impacted third molars in the mandible and maxilla

In this study recorded a higher prevalence of impacted mandibular third molars (56.40%) than impacted maxillary third molars (43.60%) in the Indian population of Durban (Table 37). The findings of the current study concur with Sandhu and Kapila (1982), who reported a 63.21% and 36.79% prevalence of impacted mandibular and maxillary third molar teeth, respectively (Table 37). These findings suggest a similarity between the Indian population of Durban and that of India, consequently genetically inherited factors may influence the prevalence of impacted third molar (Omar, 2008) .

Table 37: Comparison between the prevalence of impacted mandibular & maxillary third molars

Authors	Year	Population	Sample size	Prevalence of impacted third molar (in %)	
				Mandible	**Maxilla**
Sandhu and Kapila	1982	Indian	1015	63.21	36.79
Present Study	**2014**	**South African (Indian)**	**274**	**56.40**	**43.60**

5.10. MORPHOMETRIC ANALYSIS OF THE MANDIBLE

The identification of human remains is essential in forensic medicine and anthropology, especially during criminal investigations and in the identification of accidental or natural disaster victims as well as in an effort to reconstruct the lives of ancient populations (Akhlaghi *et al*., 2012 and Indira *et al.*, 2012). One of the indispensable aspects of forensic medicine and anthropology is to determine sex from fragmented jaws and dentition (Indira *et al.,* 2012). There is paucity of literature with regards to the measurements of the mandible using digital panoramic radiographs (Indira *et al*., 2012). In this study, the morphometric parameters of the male mandibles were greater than that in the female, which concurs with the finding of Indira *et al.* (2012), who stated that male bones are generally bigger and more robust than females. Duthie *et al*. (2007) recorded that the morphometric parameters of the mandible was longer in males than females. Consequently, third molar impaction is more prevalent in females than males, due the smaller jaw size in females. Yassir (2013) stated that this finding may be ascribed to the fact that maturation is achieved earlier in females than males, as males have a longer growth period.

5.10.1. Length of the mandibular ramus

In the current study, a statistically significant relationship between the length of the mandibular ramus and sex is recorded on both the right and left sides of the mandible (P-value = 0.000) (Table 38). The results of the current study confirmed that of previous studies as the authors in Table 38 recorded the length of the mandibular ramus to be longer in males than females. In addition, Rai *et* al. (2007) and Indira *et al.* (2012) stated that the mandibular ramus tends to show a higher sexual dimorphism than any of the other parameters of the mandible. Humphrey *et al*. (1999) stated that almost any site of mandibular bone deposition, or resorption, or remodelling has the potential for becoming sexually dimorphic therefore, the mandibular condyle and ramus specifically are the sites associated with the greatest morphological changes in size and remodelling during growth thus showing the highest sexual dimorphism. In addition, Indira *et al*. (2012) stated that the development of the muscles of mastication is also known to influence the sexual dimorphism of the mandibular ramus as the masticatory forces exerted differ between the sexes. In addition, from Table 38 it is evident that morphometric differences in the mandible exist between the Northern and Southern hemispheres. Since majority of the African countries (South Africa; Kenya and Zimbabwe) recorded a longer mandibular ramus than countries of the Northern hemisphere (America; Iraq and India) (Table 38). The results of this study concur with Iscan and Steyn (1999) who documented a difference in the craniometric dimensions between South African and North American populations.

Table 38: Length of the mandibular ramus in males and female (in mm)

Author	**Year**	**Population**	**Length of mandibular ramus (in mm)**	
			Male	**Female**
Burstone *et al.*	1978	American	52.0	46.8
Mbajorgu *et al.*	1996	Zimbabwean	61.3	59.8
Fabian & Mpembeni	2002	Tanzanian	49.9	44.2
Rai *et al.*	2007	Indian	53.9	51.8
Kenyanya	2011	Kenyan	57.7	52.0
Shamout *et al.*	2012	Jordanian	53.2	49.1
Yassir	2013	Iraqi	51.4	45.1
Present Study	**2014**	**South African**	**59.9**	**54.1**

5.10.2. Width of the mandibular ramus

In this study, the width of the mandibular ramus is longer in males than females, which concur with the results recorded by Vinay and Gowri. (2013). However, Ranganath *et al*. (2008) found that the mandibular ramus is longer in females as compared to males (Table 39). Although no statistically significant relationship with age or sex was reported in this study (P-value > 0.05), the result compared favourably with the findings of Rai *et al.* (2007), who reported no significant relationship between sex and breadth of the mandibular ramus. The aforementioned authors did not provide an explanation for their findings. In addition, the mean width of the mandibular ramus in this study was smaller than that recorded by Rai *et al.* (2007) and Vinay and Gowri (2013) in an Indian population (Table 39). However, the mean width in the current study was greater than the Japanese population (Suzuki and Takahashni, 1975), thus once again suggesting morphometric difference between the two hemispheres (Table 39).

Table 39 : Width of the mandibular ramus in males and female (in mm)

Author	**Year**	**Population**	**Width of mandibular ramus (in mm)**	
			Male	**Female**
Suzuki and Takahashni	1975	Japanese	32.9	31.9
Ranganath *et al.*	2008	Indian	38.8	40.7
Vinay and Gowri	2013	Indian	41.7	38.9
Present Study	**2014**	**South African**	**35.6**	**34.9**

5.10.3. Length of the mandibular body

The length of the male mandibular body in this study was longer than the female, with a mean length of 84.9 mm and 81.0 mm in males and females, respectively (Table 40), which concur with previous studies in Table 39. The mean length of the mandibular body in the current study was longer than the Indian (Jayakaran *et al*., 2000 and Vinay *et al*., 2013); Zimbabwean (Mbajorgu *et al*., 1996) and Iraqi population however the length was smaller than the Kenyan (Kenyanya, 2011) and Thailand (Ongkana *et al.*, 2009) population (Table 40).

Racial, genetic and regionally differences in functional activity of the mandible during the early stages of growth development may affect its shape and size (Rai *et al*., 2007). Indira *et al.* (2012) stated that socio-environmental factors, viz. nutrition, climate, dietary habits, pathologies and a lack of proper dental care influence the growth and development, and consequently the appearance of bones. In addition, various studies confirmed that skeletal characteristics differ in each population as there are population specific osteometric standards for sex determination (Vodanovic *et al.*, 2006; Saini *et al*., 2011 and Indira *et al*., 2012).

However, only the relationship between the length of the right mandibular body and sex displayed a statistically significant difference in this study (P-value = 0.040). There is a paucity of literature regarding this particular relationship. Luca *et al.* (2003) stated that mastication and dietary habits influences the growth of the mandible. They recorded that individuals who consumed an abrasive diet had larger jaws in comparison to those that had a soft diet. In addition, Weiner (2001) reported that individuals tend to favour either their right or left side, therefore this study suggests that individuals tend to favour chewing on their right side in comparison to the left.

Table 40*: Length of the mandibular body in males and female (in mm)*

Author	Year	Population	Length of mandibular body (in mm)	
			Male	Female
Mbajorgu *et al.*	1996	Zimbabwean	77.8	72.3
Jayakaran *et al.*	2000	Indian	74.4	70.6
Ongkana *et al.*	2009	Thai	89.4	85.3
Kenyanya	2011	Kenyan	99.8	93.4
Vinay *et al.*	2013	Indian	75.4	72.5
Yassir	2013	Iraqi	74.9	69.9
Present Study	**2014**	**South African**	**84.9**	**82.0**

5.11. LIMITATION OF THIS STUDY

One of the major limitations of this study was access to oral health care facilities and lack patient demographic records (viz. age, sex and ethnic group) available at these facilities. In addition, the instrumentation in the Public Sector was inoperational during the time of data collection. Due to this, the ethnic distribution of this study appears skewed as the sample was dependent on individuals that visited a Private Dental Practitioner.

Further studies are required on a broader spectrum (larger sample size) to investigate the correlation between age and sex, and the morphometric and morphological parameters of the mandible to obtain specific standard for a homogenous South African population. The following studies are required for a South African population: a) to establish if a relationship exists between tooth-size and the size of the mandible; b) to investigate the retromolar space in relation to third molar eruption; c) to examine the gonial angle in relation to sex and age; d) to compare the prevalence of impacted third molars between individuals of Urban and Rural areas; e) to compare the prevalence of impacted third molars between ethnic groups.

In addition, studies on root canal morphology are required to determine the accuracy of the proposed theories by the Belfast Group about the angulation of third molars in relation to the differential root growth and to determine if a relationship exists between root angulation and the angle of impaction. It is also essential to evaluate the aetiology (viz. diet) behind the high prevalence of impacted third molar teeth in the Greater Durban Metropolitan population.

CHAPTER SIX

CONCLUSION

The highest prevalence of impacted third molars was recorded in the Greater Durban Metropolitan population, as 77.9% of the population presented with at least one impacted third molar, with third molar impaction being more prevalent in females than males (1.1:1). A greater prevalence of impacted third molar teeth was recorded in the mandible than the maxilla, with a ratio of 1.3:1, respectively. In addition, the third molar impaction was most prevalent of the left side of the mandible and maxilla in both sexes however, no statistically significant correlation between side and impacted mandibular and maxillary third molars in both males and females were recorded. In this study, the most prevalent pattern of impacted third molar was found to be mesio-angulation in the mandible and vertical angulation in the maxilla. With regard to the level of impaction, class IIB and class A were most common in the mandible and maxilla, respectively. The highest frequency of impacted third molars was recorded in the 20-25 year age group. Therefore, maxillofacial surgeons, dentists, orthodontists and anatomists may use these results to predict if the patient is a possible candidate for third molar impaction, and they are able to evaluate and provide treatment to the patient more efficiently. These results may also encourage young adults to be screened for impacted third molars before the impaction becomes severe. In addition, the inclusion of these results in the dental and medical science curricula, may enable young dental practitioners and scientists to easily identify the type of impaction, which may assist them in research and clinical procedures, such as extraction of the impacted third molars.

All the morphometric parameters (length and width of the mandibular ramus and length of the mandibular body) of the male mandibles were greater than that of the female. This study also recorded that difference exists in the aforementioned morphometric parameters of the mandible between the Northern and Southern Hemispheres. The length of the mandibular ramus may be considered as an indispensible tool in sex determination for anthropologist and forensic investigators since a statistical significant difference was recorded between males and females (P-value = 0.000). In addition, the ramus of the mandible is said to be highly resistant to damage and the disintegration process, which may be useful in providing anthropological data that can be used in dental or medico-legal procedures. There was no statistically significant relationship found between the width of the mandibular ramus with age or sex. However, the right mandibular body showed a statistically significant correlation with sex (P-value 0.040), which may suggest that individuals tend to favour chewing on their right side in comparison to their left.

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APPENDICES

APPENDIX

ONE

ETHICAL CLEARANCE

PROVISIONAL ACCEPTANCE

UNIVERSITY OF
KWAZULU-NATAL
INYUVESI
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20 February 2014

Miss Sundika Ishwarkumar
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4339
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Dear Ms Ishwarkumar

PROTOCOL: Prevalence of impacted third molar teeth in the greater Durban Metropolitan population. REF: BE410/13

PROVISIONAL APPROVAL

A sub-committee of the Biomedical Research Ethics Committee has considered your application received on 22 November 2013.

The study is given **PROVISIONAL APPROVAL** pending a response to the following:

1. Gatekeeper permission is required.
2. What is the significance of this study?
3. How would this study add value to a patient's dental history?
4. The data collection sheet: Does the radiological report or dentist/ orthodontist not already document these findings?
5. What is the difference and significance of describing Pell, Gregory's and Winter's classification?
6. The statistical analysis does not include the prevalence of impacted wisdom and jaw morphometry.
7. Comment: the real prevalence of impacted third molars in the greater Durban Metropolitan area cannot be determined by this study as data will be drawn only from those members of the population of 16 to 30 y who have presented to public health dental facilities and have had a panoramic dental X-ray. The title of the study should reflect this, and due discussion of this limitation made in the paper. A title "Prevalence of impacted third molar teeth among young adults presenting to public health dental facilities in the greater Durban Metropolitan area" would be more appropriate.

Only when full ethical approval is given, may the study begin. **Full ethics approval has not been given at this stage.**

PLEASE NOTE: Provisional approval is valid for 6 months only – should we not hear from you during this time – the study will be closed and reapplication will need to be made.

Your acceptance of this provisional approval denotes your compliance with South African National Research Ethics Guidelines (2004), South African National Good Clinical Practice Guidelines (2006) (if applicable) and with UKZN BREC ethics requirements as contained in the UKZN BREC Terms of Reference and Standard Operating Procedures, all available at http://research.ukzn.ac.za/ResearchEthics11415.aspx.

BREC is registered with the South African National Health Research Ethics Council (REC-290408-009). BREC has US Office for Human Research Protections (OHRP) Federal-wide Assurance (FWA 678).

Yours sincerely

Ms A Marimuthu
Senior Administrator: Biomedical Research Ethics

ADMENDMENT

BIOMEDICAL RESEARCH ETHICS COMMITTEE

APPLICATION FOR ETHICS APPROVAL OF AMENDMENTS

NAME OF RESEARCHER: SUNDIKA ISHWARKUMAR

DEPARTMENT: CLINICAL ANATOMY

TITLE OF STUDY: PREVALENCE OF IMPACTED THIRD MOLAR TEETH IN THE GREATER DURBAN METROPOLITAN POPULATION

ETHICS REFERENCE NO: BE410/13

DATE OF ETHICAL APPROVAL OF STUDY: 20/02/14 (Provisional Ethics)

DATE OF AMENDMENTS: 10/04/14

AMENDMENTS REQUESTED:

1. Itemise required amendments in following format:

   (i) original protocol states..................... amendment requested......... etc.

2. Reason for amendment and the impact this will have on the participant or patient.

3. If additional investigators are added: Outline role and submit 2-page CV and proof of current HPCSA registration and GCP certification with the application.
4. If a new site is added, submit permission letter from the manager of the hospital/clinic/institution, if applicable.

AMENDMENT:

1. Original Protocol states:

(i) The original protocol states that the radiographs will be obtained from the Radiology Departments of Provisional Hospitals. The approval for collection of the radiographs will be obtained from the Hospital's Superintendent. In addition to the amendment request, I would also like to include the Private sector. I consulted with Dr Shenuka Singh from the Dentistry Department of UKZN and she recommended that I include the Private sector as they deal with impaction on a regular basis.

(ii) The original protocol states that the angle of impaction will be measured by adopting the method proposed by Quek *et al*. (2003). The amendment request is to remove this method from my Materials and Methods as I am unable to access a digital programme that measures the angle.

(iii) The original protocol states that 400 panoramic radiographs will be analysed. The amendment request is to decrease the sample size to 250 panoramic radiographs.

2. Reasons:

(i) The addition of the Private sector will broaden this study and it will be a more accurate representation of the Durban population.

(ii) I am unable to access a digital programme to measure the angulation of impaction.

Both amendments, (i) and (ii), will have no impact on any patients. The patient's names are not required for this study. Biometric data required include the date of birth, date of radiographs, race and gender only. The patients will not be able to be traced from the information required for this study. All data obtained will be secured in password protected files by the researcher.

(iii) There is a shortage of panoramic radiographs that can be reviewed as not all patient files has the age, sex and ethnic group of the patient.

3. N/A

4. Addition of the Private Sector:

- Please find attached permission letter from the Doctors of the Private Practices.

Thank you for your time and consideration.

SIGNATURE OF PRINCIPAL RESEARCHER: ……………………………………DATE: ………………

FULL ETHICAL CLEARANCE

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

26 June 2014

Miss Sundika Ishwarkumar
27A Munn Road
Ottawa
Verulam
4339
Sundika07@gmail.com

Dear Ms Ishwarkumar

PROTOCOL: Prevalence of impacted third molar teeth in the greater Durban Metropolitan population. REF: BE410/13

EXPEDITED APPLICATION

A sub-committee of the Biomedical Research Ethics Committee has considered and noted your application received on 22 November 2013.

The study was provisionally approved pending appropriate responses to queries raised. Your responses received on 28 March 2014 to queries raised on 20 February 2014 have been noted by a sub-committee of the Biomedical Research Ethics Committee. The conditions have now been met and the study is given full ethics approval and may begin as from 26 June 2014.

This approval is valid for one year from **26 June 2014**. To ensure uninterrupted approval of this study beyond the approval expiry date, an application for recertification must be submitted to BREC on the appropriate BREC form 2-3 months before the expiry date.

Any amendments to this study, unless urgently required to ensure safety of participants, must be approved by BREC prior to implementation.

Your acceptance of this approval denotes your compliance with South African National Research Ethics Guidelines (2004), South African National Good Clinical Practice Guidelines (2006) (if applicable) and with UKZN BREC ethics requirements as contained in the UKZN BREC Terms of Reference and Standard Operating Procedures, all available at http://research.ukzn.ac.za/Research-Ethics/Biomedical-Research-Ethics.aspx.

BREC is registered with the South African National Health Research Ethics Council (REC-290408-009). BREC has US Office for Human Research Protections (OHRP) Federal-wide Assurance (FWA 678).

The sub-committee's decision will be **RATIFIED** by a full Committee at its next meeting taking place on 12 August 2014.

We wish you well with this study. We would appreciate receiving copies of all publications arising out of this study.

Yours sincerely

Professor D.R Wassenaar
Chair: Biomedical Research Ethics Committee

Professor D Wassenaar (Chair)
Biomedical Research Ethics Committee
Westville Campus, Govan Mbeki Building
Postal Address: Private Bag X54001, Durban, 4000, South Africa
Telephone: +27 (0)31 260 2384 **Facsimile:** +27 (0)31 260 4609 **Email:** brec@ukzn.ac.za
Website: http://research.ukzn.ac.za/Research-Ethics/Biomedical-Research-Ethics.aspx

Founding Campuses: Edgewood | Howard College | Medical School | Pietermaritzburg | Westville

INSPIRING GREATNESS

CERTIFICATES

GATE KEEPERS LETTERS

PUBLIC SECTOR

health

Department:
Health
PROVINCE OF KWAZULU-NATAL

KING DINUZULU HOSPITAL COMPLEX
ORAL & DENTAL TRAINING COMPLEX
STANLEY COPLEY DRIVE
SYDENHAM
4015
TELEPHONE : (031) 2426243
EMAIL : NTOMBIFUTHI.DAKI@KZNHEALTH.GOV.ZA

14 March 2014
Enquiries : Mrs. S. Baboolal

Miss Sundika Ishwarkumar
27A Munn Road
Ottawa
VERULAM

RE: LETTER OF SUPPORT TO CONDUCT RESEARCH AT ODTC: PREVALENCE OF IMPACTED THIRD MOLAR TEETH IN THE GREATER DURBAN METROPOLITAN POPULATION

Kindly note that at the Oral and Dental Training Centre we support your request to conduct research in our x-ray department.

Please note the following :-

1. Please ensure that you adhere to all the policies, procedures, protocols and guidelines of the Department of Health with regards to this research.
2. This research will only commence once this office has received confirmation from the Institutional/Provincial Health Research Committee in the KZN Department of Health.
3. Please ensure this office is informed before you commence your research.
4. The facility will not provide any resources for this research.
5. You will be expected to provide feedback on your findings to the Facility.

Thanking you.

Sincerely

Noted & Supported
Please complete & submit Indemnity form prior to starting

DR S.B. MAHARAJ
MEDICAL MANAGER
KING DINUZULU HOSPITAL COMPLEX

13/3/2014

DR N DAKI
CLINICAL MANAGER : ODTC

uMnyango Wezempilo . Departement van Gesondheid

Fighting Disease, Fighting Poverty, Giving Hope

health

Department
Health
PROVINCE OF KWAZULU-NATAL

OFFICE OF THE HOSPITAL CEO

KING EDWARD VIII REGIONAL HOSPITAL
Private Bag X02, CONGELLA, 4013
Corner of Rick Turner & Sydney Road
Tel.031 3603953/3016 Fax.031 2051457.
Email:[illegible]@kznhealth.gov.za
www.kznhealth.gov.za

Ref.: KE 2/7/1/ (13/2014)
Enq.: Mrs. R. Sibiya
Research Programming

25 March 2014

Miss Suncka Ishwarkumar
27A Munn Road
Ottawa
VERULUM
4339

Dear Dr.S Ishwarkumar

Protocol: Prevalence of impacted third molar teeth in greater Durban Metropolitan population. BE410/13

Permission to conduct research at King Edward VIII Hospital is provisionally granted, pending approval by the Provincial Health Research Committee, KZN Department of Health.

Kindly note the following:

- The research will only commence once confirmation from the Provincial Health Research Committee in the KZN Department of Health has been received.
- Signing of an indemnity form at Room 8, CEO Complex before commencement with your study.
- King Edward VIII Hospital received full acknowledgment in the study on all publications and reports and also kindly present a copy of the publication or report on completion.

The Management of King Edward VIII Hospital reserves the right to terminate the permission for the study should circumstances so dictate.

Yours faithfully

SUPPORTED/~~NOT SUPPORTED~~

DR. OSB BALOYI
ACTING CHIEF EXECUTIVE OFFICER

25/03/2014
DATE

uMnyango Wezempilo . Departement van Gesondheid

Fighting Disease, Fighting Poverty, Giving Hope

health

Department:
Health
PROVINCE OF KWAZULU-NATAL

Health Research & Knowledge Management sub-component
10 – 103 Natalia Building, 330 Langalibalele Street
Private Bag X9051
Pietermaritzburg
3200
Tel : 033 – 3953189
Fax : 033 – 394 3782
Email : hrkm@kznhealth.gov.za
www.kznhealth.gov.za

Reference : **HRKM 67/14**
Enquiries : **Mr X Xaba**
Tel : 033 – 395 2805

Dear Ms G. Ishwarkumar

Subject: Approval of a Research Proposal

1. The research proposal titled **'Prevalence of impacted third molar teeth in the greater Durban Metropolitan Population'** was reviewed by the KwaZulu-Natal Department of Health.

   The proposal is hereby **approved** for research to be undertaken at King Dinuzulu Hospital Complex and King Edward VIII Hospital.

2. You are requested to take note of the following:
   a. Make the necessary arrangement with the identified facility before commencing with your research project.
   b. Provide an interim progress report and final report (electronic and hard copies) when your research is complete.

3. Your final report must be posted to **HEALTH RESEARCH AND KNOWLEDGE MANAGEMENT, 10-102, PRIVATE BAG X9051, PIETERMARITZBURG, 3200** and e-mail an electronic copy to hrkm@kznhealth.gov.za

For any additional information please contact Mr X. Xaba on 033-395 2805.

Yours Sincerely

E Lutge

Dr E Lutge
Chairperson, Health Research Committee
Date: 5/05/2014.

uMnyango Wezempilo . Departement van Gesondheid

Fighting Disease, Fighting Poverty, Giving Hope

PRIVATE SECTOR

VAT no: 4060120989 | PR No: 5420555

Dr. A MAHOMED & ASSOCIATES

Miss Sundika Ishwarkumar
27 A Munn Road
Ottawa
Verulam
4339

LETTER OF SUPPORT TO CONDUCT REASEARCH AT MY PRACTICE
PREVALENCE OF IMPACTED THIRD MOLAR TEETH IN THE GREATER DURBAN METROPOLITAN POPULATION : BE410/13

Kindly note that at the Practice 5420555 , we support your request to conduct research in our practice .

Thanking you

Yours faithfully

24|04|14
DATE

DR ADAM MAHOMED

Dental Surgeon

Suite 3
Knowles Centre *(next to muscle and fitness gym)*
Pinetown , 3610

Tel: (031) 701 4519
Tel/Fax: (031) 701 4232
nooriem@mweb.co.za

Dr. HASSAN G.M.HAFFEJEE

B.D.S (India) M.Dent. (Wits)

1st Floor
Orthomax Centre
29 Ismail.C.Meer Street (Lorne Street)
Durban
4001

Pr No: 6200850
Tel No: 031 309 5202
031 309 5374

Fax No: 086 219 8878

Email: hhaffejee@pop.co.za
reception@drhaffejee.co.za

Miss Sundika Ishwarkumar
27 A Munn Road
Ottawa
Verulam
4339

LETTER OF SUPPORT TO CONDUCT RESEARCH AT MY PRACTICE
PREVALENCE OF IMPACTED THIRD MOLAR TEETH IN THE GREATER DURBAN METROPOLITAN POPULATION: BE410/13

Kindly note that at the 6200850 Practice, we support your request to conduct research in our practice.

Thanking you.

Yours faithfully

DR.H.G.M HAFFEJEE

Maxillo-facial surgeon

DATE

DR P NUNKOO(BDS-MEDUNSA)
PRACTICE NO: 5452287
DENTAL SURGEON

PRACTICE:
2 Stanmore Drive
Stanmore
Phoenix

CORRESPONDENCE:
P O Box 60246
Phoenix
4068

Tel No: 0315026526
Fax No: 0315026524
Email : dentdoc@absamail.co.za

07 February 2014

Miss Soudika Ishwarkumar
27 A Munn Road
Ottawa
Verulam
4339

LETTER OF SUPPORT TO CONDUCT RESEARCH AT MY PRACTICE
PREVALENCE OF IMPACTED THIRD MOLAR TEETH IN THE GREATER DURBAN METROPOLITAN POPULATION; BE410/13

Kindly note that at the dental practice of Dr P Nunkoo (5452287) we support your request to conduct research in our practice.

Thank you

Yours faithfully,

DR P NUNKOO
DENTAL SURGEON

DR. P. NUNKOO BDS (MEDUNSA)
DENTAL SURGEON
P.O. BOX 60246
PHOENIX 4068

26-04-2014
DATE

Dr. W. Maistry

[illegible], BDS (MEDUNSA)
PR NO: [illegible]

27 IRELAND STREET, VERULAM - NORTH COAST MEDICAL & DENTAL CENTRE

For Appointments Phone Dr. Maistry

Tel/Fax: 032 - 533 5579

BUSINESS HOURS:

Monday - Friday : 8:00 - 5.30pm. - Saturday : 8:00 - 1:00pm. - Sunday / Public Holidays : 8:00 - 11am.

---

10 June 2011

Miss Sundika Iswarkumar
27 A Munt Road
Ottawa
Verulam
4339

LETTER OF SUPPORT TO CONDUCT RESEARCH AT MY PRACTICE
PREVALENCE OF IMPACTED THIRD MOLAR TEETH IN THE GREATER DURBAN METROPOLITAN POPULATION: BE410/13

Kindly note that at the dental practice of Dr Maistry (0445185) we support your request to conduct research at our practice.

Thank you

Yours faithfully,

[illegible signature], BDS (MEDUNSA)
Dr W MAISTRY
DENTAL SURGEON

[illegible]
DATE

DR. W. MAISTRY
[illegible]
TEL/FAX: 032 - 533 5579

APPENDIX

TWO

DATA SHEET

RAW RESULTS

Results_Raw Data_Impacted third molars

No. of x-ray	Age	Sex	Race	Type of angulation of the third molar				Depth of the third molar				Relation to mandible		Length of ramus		Width of ramus		Length of body	
				Mandible Right	Mandible Left	Maxilla Right	Maxilla Left	Mandible Right	Mandible Left	Maxilla Right	Maxilla Left	Right	Left	Right	Left	Right	Left	Right	Left
P1	23	F	I	Mesio	mesio	vertical	vertical	A	A	A	A	i	i	55.9	50.5	31.6	28.9	79.5	76.6
														55.6	50.4	31.8	28.8	79.1	76.8
														55.8	50.8	31.4	28.8	79.3	76.9
														55.7667	50.5667	31.6	28.8333	79.3	76.767
P3	20	F	I	Mesio	mesio	vertical	vertical	C	C	B	B	iii	iii	46.8	47.1	30.5	28.1	84.2	85.6
														46.2	47.2	30.5	28	84.1	85.3
														46	47.5	29.9	28.5	84.2	85.3
														46.3333	47.2667	30.3	28.2	84.1667	85.4
P7	20	F	I	mesio	mesio	vertical	vertical	B	B	A	A	ii	ii	57.1	56.4	33.4	34.1	84.7	82
														57.6	56.8	33.6	34.3	84.6	82.4
														57.1	56.9	33.2	34.5	84.5	82.6
														57.2667	56.7	33.4	34.3	84.6	82.333
P8	21	F	I	mesio	vertical	vertical	vertical	B	B	A	A	ii	ii	53	51.6	30	27.9	86.9	86.6
														52.9	51.3	30.2	27.5	86.2	86.4
														53.1	51.4	30.4	27.3	86.8	86.8
														53	51.4333	30.2	27.5667	86.6333	86.6

P9	16	F	C	mesio	mesio	disto	disto	C	C	A	A	iii	iii	49.5	50.3	31	31.5	79.6	80.3
														49.4	50.2	31.3	31.6	79.7	80.7
														49.7	49.9	31.3	31.4	79.1	80
														49.5333	50.1333	31.2	31.5	79.4667	80.333
P10	26	F	I		horizontal				B				ii	52.8	54.4	28.8	27.5	81.2	83.4
														52.7	54.6	28.3	27.7	81.3	83.5
														52.1	54.1	28.9	27	81.8	83.2
														52.5333	54.3667	28.667	27.4	81.4333	83.367
P13	23	M	I	horizontal	mesio	vertical	vertical	B	B	A	A	ii	ii	62.5	71.2	31.9	34.6	77.5	78.55
														62.6	71.8	32.1	34.4	77.1	78.6
														62.7	71.6	31.9	34.9	77.4	78.4
														62.6	71.5333	31.967	34.6333	77.3333	78.517
P14	16	M	C	mesio	mesio	vertical	vertical	B	B	A	A	ii	ii	53.5	54.4	37.2	36.1	91.9	89.1
														53.8	54.9	37.9	36.5	92.1	89.3
														54	54.7	37.6	36.2	92.2	89.8
														53.7667	54.6667	37.567	36.2667	92.0667	89.4
P15	21	F	I	mesio	mesio	disto	disto	C	C	B	B	iii	iii	47.2	51.5	35.8	35.6	88.1	89.2
														47.9	51.9	35.6	35.5	88.4	89.3
														47.4	51.4	35.9	35.8	88.6	89.7
														47.5	51.6	35.767	35.6333	88.3667	89.4

P16	22	F	I	vertical	vertical	vertical	vertical	B	B	A	A	ii	ii	33.6	32.2	55.9	55.4	82	85.2
														33.7	32.1	55	55.5	82.3	84
														33.4	32.4	55.8	55.8	82.5	84.9
														33.5667	32.2333	55.567	55.5667	82.2667	84.7
P17	21	M	I	mesio	mesio	mesio	mesio	A	B	A	A	i	ii	30.4	30.2	60.6	63.9	73.4	71.8
														30.1	30	60.8	63.4	73.8	71.3
														30.7	30.5	60.4	63	73	71.6
														30.4	30.2333	60.6	63.4333	73.4	71.567
P18	16	F	I	mesio	mesio	vertical	vertical	C	C	A	A	iii	iii	30.4	27.7	54.2	56.4	64.3	62.1
														30.7	27.5	54	56.7	64.1	62.4
														30.4	27.9	54.3	56.9	64.7	62.8
														30.5	27.7	54.167	56.6667	64.3667	62.433
P19	18	F	C	mesio	mesio	vertical	vertical	A	A	A	A	i	i	29.2	29.3	47.5	47.5	71.8	73
														29.3	29	47.7	47.8	71.6	73.5
														29.8	29.1	47.9	47.9	71.3	73.2
														29.4333	29.1333	47.7	47.7333	71.5667	73.233
P21	17	F	W	mesio	mesio	vertical	disto	B	B	A	A	ii	ii	34.6	36.8	56.9	58.1	83.9	82
														34.6	36.1	57.2	58.2	83.7	82.4
														34.9	36.2	57.3	58.5	84.2	82.7
														34.7	36.3667	57.1333	58.2667	83.9333	82.3667

P24	19	M	I	mesio	mesio	vertical	vertical	B	B	A	A	ii	ii	30.1	27.9	60.1	60.9	78.7	74.6
														29.9	27.5	59.9	60.6	78.5	74.9
														30	27	60	60.5	78.1	74.3
														30	27.4667	60	60.6667	78.4333	74.6
P25	19	F	I	mesio	mesio	vertical	vertical	B	B	A	A	ii	ii	25.2	23.4	54	53.5	86.5	84.6
														25.9	23.3	53.8	53.9	86.2	84.8
														25.7	23.8	53.9	53.2	86.9	84.9
														25.6	23.5	53.9	53.5333	86.5333	84.767
P26	25	F	I	vertical	vertical			B	B			ii	ii	32.8	29.9	56.9	58.1	77.2	76
														33	30.1	56.5	58.4	76.9	76.5
														32.7	30.2	56.8	57.9	77.3	76.2
														32.8333	30.0667	56.733	58.1333	77.1333	76.233
P27	25	F	I	horizontal				B				ii		30.6	29.8	45.8	45.1	65.9	67.3
														30.8	30.2	45.6	45.9	66.1	68
														31.2	30	45.4	45.7	66.3	67.7
														30.8667	30	45.6	45.5667	66.1	67.667
P28	23	F	I				vertical				A			29.3	28.4	59.8	59.5	75.9	73.3
														29.5	28.9	59.2	59.7	75.4	73.9
														29.6	28.7	59.6	59.2	75.7	73.7
														29.4667	28.6667	59.533	59.4667	75.6667	73.633

P29	29	M	C	horizontal			vertical	B			A	ii		32.5	39.6	65.1	66.1	85.4	90.3
														31.9	39.8	65.4	66.2	85.9	90.4
														32.3	39.6	65.9	66.5	85.7	90.5
														32.2333	39.6667	65.467	66.2667	85.6667	90.4
P30	24	F	C	mesio	mesio			B	B			ii	ii	31	30.3	45.1	51.7	74.4	75.8
														31.4	30.4	44.9	51.9	74.6	75.6
														31.6	30.9	44.7	51.6	74.8	75.2
														31.3333	30.5333	44.9	51.7333	74.6	75.533
P32	19	F	I	mesio	mesio	vertical	disto	B	B	A	A	ii	ii	28.4	32.6	52.7	59.1	89.6	90.7
														28.5	32.1	52.9	59.3	89.2	90.2
														28.7	32	53	59.2	89.1	90.4
														28.5333	32.2333	52.867	59.2	89.3	90.433
P33	23	F	I	vertical	vertical			B	B			ii	ii	31.2	28.9	54.8	57.2	83.3	84.4
														31.1	28.5	54.6	57.1	83	84.3
														30.9	28.4	54.3	57.5	83.5	84.7
														31.0667	28.6	54.567	57.2667	83.2667	84.467
P34	22	M	I	mesio	mesio	vertical	vertical	B	C	A	A	ii	iii	30.5	28	60.1	56.9	72.4	65.6
														30.8	28.6	59.9	56.2	72.4	65.8
														30.6	28.5	60.2	56.5	72.7	65.4
														30.6333	28.3667	60.067	56.5333	72.5	65.6

P35	25	F	I	mesio	mesio	vertical	buccal	C	C	A	A	iii	iii	34.8	31.7	53.4	53.1	81.3	81.4
														34.6	31.3	53.6	53.2	81.8	81.6
														34.5	31.6	53.8	53.5	81.5	81.5
														34.6333	31.5333	53.6	53.2667	81.5333	81.5
P38	29	M	I	mesio	horizontal			B	C			ii	iii	39	32.2	59.4	59	77.4	74.9
														39.6	32.6	59.8	59.2	77.2	74.2
														39.1	32.8	59.2	59.9	77.8	74.7
														39.2333	32.5333	59.467	59.3667	77.4667	74.6
P39	27	F	I	vertical	vertical			A	A			ii	ii	33.2	32.8	64.7	60.8	75.1	78.5
														33.1	32.9	64	60.7	75.5	78.3
														33.4	33.2	64.2	61	75.3	78.1
														33.2333	32.9667	64.3	60.8333	75.3	78.3
P40	18	M	I	mesio	mesio	vertical	disto	C	C	A	A	iii	iii	30.5	32.4	48.7	49.5	87	84.6
														30.9	32.8	48	49.3	87.8	84.3
														30.7	32.1	48.9	49.8	87.8	84.4
														30.7	32.4333	48.533	49.5333	87.5333	84.433
P41	16	M	B	buccal	buccal	vertical	vertical	B	B	A	A	ii	ii	28.7	25.4	49.6	49	67.4	67.3
														28.6	25.3	49.8	49.6	67.8	67.8
														28.4	25.8	49.4	49.8	67.6	67.3
														28.5667	25.5	49.6	49.4667	67.6	67.467

P43	27	F	I	vertical	vertical			B	B			ii	ii	31.5	28	52.5	57.1	72.1	73.5
														31.6	28.5	52.6	57.3	72.5	73.1
														31.8	28.6	52.8	57.1	72.8	73.6
														31.6333	28.3667	52.633	57.1667	72.4667	73.4
P45	29	M	I	vertical	horizontal	disto	horizontal	B	B	B	A	ii	ii	66.1	65.4	38.9	35.9	79.1	80.6
														66.3	65.3	38.6	35.5	79.3	80.8
														66.4	65.7	38.4	35.7	79.4	81
														66.2667	65.4667	38.633	35.7	79.2667	80.8
P46	25	F	I	vertical	vertical			A	A			i	i	50.9	52.8	35.1	34.3	83.7	85.5
														51.2	52.6	35.7	34.5	83.5	85.9
														51.3	52.1	35.4	34.7	83.2	85.2
														51.1333	52.5	35.4	34.5	83.4667	85.533
P47	27	M	I	horizontal	horizontal			B	A			ii	i	61	58.6	35.6	34.7	83.8	86
														59.8	58.5	35.7	34.2	83.6	86.9
														59.7	58.2	35.4	34.9	83.2	86.2
														60.1667	58.4333	35.567	34.6	83.5333	86.367
P48	30	M	C	horizontal	mesio	vertical	disto	B	C	A	A	ii	iii	63.6	66.8	41.9	32.9	88.2	84.1
														63.9	66.1	41.6	32.6	88	84.3
														63.8	66.3	41.5	32.4	87.9	84.5
														63.7667	66.4	41.667	32.6333	88.0333	84.3

P49	20	M	I		mesio	vertical	vertical		C	B	B		iii	58.5	60.1	40.9	38.6	92.2	90.1
														58.7	60.9	40.3	38.4	92.4	90.6
														58.9	60.4	40.6	38.5	92.5	90.7
														58.7	60.4667	40.6	38.5	92.3667	90.467
P50	21	M	B		mesio				B				ii	66	62.8	39	42.9	89.4	93.4
														66.1	62.9	37.7	42.7	89.9	93.1
														66.5	63.1	37.9	42.5	89.7	93.7
														66.2	62.9333	38.2	42.7	89.6667	93.4
P52	18	F	I	mesio	mesio	vertical	vertical	C	C	C	C	iii	iii	49	50.6	34.9	31.2	79	83.9
														49.6	50.8	34.7	31.9	79.4	83
														49.2	50.2	34.5	31.4	79.9	83.2
														49.2667	50.5333	34.7	31.5	79.4333	83.367
P53	27	M	I		mesio				B				ii	65.8	64.7	31	30.2	76.3	78.1
														65.5	64.5	31.3	30.7	76.8	78.3
														65.3	64.3	31.7	30.5	76.7	78.8
														65.5333	64.5	31.333	30.4667	76.6	78.4
P54	29	M	B	horizontal	horizontal	vertical	vertical	C	B	A	A	iii	ii	64	65.3	34.4	35.7	79.9	77
														64.2	64.9	34.8	35.3	79.5	76.9
														63.9	65.4	34.9	36.4	79.2	76.5
														64.0333	65.2	34.7	35.8	79.5333	76.8

P55	25	F	I	vertical	vertical			B	B			ii	ii	50.3	53.1	28.9	26.2	82.6	81.3
														50.7	53.5	28.4	26.4	82.9	81.1
														50.5	53.7	28.3	26.1	82.2	81.6
														50.5	53.4333	28.533	26.2333	82.5667	81.333
P56	17	F	B	mesio	mesio	vertical	vertical	B	B	A	A	ii	ii	52.9	54.3	37	33.3	74.4	75.6
														52.4	54.8	37.3	33.5	74.8	75.9
														52.6	54.6	37.5	33.8	74.9	75.4
														52.6333	54.5667	37.267	33.5333	74.7	75.633
P58	30	F	I	vertical	mesio			A	B			i	ii	62.1	64.1	33.7	30.9	81.4	75.7
														62.5	64.7	33.8	31	81.2	75.4
														62.8	64.5	34.1	30.7	81.5	75.3
														62.4667	64.4333	33.867	30.8667	81.3667	75.467
P59	17	M	I	mesio	mesio	vertical	vertical	C	C	C	C	iii	iii	53.6	56.3	32	33.9	77.9	84.3
														53.7	56.5	32.3	33.4	78.1	84.5
														53.2	56.9	32.8	33.5	78.3	84.2
														53.5	56.5667	32.367	33.6	78.1	84.333
P61	28	M	B	vertical	vertical	vertical	vertical	B	B	A	A	ii	ii	53.1	58.8	30.7	30.5	79.6	78.3
														53.5	58.1	30.8	30.7	79.2	78.6
														53.7	58.5	30.5	30.2	79.8	78.2
														53.4333	58.4667	30.667	30.4667	79.5333	78.367

P62	23	M	B	vertical	vertical			B	B			ii	ii	74.8	71.6	29.5	31.9	104.1	102
														74.6	71.2	29.8	31	103.9	102.5
														74.2	71.1	29.3	31.5	103.7	102.1
														74.5333	71.3	29.533	31.4667	103.9	102.2
P63	17	M	B	buccal		disto	disto	B		A	A	ii		54.8	53.8	30.1	29.5	96.6	95.7
														54.2	53.2	30.4	29.8	96.4	95.1
														54.1	53.1	30.8	29.2	96.3	95.3
														54.3667	53.3667	30.433	29.5	96.4333	95.367
P64	16	M	B	mesio	mesio	vertical	vertical	B	B	A	A	ii	ii	47	47.3	39.4	37.7	74.2	69.1
														47.3	47.5	39.2	37.2	74.4	69.7
														47.5	47.2	39.1	37.4	74.9	69.3
														47.2667	47.3333	39.233	37.4333	74.5	69.367
P65	16	M	I	mesio	mesio	vertical	vertical	C	C	A	A	iii	iii	56.2	59.7	33.1	34.1	84.8	81.1
														56.5	59.2	33.4	34.2	84.2	81.3
														56.4	59.4	33.7	34.8	84.5	81.6
														56.3667	59.4333	33.4	34.3667	84.5	81.333
P66	21	M	I	mesio	mesio			B	B			ii	ii	69.7	74	35.5	34.5	85.6	82
														69.2	74.2	35.6	34.6	85.2	82.4
														69.4	74.5	35.7	34.3	85.1	82.6
														69.4333	74.2333	35.6	34.4667	85.3	82.333

P67	25	M	I	horizontal	mesio			B	A			ii	i	68.9	70.3	30	33.7	82	74.3
														68.1	70.5	30.9	33.2	82.5	74.5
														68.5	70.1	30.4	33.1	82.1	74.6
														68.5	70.3	30.433	33.3333	82.2	74.467
P68	20	M	I	mesio	mesio	vertical	vertical	B	B	A	A	ii	ii	57.5	56.3	32	34.2	82.8	79
														57.3	55.9	32.1	34.3	82.1	79.9
														57.9	56	32.5	34.6	82.6	79.5
														57.5667	56.0667	32.2	34.3667	82.5	79.467
P69	23	M	I	vertical	mesio	vertical	vertical	B	B	A	A	ii	ii	70.6	76	34.1	34.1	92.8	91
														70.9	76.1	34.3	34.5	92	91.5
														70.2	76.5	34.5	34.7	92.4	91.2
														70.5667	76.2	34.3	34.4333	92.4	91.233
P70	27	F	I	vertical	vertical	vertical	vertical	B	B	A	A	ii	ii	54.3	50.1	29.5	29.9	67.4	68.2
														54.5	50.9	29.3	29.7	67.8	68.6
														54.8	50.6	29.2	29.5	67.3	68.6
														54.5333	50.5333	29.333	29.7	67.5	68.467
P71	27	M	I	vertical	mesio		vertical	B	B		A	ii	ii	61.3	62.4	31.2	33.2	73.5	75
														61.5	62.1	31.5	33.4	73.2	75.2
														61.7	62.7	31.3	33.7	73.6	75.4
														61.5	62.4	31.333	33.4333	73.4333	75.2

P72	21	F	I	vertical	vertical		vertical	A	B		A	i	ii	59.4	62.2	30.4	26.6	85.6	83.2
														59.7	62.5	30.6	26.8	85.4	83.5
														59.9	62.1	30.1	26.9	85.2	83.7
														59.6667	62.2667	30.367	26.7667	85.4	83.467
P75	21	M	B	horizontal	horizontal	vertical	vertical	B	B	A	A	ii	ii	55.5	55.3	37.2	33	92.1	88.1
														55.4	55.6	37.6	33.4	92.5	88.4
														55.8	55.1	37.5	33.8	92.2	88.5
														55.5667	55.3333	37.433	33.4	92.2667	88.333
P76	17	F	B	mesio	mesio	disto	disto	C	C	A	A	iii	iii	59.5	60.1	38.3	37	98.8	95
														59.8	60.7	38.8	37.9	98.5	95.3
														59.2	60.5	38.5	37.7	98.9	95.4
														59.5	60.4333	38.533	37.5333	98.7333	95.233
P77	16	F	I	mesio	mesio	vertical	vertical	B	C	C	C	ii	iii	55.2	54.1	28.8	26.6	59.1	63.4
														55.5	54.9	28.2	26.7	59.6	63.5
														55.9	54.5	28.5	26.5	59.4	63.1
														55.5333	54.5	28.5	26.6	59.3667	63.333
P79	29	M	I	vertical	vertical		disto	B	B		A	ii	ii	61	66.4	33.2	30	83	87.7
														61.5	66.7	33.2	30.4	83.5	87
														61.7	66.2	33.4	30.2	83.7	87.2
														61.4	66.4333	33.267	30.2	83.4	87.3

P80	23	M	I	vertical	vertical	vertical	vertical	B	A	A	A	ii	i	60.4	59.9	33.2	33.7	78.2	71.6
														60.1	60.2	33.7	33.4	78	71.2
														60.7	60	33.5	33.8	78.5	71.1
														60.4	60.0333	33.467	33.6333	78.2333	71.3
P81	24	F	I	mesio	mesio			B	B			ii	ii	43.9	52.3	33	33.1	74	71.1
														44.1	52.5	32.8	33	73.9	71.8
														44.3	52.1	33.1	33.5	74.2	71
														44.1	52.3	32.967	33.2	74.0333	71.3
P82	21	F	I	mesio	mesio	mesio	mesio	B	B	A	A	ii	ii	47.6	58.1	29.2	31.4	77.6	75.4
														47.2	58.8	29.5	31.2	77.2	75.1
														47.1	58.3	29.9	31.5	77.3	75
														47.3	58.4	29.533	31.3667	77.3667	75.167
P83	21	M	I	vertical	mesio	vertical	vertical	B	B	A	A	ii	ii	64.4	66	30.6	31.4	77.6	75.4
														64.1	66.2	30.2	31.2	77.2	75.1
														64.2	65.9	30.4	31.7	77.3	75
														64.2333	66.0333	30.4	31.4333	77.3667	75.167
P84	17	F	I	vertical	mesio	vertical	vertical	A	B	A	A	i	ii	49.7	55.8	31.8	31.7	82.5	79.3
														49.2	55.1	31.4	31.4	82.1	79.8
														49.5	55.3	31.3	31.2	82.7	79.1
														49.4667	55.4	31.5	31.4333	82.4333	79.4

P85	22	M	I	horizontal	horizontal			B	B			ii	ii	58.7	62.7	26.3	24.2	76.6	71.5
														58.9	62.1	26.5	24.5	76.1	71.2
														59	61.9	26.1	24.1	76.2	71.8
														58.8667	62.2333	26.3	24.2667	76.3	71.5
P86	22	F	I	horizontal	mesio			B	B			ii	ii	54.9	60	31	28.7	78	75.5
														54.7	59.8	31.4	28.2	78.1	75.1
														54.1	59.6	31.2	29.5	78.4	75.3
														54.5667	59.8	31.2	28.8	78.1667	75.3
P87	16	M	I	mesio	mesio	vertical	vertical	C	C	A	A	iii	iii	54.4	54.1	30.8	30.1	78.1	79.6
														54.8	54.3	30.4	30.4	78.4	79.2
														54.7	54.7	30.5	30.2	78.2	79.1
														54.6333	54.3667	30.567	30.2333	78.2333	79.3
P88	29	M	I	horizontal	horizontal	vertical	vertical	B	B	A	A	ii	ii	66.3	67.4	33.5	31.4	77.4	73.8
														66.8	67.2	33.9	31.2	77.2	73.4
														66.1	67.5	33.1	31.5	77.8	73.9
														66.4	67.3667	33.5	31.3667	77.4667	73.7
P89	25	F	I	mesio		vertical		B		A		ii		56.6	58.4	28.4	28.4	77.8	74.6
														56.8	58.1	28.1	28.1	77.2	74.4
														56.1	58.7	28.2	28.5	77.1	74.6
														56.5	58.4	28.233	28.3333	77.3667	74.533

P92	18	F	I	mesio	mesio	vertical	vertical	C	C	A	A	iii	iii	61.2	63.4	33.2	29.7	70.5	65.9
														61.4	63.1	33.4	29.1	70.1	65.6
														61.7	63.7	33.7	29.4	70.7	65.4
														61.4333	63.4	33.433	29.4	70.4333	65.633
P93	26	F	I	mesio	mesio	buccal	disto	C	C	B	B	iii	iii	54.9	48.2	29.4	28.4	71.1	74.7
														54.2	48.9	29.1	28.1	71.5	74.5
														54.1	48.3	29.7	28.5	71.9	74.1
														54.4	48.4667	29.4	28.3333	71.5	74.433
P94	30	M	I	horizontal	vertical			B	A			ii	ii	62.7	58.9	33.4	31.7	82.2	78.8
														62.1	58.1	33.1	31.2	82.1	78.9
														62.5	58.7	33	31.4	82.5	78.2
														62.4333	58.5667	33.167	31.4333	82.2667	78.633
P96	22	M	I	horizontal	vertical	vertical	vertical	B	A	A	A	ii	i	51	51.7	34.4	30	98.8	93.7
														51.7	51.2	34.2	30.2	98.1	93.2
														51.2	51.5	34.1	30.4	98.4	93.5
														51.3	51.4667	34.233	30.2	98.4333	93.467
P98	22	M	I	horizontal	horizontal	vertical	vertical	B	C	A	A	ii	iii	59.4	61.5	35.7	35.8	86.7	83.1
														59.5	61.6	35.1	35.4	86.4	83.4
														59.4	61.2	35.4	35.1	86.2	83.3
														59.4333	61.4333	35.4	35.4333	86.4333	83.267

P99	18	F	I	buccal	horizontal	disto	disto	C	C	C	C	iii	iii	48.1	52.3	31.1	27.2	88	78.2
														48.4	52.1	31.4	27.3	88.1	78.1
														48.7	52.1	31.2	27.5	87.9	78.3
														48.4	52.1667	31.233	27.3333	88	78.2
P100	23	F	I	vertical	vertical	vertical	vertical	A	B	A	A	i	ii	58.5	58.5	31.1	27.3	79	73.5
														58.2	58.2	31.4	27.1	79.1	73.4
														58.3	58.1	31.5	27.5	79.6	73.3
														58.3333	58.2667	31.333	27.3	79.2333	73.4
P101	17	F	I	mesio	mesio			B	B			ii	ii	54.6	52.2	30.7	35.4	69	68.5
														54.1	52.4	30.5	35.2	69.1	68.1
														54.2	52.1	30.2	35.1	68.8	68.1
														54.3	52.2333	30.467	35.2333	68.9667	68.233
P103	19	M	I	vertical	mesio	disto	vertical	A	B	A	A	i	ii	62.7	64.4	36.4	35.4	83.8	77.7
														62.1	64.2	36.1	35.1	83.1	77.9
														62.5	64.1	36.2	35.8	83.1	77.2
														62.4333	64.2333	36.233	35.4333	83.3333	77.6
P104	19	F	I	horizontal	mesio			B	A			ii	i	51.1	48.8	32.3	32.8	88.8	88.8
														51.4	48.1	32.5	32.1	88.4	88.6
														51.2	48.2	32.1	32.4	88.1	88.3
														51.2333	48.3667	32.3	32.4333	88.4333	88.567

P105	17	M	I	mesio	mesio	vertical	vertical	C	C	A	A	iii	iii	64.1	64.6	36.7	32.3	76.7	72.2
														64.4	64.1	36.4	32.5	76.1	72.4
														64.2	64.2	36.2	32.1	76.2	72.8
														64.2333	64.3	36.433	32.3	76.3333	72.467
P106	25	M	I	horizontal	horizontal			B	B			ii	ii	67.7	69	27.1	29.4	81.3	71.5
														67.2	69.2	27.4	29.2	81.1	71.5
														67.5	69.4	27.8	29.8	81.5	71.4
														67.4667	69.2	27.433	29.4667	81.3	71.467
P107	29	F	I	horizontal	mesio	disto	disto	B	B	C	C	ii	ii	52.4	50.7	25	27.2	64.2	66
														52.1	50.9	25.4	27.4	64.3	66.1
														52.7	50.2	25.1	27.1	64.5	66.5
														52.4	50.6	25.167	27.2333	64.3333	66.2
P108	18	M	I	mesio	mesio	vertical	vertical	C	C	B	B	iii	iii	55.2	56.3	35.8	29.8	64.5	66.7
														55.4	56.2	35.4	29.9	64.1	66.5
														55.8	56.5	35.1	30.2	64.2	66.2
														55.4667	56.3333	35.433	29.9667	64.2667	66.467
P109	29	F	I		horizontal				B				i	54.7	60	29.8	29.7	71.8	73.3
														54.1	60.5	29.4	29.1	71.6	73.5
														54.3	60.9	29.1	29.5	71.4	73.8
														54.3667	60.4667	29.433	29.4333	71.6	73.533

P110	29	M	I	horizontal	mesio		vertical	B	A		B	ii	ii	55.3	58.3	32.9	29.9	86	83.5
														55.8	58.5	32.7	29.7	86.2	83.6
														55.4	58.1	32.8	29.4	86.3	83.7
														55.5	58.3	32.8	29.6667	86.1667	83.6
P111	29	M	I	horizontal	vertical			C	A			iii	i	55.7	55.9	30	24.4	79	82.3
														55.1	55.7	30.4	24.5	79.4	82.5
														55.3	55.4	30.1	24.1	79.1	82.1
														55.3667	55.6667	30.167	24.3333	79.1667	82.3
P112	22	F	I	mesio	mesio	vertical	vertical	B	B	A	A	ii	ii	52.5	55.1	25.2	24.4	79	82.3
														52.7	55.4	25.4	24.5	79.4	82.5
														52.3	55.3	25.7	24.1	79.1	82.1
														52.5	55.2667	25.433	24.3333	79.1667	82.3
P113	20	M	B	mesio	mesio	vertical	vertical	B	B	A	A	ii	ii	56.2	51	32	28	101.8	96.6
														56	51.4	32.4	28.5	101.4	96.4
														56.7	51.2	32.1	28.3	101.2	96.7
														56.3	51.2	32.167	28.2667	101.467	96.567
P114	26	F	W	mesio	mesio	vertical	vertical	C	C	A	A	iii	iii	60.6	59.3	36.7	35.7	83.1	78.6
														60.3	59.2	36.1	36.4	83.8	78.1
														60.7	59.5	36.8	36.1	83.4	78.2
														60.5333	59.3333	36.533	36.0667	83.4333	78.3

P115	29	M	I	horizontal	horizontal			B	B			ii	ii	61	61.5	39	36.9	79.3	72.5
														61.5	61.4	39.4	36.1	79.1	72.7
														61.8	61.9	39.6	36.4	79.8	72.4
														61.4333	61.6	39.333	36.4667	79.4	72.533
P116	20	M	B	vertical	vertical		vertical	A	A		A	i	i	54.9	54.4	36.6	34.7	86	80.1
														54.5	54.2	36.1	34.9	86.5	80.4
														54	54.9	36.2	34.9	86.2	80.5
														54.4667	54.5	36.3	34.8333	86.2333	80.333
P118	29	F	I			buccal	vertical			A	A			55.8	54.8	34.5	33.8	72.5	69.4
														55.1	54.1	34.1	33.1	72.1	69.8
														55.6	54.6	34.6	33.4	72.6	69.1
														55.5	54.5	34.4	33.4333	72.4	69.433
P121	16	M	I	mesio	mesio	vertical	vertical	B	B	A	A	ii	ii	52.4	58.1	34	32.7	78.3	80.5
														52.6	58.3	34.2	32.9	78.1	80.1
														52.1	58.5	34.5	32.1	78.5	80.7
														52.3667	58.3	34.233	32.5667	78.3	80.433
P122	17	M	I	mesio	mesio	vertical	vertical	C	C	A	A	iii	iii	62.8	60	34	33.1	75.6	67.6
														62.1	60.2	34.2	33.4	75.2	67.2
														62.1	60.9	34.6	33.1	75.1	67.1
														62.3333	60.3667	34.267	33.2	75.3	67.3

P123	18	F	I	mesio	mesio	disto	disto	C	C	A	A	iii	iii	46.5	55.8	32.9	25.8	73.3	71.4
														46.7	55	32.7	25.9	73.1	71.9
														46.4	55.1	32.4	25.1	73.2	71.1
														46.5333	55.3	32.667	25.6	73.2	71.467
P124	20	F	I	vertical	vertical	vertical	vertical	A	B	A	A	i	ii	50.2	49.7	28.2	28.7	71.5	64.5
														50.1	49.1	28.4	28.9	71.4	64.1
														50.9	49.2	28.1	28.1	71.1	64.7
														50.4	49.3333	28.233	28.5667	71.3333	64.433
P125	27	F	I	mesio	mesio	vertical	disto	B	C	A	A	ii	iii	52.4	53.6	28.8	32.1	74.2	80.9
														52.1	53.4	28.9	32.4	74.1	80.1
														52.7	53.1	28.8	32.6	74.9	80.4
														52.4	53.3667	28.833	32.3667	74.4	80.467
P126	30	M	I	vertical	mesio	vertical	disto	A	B	A	A	i	ii	72.8	73.2	33.6	32.5	90.4	84.9
														72.1	73.5	33.1	32.4	90.1	84.1
														72.4	73.1	33.4	32.1	90.2	84.9
														72.4333	73.2667	33.367	32.3333	90.2333	84.633
P127	17	F	I	mesio	mesio	disto	disto	C	C	A	A	iii	iii	61.7	60.3	32.7	31.2	72.4	65.4
														61.4	60.5	32.1	31.4	72.1	65.2
														61.2	60.1	32.4	31.5	72	65.1
														61.4333	60.3	32.4	31.3667	72.1667	65.233

P128	21	F	I	horizontal	mesio	vertical	vertical	C	B	A	A	iii	ii	51.4	52	30	26.3	68.4	66.9
														51.2	52.4	30.4	26.9	68.1	66.1
														51.7	52.9	30.1	26.1	68.7	66.4
														51.4333	52.4333	30.167	26.4333	68.4	66.467
P129	17	F	I	buccal	buccal	disto	disto	B	B	A	A	ii	ii	68.8	67.5	35	31.2	56.9	57
														68.1	67.7	35.4	31.4	56.1	57.4
														68.4	67.1	35.1	31.1	56.1	57.1
														68.4333	67.4333	35.167	31.2333	56.3667	57.167
P130	25	M	I	horizontal	horizontal			B	B			ii	ii	62.4	64.4	39.8	32.8	94.7	93.5
														62.7	64.7	39.4	32.4	94.1	93.1
														62.1	64.1	39.1	32.1	94.2	93.4
														62.4	64.4	39.433	32.4333	94.3333	93.333
P131	18	F	I	vertical	mesio	vertical	vertical	C	C	A	A	iii	iii	52.6	54.6	26.9	26.5	67.7	64.8
														52.1	54.1	26.1	26.1	67.1	64.1
														52.7	54.2	26.5	26.1	67.4	64.2
														52.4667	54.3	26.5	26.2333	67.4	64.367
P132	25	F	I	mesio	mesio	buccal	vertical	B	C	A	A	ii	iii	57.1	49.2	35	32.9	74.6	61.9
														57.4	49.4	35.4	32.1	74.1	61.4
														57.9	49.6	35.1	32.4	74.2	61.7
														57.4667	49.4	35.167	32.4667	74.3	61.667

P133	17	M	I	mesio	mesio	vertical	vertical	C	C	A	A	iii	iii	58.5	63.5	33.7	31.3	85.6	72.6
														58.4	63.2	33.4	31.7	85.4	72.1
														58.1	63.8	33.6	31.9	85.1	72.5
														58.3333	63.5	33.567	31.6333	85.3667	72.4
P134	19	F	I	horizontal	horizontal	vertical	vertical	B	B	A	A	ii	ii	57.3	56.8	26.5	27.4	88.3	82.4
														57.1	56.4	26.1	27.1	88.1	82.9
														57.2	56.1	26.2	27.5	88.4	82.1
														57.2	56.4333	26.267	27.3333	88.2667	82.467
P135	24	M	I	horizontal	horizontal		vertical	C	C		A	iii	iii	57.2	59.9	30.9	31.7	86.5	77.7
														57.4	60.1	30.1	31.4	86.1	77.9
														57.5	59.7	30.4	31.2	86	77.1
														57.3667	59.9	30.467	31.4333	86.2	77.567
P136	16	M	I	mesio	mesio	disto	disto	C	C	C	C	iii	iii	54.7	59.9	30.9	31.7	86.5	77.7
														54.1	60.1	30.1	31.4	86.1	77.9
														54.4	59.7	30.4	31.2	86	77.1
														54.4	59.9	30.467	31.4333	86.2	77.567
P138	24	M	I	horizontal	horizontal			B	B			ii	ii	63.3	65.5	34.9	32.4	88.7	82.8
														63.5	65.4	34.4	32.9	88.4	82.1
														63.1	65.1	34.9	32.5	88.1	82.7
														63.3	65.3333	34.733	32.6	88.4	82.533

P139	16	M	I	mesio	mesio	vertical	vertical	C	C	C	C	iii	iii	54.5	52.7	33.4	27	84.9	78.4
														54.1	52.1	33.9	27.9	84.1	78.1
														54.9	52.4	33.1	27.4	84.5	78.5
														54.5	52.4	33.467	27.4333	84.5	78.333
P140	26	M	I	horizontal	horizontal	vertical	vertical	B	A	A	A	ii	i	61.6	57.8	30.5	29.5	78.9	69.8
														61.1	57.9	30.4	29.1	78.1	69.4
														61.4	57.4	30.8	29.3	78.2	69.1
														61.3667	57.7	30.567	29.3	78.4	69.433
P141	18	M	I	mesio	mesio	vertical	vertical	A	A	A	A	i	i	68.4	65.6	32.8	30.6	77.1	76.5
														68.1	65.4	32.4	30.4	77.3	76.1
														68.9	65.1	32.8	30.9	77.4	76.4
														68.4667	65.3667	32.667	30.6333	77.2667	76.333
P142	22	M	I	mesio	mesio			B	B			ii	ii	63.9	62.5	35.6	33.5	72.8	68.5
														63.4	62.9	35.1	33.2	72.1	68.1
														63.9	62.4	35.4	32.9	72.4	68.2
														63.7333	62.6	35.367	33.2	72.4333	68.267
P144	19	F	I	vertical	vertical	vertical	vertical	B	A	A	A	ii	i	58.3	55.1	33.7	29.1	81.5	76.3
														58.1	55.4	33.1	29.7	81.1	76.1
														58.9	55.1	33.4	29.4	81.4	76.5
														58.4333	55.2	33.4	29.4	81.3333	76.3

P145	23	M	I				disto				A			50.7	54.7	30.7	28.7	80.8	75.5
														50.5	54.1	30.4	28.1	80.4	75.1
														50.1	54.4	30.1	28.2	80.1	75.3
														50.4333	54.4	30.4	28.3333	80.4333	75.3
P146	22	F	I	horizontal	horizontal	mesio	disto	C	C	C	C	iii	iii	52.8	52.6	30.7	28.1	73.6	69.4
														52.1	52.1	30.2	28.8	73.2	69.1
														52.4	52.3	30.4	28.5	73.1	69.9
														52.4333	52.3333	30.433	28.4667	73.3	69.467
P147	21	F	I	mesio	mesio	vertical	vertical	B	B	A	A	i	ii	52.4	55.8	29.3	25.6	74.2	69.8
														52.1	55.1	29.5	25.9	73.9	69.1
														52.9	55.4	29.1	25.4	74	69.4
														52.4667	55.4333	29.3	25.6333	74.0333	69.433
P148	17	F	I	mesio	mesio	vertical	disto	B	B	A	A	ii	ii	55.4	49.3	30.8	32.7	73.4	69.8
														55.1	49.5	30.1	32.1	73.9	69.1
														55	49	30.4	32.4	73.1	69.4
														55.1667	49.2667	30.433	32.4	73.4667	69.433
P149	23	F	I	vertical	mesio	disto	vertical	A	B	C	A	i	ii	53.6	52.6	35.4	31.9	100	91.1
														53.1	52.4	35.1	31.4	100.4	91
														53	52.1	35	31.2	99.9	91.4
														53.2333	52.3667	35.167	31.5	100.1	91.167

P150	22	M	I	horizontal	horizontal	disto	disto	B	B	C	C	ii	ii	62	61.9	28.7	31	75.6	72.9
														62.4	61.4	28.9	31.4	75.1	72.1
														62.1	61.1	28.4	31.2	75.4	72.5
														62.1667	61.4667	28.667	31.2	75.3667	72.5
P151	27	M	I	mesio	mesio	vertical		A	B	A		i	i	62.1	63.9	37.1	37.6	86	88.3
														62.4	63.4	37.4	37.4	86.4	88.4
														62.3	63.1	37.1	37.1	86.2	88.1
														62.2667	63.4667	37.2	37.3667	86.2	88.267
P152	23	F	I	mesio	mesio	mesio	mesio	C	C	C	C	iii	iii	59	58.7	28.9	28.6	76.9	75.6
														59.4	58.4	28.4	28.4	76.4	75.4
														59.1	58.3	28.5	28.1	76.5	75.1
														59.1667	58.4667	28.6	28.3667	76.6	75.367
P153	17	M	I	mesio	mesio	vertical	vertical	B	B	A	A	ii	ii	53.4	52.8	26.2	25.3	74.3	68.5
														53.1	52.1	26.4	25.4	74.5	68.1
														53.5	52.6	26.1	25.1	74.6	68.2
														53.3333	52.5	26.233	25.2667	74.4667	68.267
P155	30	M	I	horizontal				B				ii		60.1	60.9	35.9	37.5	65.7	63.4
														60.5	60.4	35.4	37.9	65.3	63.2
														60.4	60.2	35.5	37.1	65.2	63.5
														60.3333	60.5	35.6	37.5	65.4	63.367

P156	16	F	I	mesio	mesio	disto	disto	C	C	C	C	iii	iii	51.6	51.3	29	22.1	84.2	86.9
														51	51.4	29.4	22.9	84.1	86.1
														51.2	51.8	29.1	22.4	84.1	86.4
														51.2667	51.5	29.167	22.4667	84.1333	86.467
P157	22	M	I		horizontal				A				i	69.2	69.5	27.8	28.6	83.9	83.9
														69.1	69.1	27.1	28.1	83.4	83.1
														69.9	69.5	27.2	28.4	83.8	83.2
														69.4	69.3667	27.367	28.3667	83.7	83.4
P158	29	M	I	vertical	vertical			A	B			i	ii	65.3	62.8	31.4	32	82.4	76.8
														65.1	62.1	31.2	32.3	82.1	76.1
														65.2	62.4	31.1	31.8	82.3	76.2
														65.2	62.4333	31.233	32.0333	82.2667	76.367
P162	23	M	I		horizontal	mesio			B	A			ii	59.3	59.2	34.5	29.7	76.7	70.2
														59.1	59.1	34.1	29.1	76.1	70.4
														59.8	58.9	34	29.4	76.5	70.5
														59.4	59.0667	34.2	29.4	76.4333	70.367
P163	18	F	I	mesio	mesio	disto	disto	B	B	A	A	ii	ii	54.1	55.7	35.6	36.3	84.8	82.6
														54.3	55.3	35.1	36.1	84.2	82.4
														54.9	55.1	35.4	36.5	84.5	82.9
														54.4333	55.3667	35.367	36.3	84.5	82.633

P165	19	M	I			vertical	vertical			A	A			65.6	64	35.2	34.5	81.6	79.7
														65.1	64.9	35.1	34.1	81.2	79.2
														65.2	64.7	35.4	34.7	81.1	79.3
														65.3	64.5333	35.233	34.4333	81.3	79.4
P166	22	F	I	mesio	buccal		vertical	B	A		A	ii	i	55.6	53	31.3	27.3	77.5	76.5
														55.1	53.1	31	27.5	77.1	76.3
														55.8	52.8	31.5	27.9	77.2	76.7
														55.5	52.9667	31.267	27.5667	77.2667	76.5
P167	16	F	I	mesio	mesio	vertical	vertical	B	B	A	A	ii	ii	52.2	54.7	43.3	40.7	91.6	86.6
														52.4	54.1	43.8	40.2	91.2	86.9
														52.9	54.3	43.1	40.9	91.9	86.1
														52.5	54.3667	43.4	40.6	91.5667	86.533
P168	19	M	I	mesio	mesio	mesio	vertical	C	C	C	C	iii	iii	63.3	62.5	37	35	79	73.3
														63.9	62.1	37.4	35.9	79.5	73.1
														63.1	62.9	37.7	35.5	79.1	73.9
														63.4333	62.5	37.367	35.4667	79.2	73.433
P169	21	M	I	vertical	vertical	vertical	disto	B	B	A	A	ii	ii	60.3	61.2	36.3	37.5	80.7	79.4
														60.1	61.5	36.1	37.1	80.1	79.3
														60.5	61.9	36.5	37.9	80.5	79.1
														60.3	61.5333	36.3	37.5	80.4333	79.267

P170	17	F	I	mesio	mesio	vertical	vertical	A	A	A	A	i	i	55.3	53.9	34.1	32.4	83.1	82.4
														55.9	53.2	34.8	32.1	83.9	82.9
														55.7	53.4	34.9	32.9	83.2	82.1
														55.6333	53.5	34.6	32.4667	83.4	82.467
P171	17	M	I	mesio	mesio	vertical	vertical	C	C	B	B	iii	iii	48.8	51.9	32.7	32.7	73.2	74.5
														48.6	51.7	32.5	32.2	73	74.1
														48.1	51.4	32.1	32.4	73.5	74.8
														48.5	51.6667	32.433	32.4333	73.2333	74.467
P172	24	M	I	mesio	mesio	vertical	vertical	B	B	A	A	ii	ii	56.3	59.9	29.2	31.2	88.7	86.4
														56.7	59.4	29.4	31.5	88.1	86.1
														56.9	59.2	29.5	31.7	88.4	86
														56.6333	59.5	29.367	31.4667	88.4	86.167
P173	21	F	I				vertical				A			56	56.7	37.8	36.9	84.2	83.4
														56.4	56.1	37.5	36.4	84.9	83.5
														56.1	56.4	37.1	36.1	84.5	83.1
														56.1667	56.4	37.467	36.4667	84.5333	83.333
P174	19	F	I	horizontal	mesio	vertical	vertical	C	B	A	A	iii	ii	58.8	59	32.7	33.7	75.5	71.8
														58.1	59.4	32.4	33.1	75.1	71.4
														58.6	59.2	32.9	33.4	75.7	71.7
														58.5	59.2	32.667	33.4	75.4333	71.633

P175	30	F	I	mesio		vertical		B		A		ii		56.2	53.9	29.9	29.3	83.7	63.1
														56.1	53.4	29.5	29.8	83.1	63.4
														56.9	53.1	29.4	29.9	83.4	63.7
														56.4	53.4667	29.6	29.6667	83.4	63.4
P176	20	F	I	horizontal	horizontal	mesio	vertical	C	C	A	A	iii	iii	61.3	59.2	33.1	29.7	70.2	69.5
														61.4	59.1	33.4	29.9	70.1	69.9
														61.7	59.8	33.1	29.4	70.5	69.7
														61.4667	59.3667	33.2	29.6667	70.2667	69.7
P177	26	F	I				vertical				A			55.7	57.3	26.9	26.5	80.8	78.5
														55.4	57.1	27.1	26.1	80.5	78.1
														55.9	56.9	27.4	26.7	80.9	78.9
														55.6667	57.1	27.133	26.4333	80.7333	78.5
P178	30	F	I	vertical	vertical		vertical	B	B		B	ii	ii	53.7	49.6	31.9	31.8	75.6	73.9
														53.4	49.1	31	31.4	75.1	73.1
														53.1	49.3	31.5	31.7	75.4	73.5
														53.4	49.3333	31.467	31.6333	75.3667	73.5
P179	17	F	I	mesio	mesio	vertical	vertical	B	B	B	A	ii	ii	52.4	52.6	28.8	29.3	71.2	68.1
														52.1	52.1	28.4	29.1	71.9	68.3
														52.7	52.2	28.1	28.9	71.5	68.5
														52.4	52.3	28.433	29.1	71.5333	68.3

P180	17	F	I	mesio	mesio	vertical	vertical	C	C	A	A	iii	iii	55.3	52.7	30.1	29.5	66.3	68.8
														54.9	52.1	30.4	29.4	66.9	68.5
														55	52.3	30.5	29.1	66.1	68.1
														55.0667	52.3667	30.333	29.3333	66.4333	68.467
P182	30	F	I		horizontal				C			i	iii	54.9	58.5	29.1	28.5	99.1	98.4
														54.1	58.1	29.4	28.1	99.4	98.2
														54.3	58.7	29.7	28.7	99	98
														54.4333	58.4333	29.4	28.4333	99.1667	98.2
P184	22	M	I	horizontal	horizontal	vertical	disto	B	B	A	A	ii	ii	62.2	63.1	31.1	30.7	79.4	73.7
														62.4	63.4	30.8	30.4	78.9	73.1
														62.1	63.9	31.4	30.1	79	73.5
														62.2333	63.4667	31.1	30.4	79.1	73.433
P185	29	M	I			vertical	disto			B	A			63.8	61.3	34.4	37.4	75.9	72.7
														63.4	61.9	34	37	75.4	72.1
														63.1	61.4	34.9	37.1	75.3	72.9
														63.4333	61.5333	34.433	37.1667	75.5333	72.567
P186	22	M	I		horizontal				B				ii	63.8	60	31.4	36.1	76.1	82.9
														63.4	60.4	31.9	36.4	76.9	82.7
														63.2	60.2	31.2	35.5	76.4	82.4
														63.4667	60.2	31.5	36	76.4667	82.667

P188	20	F	I	mesio	mesio	mesio	vertical	B	B	A	A	ii	ii	62.5	59.3	29.9	34.8	79.2	82.5
														62.4	59.5	29.4	34.7	79	82.1
														62.1	59.7	29.1	34.4	79.5	82
														62.3333	59.5	29.467	34.6333	79.2333	82.2
P189	21	M	I	horizontal	horizontal	disto	disto	B	B	A	A	ii	ii	61.6	60.8	35.6	30.7	86.4	82.6
														61.2	60.4	35	30.1	86.2	82.1
														61	60.1	35.4	30.4	86.1	82.4
														61.2667	60.4333	35.333	30.4	86.2333	82.367
P190	23	F	I	mesio	mesio			B	B			ii	ii	56.8	58.2	31.8	31.1	70.4	72.6
														56.1	58.4	31.4	31.6	70.1	72.1
														56.4	58.1	31.5	31.7	70.9	72.4
														56.4333	58.2333	31.567	31.4667	70.4667	72.367
P191	17	M	I	mesio	mesio	vertical	vertical	C	C	A	A	iii	iii	58.6	51.5	35.2	29.6	59.9	65.4
														58.1	51.8	35.1	29.7	60.4	65.1
														58.4	51.4	35.4	29.1	59.7	65
														58.3667	51.5667	35.233	29.4667	60	65.167
P192	22	F	I	mesio	mesio	vertical	vertical	B	B	B	B	ii	ii	57.7	68.4	31.3	29.2	72.2	74.5
														57.9	68	31.9	29.4	72.9	74.1
														57.4	68.1	31.5	29.9	72.4	74.9
														57.6667	68.1667	31.567	29.5	72.5	74.5

P194	28	F	I	horizontal	horizontal	vertical	disto	B	B	A	A	ii	ii	55.9	55	31.4	26.9	86.3	82.6
														55.1	55.1	31.6	26.4	86	82.8
														55.7	55.4	31.1	26.1	86.5	82.1
														55.5667	55.1667	31.367	26.4667	86.2667	82.5
P196	18	M	I	mesio	mesio	vertical	vertical	C	C	A	A	iii	iii	51.7	51	30.4	31.5	72.1	73.1
														51.4	51.6	30.1	31.4	72.4	73.4
														51.2	51.4	30.6	31.2	72.8	73.8
														51.4333	51.3333	30.367	31.3667	72.4333	73.433
P198	19	F	I	mesio	mesio	vertical	vertical	B	B	A	A	ii	ii	64.7	58.8	38.1	34	86.3	78.7
														64.4	58.4	38.4	34.8	86.1	78.4
														64.3	58.4	38.5	34.4	86.4	78.1
														64.4667	58.5333	38.333	34.4	86.2667	78.4
P199	17	M	I	vertical	vertical	vertical	vertical	C	C	B	B	iii	iii	50.9	45.8	27.2	26.8	76.5	70.6
														50.4	45.6	27.1	26.4	76.4	70.4
														50.1	45.2	26.9	26.2	76.1	70.1
														50.4667	45.5333	27.067	26.4667	76.3333	70.367
P200	19	F	I	vertical	vertical	vertical	vertical	B	B	A	A	ii	ii	52.4	54.2	33	31.2	67	65.3
														52.9	54.9	33.4	31.4	67.4	65.4
														52.6	54.3	33.2	31.1	67.3	65.9
														52.6333	54.4667	33.2	31.2333	67.2333	65.533

P201	22	M	I				horizontal				C			67.4	67.4	41.5	36.8	79	75.9
														67.2	67.1	41	36.4	79.4	75.1
														67.6	67.9	41.2	36.2	79.1	75.4
														67.4	67.4667	41.233	36.4667	79.1667	75.467
P202	19	M	I		horizontal				B				ii	68.7	65	36.1	34.3	78.3	75.9
														68.2	65.4	36.4	34	78.1	75
														68.4	65.1	36.2	34.5	78.4	75.4
														68.4333	65.1667	36.233	34.2667	78.2667	75.433
P204	30	F	I		horizontal		vertical	B					ii	60.1	58.9	33.9	33.3	79.3	75.9
														60.4	58.4	33.7	33.8	79.4	75.7
														60.4	58.2	33.4	33.5	79.1	75.4
														60.3	58.5	33.667	33.5333	79.2667	75.667
P205	21	F	I	vertical	horizontal	vertical	vertical	A	B	A	A	i	ii	57.7	60.7	27.1	28.9	66.2	70.6
														57.2	60.4	27.4	28.4	66.5	70.4
														57.4	60.2	27.4	28.5	66.1	70.2
														57.4333	60.4333	27.3	28.6	66.2667	70.4
P206	30	M	I	horizontal	horizontal		buccal	B	B		A	ii	ii	66.1	66.1	27.9	31.5	72.6	75.2
														66.5	66.4	27.1	31.4	72.1	75.1
														66.8	66.2	27.4	31.1	72.9	75.4
														66.4667	66.2333	27.467	31.3333	72.5333	75.233

P207	29	F	I	mesio	mesio			A	A			i	i	54.7	53.4	31.2	27.2	83.8	76.6
														54.2	53.1	31.7	27.4	83.2	76.4
														54.1	53.9	31.6	27.1	83.6	76.1
														54.3333	53.4667	31.5	27.2333	83.5333	76.367
P211	24	M	I	horizontal	horizontal			B	B			ii	ii	68.7	68.8	37.8	33.4	83.5	82.5
														68.1	68.1	37.1	33.1	83.1	82.1
														68.4	68.4	37.4	33	83.9	82.4
														68.4	68.4333	37.433	33.1667	83.5	82.333
P212	28	F	I				vertical				A			58.2	55.3	29.5	29	77.3	85.8
														58	55.1	29.1	29.1	77.9	85.2
														58.8	55.9	29.8	29.4	77.6	85.4
														58.3333	55.4333	29.467	29.1667	77.6	85.467
P214	21	M	I	mesio	mesio	vertical	disto	B	B	A	A	ii	ii	48.5	53.2	27.2	25.3	75	73.6
														48.1	53.9	27.4	25.1	75.4	73.4
														48.9	53.5	26.8	25.9	75.1	73.1
														48.5	53.5333	27.133	25.4333	75.1667	73.367
P215	16	F	I	mesio	mesio	disto	disto	C	C	C	C	iii	iii	42.7	43.3	27.7	28.5	80.9	74.2
														42.1	43.1	27.4	28.1	80.4	74.5
														42.5	43	27.1	28.4	80.1	74.1
														42.4333	43.1333	27.4	28.3333	80.4667	74.267

P216	30	M	I	mesio	mesio	disto	disto	C	B	B	B	iii	ii	63.4	59.6	38.7	33.9	79.1	72.1
														63.1	59.4	38.1	33.4	79.4	72.4
														63	59.1	38.4	33.1	79.5	72.5
														63.1667	59.3667	38.4	33.4667	79.3333	72.333
P217	16	F	I	mesio	mesio	vertical	vertical	C	C	C	C	iii	iii	55.1	50.6	53.6	31.3	81.5	75.8
														55.4	50.1	53.4	31.6	81.9	75.4
														55.9	50.4	53	31.4	81.4	75.1
														55.4667	50.3667	53.333	31.4333	81.6	75.433
P218	16	M	I	vertical	vertical	vertical	vertical	B	A	A	A	ii	i	48.2	49.6	32	28.7	78.7	73.7
														48.6	49.2	32.4	28.5	78.1	73.1
														48.5	49.3	32.1	28.4	78.4	73.4
														48.4333	49.3667	32.167	28.5333	78.4	73.4
P220	18	F	I	mesio	mesio	vertical	vertical	B	A	A	A	ii	i	58.4	51.4	32.1	30.5	80.7	71.2
														58.1	51.2	32.4	30.1	80.2	71.4
														58.2	51.4	32.9	30	80.5	71.3
														58.2333	51.3333	32.467	30.2	80.4667	71.3
P221	30	F	I	vertical	horizontal	disto	vertical	B	B	A	A	ii	ii	58.7	59.1	33.5	30.2	80.1	76.7
														58.2	59	33.1	30.9	80.4	76.2
														58.4	59.4	33	30.4	80.2	76.9
														58.4333	59.1667	33.2	30.5	80.2333	76.6

P222	30	F	I	mesio		vertical	vertical	B		A	A	ii		45.4	50.1	35.8	29.6	75.6	78.9
														45.9	50.4	35.1	29.9	75.9	78.4
														45.1	50.8	35.4	29.8	75.8	78.1
														45.4667	50.4333	35.433	29.7667	75.7667	78.467
P224	26	M	I	horizontal	mesio			B	A			ii	i	67.7	64.7	26.7	25.6	80.8	77.3
														67.1	64.9	26.3	25.9	80.1	77.4
														67.9	64.2	26.9	25.6	80.4	77.1
														67.5667	64.6	26.633	25.7	80.4333	77.267
P225	27	F	I	horizontal				B				ii		52.9	52.1	32	30.5	75.9	72.9
														52.4	52.9	32.4	30.9	75.4	72.1
														52.1	52.4	32.1	30.4	75.8	72.4
														52.4667	52.4667	32.167	30.6	75.7	72.467
P226	16	M	I	mesio	mesio	vertical	vertical	C	C	C	C	iii	iii	47.2	46.7	37.2	31.1	74.1	73.9
														47.9	46.8	37.3	31.4	74.9	73.4
														47.4	46.2	37.9	31.9	74.3	73.2
														47.5	46.5667	37.467	31.4667	74.4333	73.5
P227	16	M	I	vertical	mesio	vertical	disto	B	C	A	A	ii	iii	61.1	62.3	41.9	36.6	89.1	85.2
														61.9	62.4	41.4	36.9	89.4	85.4
														61.4	62.9	41.8	36.4	89.3	85.4
														61.4667	62.5333	41.7	36.6333	89.2667	85.333

P228	30	M	I	vertical	vertical			A	A			i	i	62.6	59.3	32.7	33.9	87.2	80.3
														62.4	59.7	32.6	33.4	86.8	80.9
														62.9	59.2	32.4	33.1	86.6	80.4
														62.6333	59.4	32.567	33.4667	86.8667	80.533
P229	30	M	I	mesio	mesio	vertical	vertical	B	B	A	A	ii	ii	69.7	65.4	33.9	33.4	79.7	83.4
														69.2	65.1	33.4	33.1	79.9	83.1
														69.4	65.3	33.2	33	80.1	83
														69.4333	65.2667	33.5	33.1667	79.9	83.167
P230	16	M	B	mesio	mesio	vertical	vertical	C	C	C	C	iii	iii	48.2	46.2	31.9	32.7	90.8	93.9
														48	46.1	31.4	32.9	90.1	93.1
														48.5	46.9	31.2	32.1	90.4	93.4
														48.2333	46.4	31.5	32.5667	90.4333	93.467
P231	16	M	I	mesio	mesio	disto	disto	C	C	C	C	iii	iii	38.2	32.3	37.1	34.8	87	90.2
														38.4	32.4	37.4	34.1	87.3	90.9
														38.5	32.1	37.9	34.6	87.4	90.5
														38.3667	32.2667	37.467	34.5	87.2333	90.533
P232	30	F	I	mesio	mesio	disto	disto	C	C	B	B	iii	iii	57.5	54.3	30.5	30.4	72.3	66.2
														57.1	54.1	30.2	30.1	72.1	66.1
														57.2	54.7	30.1	30	72.9	65.8
														57.2667	54.3667	30.267	30.1667	72.4333	66.033

P233	16	M	I	mesio	mesio	disto	disto	C	C	B	C	iii	iii	61	59.5	32.8	32.7	79.8	83
														61.4	59.4	32.1	32.1	79.2	83.4
														61.5	59.2	32.4	32.4	79.5	83.1
														61.3	59.3667	32.433	32.4	79.5	83.167
P234	30	F	I	horizontal	mesio		vertical	B	A		B	ii	i	59.5	60.1	31.7	32.1	81.6	82.3
														59.4	60.4	31.2	32.4	81.2	82.5
														59.8	60.9	31.4	32.9	81.9	82.1
														59.5667	60.4667	31.433	32.4667	81.5667	82.3
P235	30	F	I		horizontal				B				ii	56.6	58.4	32.1	29.9	71.2	78.2
														56.2	58.1	32.9	29.4	71.9	78.9
														56.1	58.2	32.4	29.2	71.4	78.4
														56.3	58.2333	32.467	29.5	71.5	78.5
P236	22	F	I	horizontal	horizontal			B	B			ii	ii	60	54.3	26.7	26.5	59.4	57.3
														60.4	54.9	26.1	26.1	59.1	57.9
														60.2	54.7	26.4	26.9	59.2	57.4
														60.2	54.6333	26.4	26.5	59.2333	57.533
P237	28	M	I	mesio	mesio	vertical	vertical	C	C	A	A	iii	iii	61.7	60.4	32.3	30.8	85.7	79.7
														61.9	60.2	32.1	30.6	85.4	79.2
														61.4	60.9	32.9	30.3	85.1	79.4
														61.6667	60.5	32.433	30.5667	85.4	79.433

P238	25	F	I		vertical		vertical		A		A		i	51.5	52.5	34.6	32.8	73.9	76
														51.4	52.1	34.2	32.9	74.2	76.2
														51.9	52.6	34.9	32.4	74	76.3
														51.6	52.4	34.567	32.7	74.0333	76.167
P241	17	F	I	mesio	mesio	vertical	disto	C	C	C	C	iii	iii	80.7	85.9	31.6	33	52.3	51.9
														80.2	85.8	31.4	33.4	52.3	51.5
														80.9	85.8	31.3	33.2	52.1	51.2
														80.6	85.8333	31.433	33.2	52.2333	51.533
P242	18	F	I	horizontal	mesio	vertical	disto	B	B	A	A	ii	ii	60.4	53.7	31.7	28.9	68.4	64.5
														60.1	53.4	31.4	28.1	68.2	64.9
														60	53.9	31.2	28.4	68.8	64.2
														60.1667	53.6667	31.433	28.4667	68.4667	64.533
P243	29	M	I	horizontal	mesio	vertical	disto	B	C	A	A	ii	iii	62.1	68	41.1	36.1	89.3	80.9
														62.5	68.2	41.3	36.5	89.1	80.4
														62.6	67.8	41.5	36.9	89.4	80.2
														62.4	68	41.3	36.5	89.2667	80.5
P245	25	F	I	mesio	vertical	vertical	disto	B	A	A	A	ii	i	50.7	52.3	34.4	33.8	73.5	60.7
														50.3	52.1	34.2	33.1	73.1	60.2
														50.1	52.4	34.1	33.6	73.3	60.1
														50.3667	52.2667	34.233	33.5	73.3	60.333

P246	20	M	I	vertical	vertical		vertical	A	A		A	i	i	61.5	64	35.8	35.9	72.2	80.1
														61.2	64.9	35.4	35.4	72.1	80.4
														61.4	64.4	35.9	35.1	72.4	80.3
														61.3667	64.4333	35.7	35.4667	72.2333	80.267
P247	29	M	I		horizontal	vertical	vertical		B	A	A		ii	59.8	59.8	34.7	29.8	81.2	75.8
														59.4	59.4	34.1	29.1	81.4	75.4
														59.1	59.1	34.2	29.4	81.4	75.1
														59.4333	59.4333	34.333	29.4333	81.3333	75.433
P248	21	F	I	vertical			vertical	A			A	i		53	51	30.1	31.1	64.7	61.8
														53.4	51.4	30.4	31.4	64.5	61.4
														53.1	51.2	30.9	31.2	64.1	61.2
														53.1667	51.2	30.467	31.2333	64.4333	61.467
P249	27	F	I		vertical	buccal			B	A			ii	51.4	49.2	30.3	29.7	65.2	60.3
														51.2	49.5	30.4	29.4	65.9	60.9
														51.8	49.8	30.9	29.2	65.4	60.2
														51.4667	49.5	30.533	29.4333	65.5	60.467
P250	25	F	I	vertical	mesio	buccal	vertical	B	B	A	A	ii	ii	50.1	54.6	35	36.1	79.3	80.1
														50.9	54.5	35.4	36.9	79.4	80.4
														50.4	54.2	35.2	36.4	79.8	80.2
														50.4667	54.4333	35.2	36.4667	79.5	80.233

P252	23	M	I	horizontal	horizontal	vertical		B	B	A		ii	ii	61.4	63.3	34.9	32	81.7	70.4
														61.9	63.9	34.5	32.4	81.2	70.2
														61.5	63.4	34.9	32.9	81.9	70.1
														61.6	63.5333	34.767	32.4333	81.6	70.233
P253	16	F	I	vertical	mesio	vertical	vertical	B	B	B	B	ii	ii	55.7	56	32.9	28.5	62.7	60.5
														55.2	56.4	32.4	28.4	62.4	60.4
														55.4	56.2	32.1	28.2	62.1	60.1
														55.4333	56.2	32.467	28.3667	62.4	60.333
P254	27	F	I	vertical	horizontal	mesio	mesio	A	B	A	A	i	ii	58.4	59.9	27.4	28.3	75.9	78
														58.1	59.4	27.1	28.1	75.1	78.4
														58.5	59.4	27.2	28.4	75.4	78.1
														58.3333	59.5667	27.233	28.2667	75.4667	78.167
P256	18	F	I	mesio	mesio	disto	disto	C	C	B	B	iii	iii	54	50.4	34.3	37.1	89.8	89
														53.9	50.9	34.1	37.4	89.4	89.4
														53.7	50.4	34.1	37.2	89.1	89.1
														53.8667	50.5667	34.167	37.2333	89.4333	89.167
P258	16	F	I	vertical	mesio	vertical	vertical	C	C	A	A	iii	iii	57.2	57.5	35.7	38.9	75.1	82.5
														57.4	57.2	35.1	38.4	75.4	82.1
														57.4	57.3	35.4	38.1	75.4	82
														57.3333	57.3333	35.4	38.4667	75.3	82.2

P261	23	F	I	vertical	buccal	disto	vertical	A	C	A	A	i	i	49.2	48.9	32.3	32.4	77.2	84.9
														49.1	48.4	32.6	32.9	77.4	84.2
														49.6	48.2	32.5	32.6	77.6	84.3
														49.3	48.5	32.467	32.6333	77.4	84.467
P262	22	F	I	mesio			vertical	A			A	i		54.9	55.1	30.9	35.4	77.5	74
														54.6	55.3	30.4	35.2	77.4	74.3
														54.3	55.7	30.2	35.9	77.9	74.9
														54.6	55.3667	30.5	35.5	77.6	74.4
P263	24	F	I	mesio	mesio	disto		B	B	A		ii	ii	50.3	55.5	34	35.5	72	68.6
														50.4	55.4	34.2	35.4	72.4	68.4
														50.6	55.3	34.6	35.2	72.9	68.3
														50.4333	55.4	34.267	35.3667	72.4333	68.433
P264	17	F	B	mesio	mesio	vertical	vertical	B	B	A	A	ii	ii	41.2	43	26.9	31	76.8	78.8
														41.3	43.8	27	31.4	76.5	78.4
														41	43.2	26.4	31.9	76.4	78.5
														41.1667	43.3333	26.767	31.4333	76.5667	78.567
P266	21	M	I	horizontal	vertical	vertical		B	B	A		ii	ii	48.2	50.5	28.2	35.2	69.2	72.5
														48.1	50.2	28.5	35.4	69.4	72.4
														48.4	50.9	28.3	35.9	69.5	72.5
														48.2333	50.5333	28.333	35.5	69.3667	72.467

P267	24	M	I	mesio	mesio			B	B			ii	ii	32.3	34	57.9	62.2	91	82.2
														32.6	34.2	57.4	62.1	90.8	82.4
														32.4	34.3	57.5	62.4	91.2	82.5
														32.4333	34.1667	57.6	62.2333	91	82.367
P268	26	M	I	vertical	vertical			B	B			ii	ii	37	33.8	63.4	70.5	92.9	83.2
														37.2	33.4	63.2	70.1	92.4	83
														37.5	33.2	63.1	70.3	92.1	83.4
														37.2333	33.4667	63.233	70.3	92.4667	83.2
P270	29	M	B	vertical	vertical	vertical	vertical	B	B	A	A	ii	ii	21.7	26.3	56.1	54.1	102.9	82.7
														21.4	26.1	56.4	54.4	102.1	82.4
														21	26.4	56.2	54.7	102.4	82.1
														21.3667	26.2667	56.233	54.4	102.467	82.4
P272	26	F	I	mesio	mesio	vertical	vertical	C	C	A	A	iii	iii	26	26.9	46.8	48.3	71.8	71.9
														26.7	26.4	46.2	48.5	71.4	71.3
														26.1	26.2	46.3	48.1	71.2	71.4
														26.2667	26.5	46.433	48.3	71.4667	71.533
P273	19	F	B	vertical	vertical	vertical		A	B	A		i	ii	30.3	33.1	56.3	54.1	100.4	100.6
														30.4	33.2	56.4	54.3	100.2	100
														30.1	33.4	56.1	54.6	100.7	99.9
														30.2667	33.2333	56.267	54.3333	100.433	100.17

P274	18	F	I	mesio	mesio	disto	disto	C	C	C	C	iii	iii	61.1	66.8	37.7	33.9	111.6	106
														61.2	66.4	37.2	33.7	111.4	106.2
														61.4	66.2	37.4	34	111.2	106.9
														61.2333	66.4667	37.433	33.8667	111.4	106.37
P275	16	M	I	mesio	mesio	vertical	vertical	B	B	A	A	ii	ii	65.4	64.9	37.6	35.9	111.5	109.4
														65.2	64.7	37.4	35.4	111.4	109.2
														65.1	64.2	37.5	35.2	111.2	109
														65.2333	64.6	37.5	35.5	111.367	109.2
P276	18	M	I	vertical	vertical	disto		B	B	A		ii	ii	81.3	82.1	30	40.4	110.2	95.4
														81	82	29.8	40.2	110.3	95.2
														80.9	81.8	29.9	40.1	110.4	95.9
														81.0667	81.9667	29.9	40.2333	110.3	95.5
P277	30	F	B	mesio	vertical			B	A			ii	i	66.4	57	42.3	42.1	111.4	108.4
														66.2	56.8	42.1	42.9	111.5	108.2
														66.5	57.2	42.4	42.8	111.8	108.5
														66.3667	57	42.267	42.6	111.567	108.37
P279	28	F	I		horizontal				B				ii	46.3	37.4	67	63.1	98.3	99.4
														46.1	37.2	66.8	63.4	98.2	99
														46.4	37.5	67.2	63.2	98	99.2
														46.2667	37.3667	67	63.2333	98.1667	99.2

P280	21	F	B		mesio				B				ii	58.4	67.2	35.2	39.4	111.8	95
														58.2	67.4	35.1	39.2	111.2	95.4
														58.4	67.5	35.9	39.5	111.3	95.5
														58.3333	67.3667	35.4	39.3667	111.433	95.3
P282	28	F	I	vertical	mesio			A	A			i	i	65.5	65.1	36.3	35.4	103.4	110.5
														65.1	65.4	36.4	35.1	103.2	110.4
														65.4	65.2	36.1	35.7	103.1	110.2
														65.3333	65.2333	36.267	35.4	103.233	110.37
P283	18	F	I	mesio	mesio	vertical	vertical	B	B	A	A	ii	ii	70.3	71	38.5	40.3	90.6	108.4
														70.4	71.3	38.7	40.4	90.4	108.4
														70.9	71.6	38.2	40.7	90.8	108.5
														70.5333	71.3	38.467	40.4667	90.6	108.43
P284	20	F	I	mesio	mesio	vertical	disto	B	B	A	A	ii	ii	56.5	56.6	40.7	36.5	96.9	93.8
														56.4	56.4	40.4	36.4	96.4	93.4
														56.1	56.1	40.3	36.1	96.5	93.4
														56.3333	56.3667	40.467	36.3333	96.6	93.533
P285	23	M	I	vertical	vertical			A	A			i	i	94.2	97	42.5	45.1	115	119.7
														94.3	97.4	42.8	45.3	115.4	119.4
														94.8	97.3	42.4	45.9	115.6	119.5
														94.4333	97.2333	42.567	45.4333	115.333	119.53

P286	22	M	I	vertical	vertical	disto	disto	B	B	A	A	ii	ii	71.6	72.5	32.7	33.5	103.8	101.7
														71.4	72.4	32.4	33.8	103.4	101.8
														71.3	72.9	32.5	33.4	103.7	101.3
														71.4333	72.6	32.533	33.5667	103.633	101.6
P287	21	F	I	horizontal	mesio	vertical	vertical	B	C	A	A	ii	iii	53.9	50.4	35.8	33.9	106	101
														54	50	35.4	33.7	106.5	101.4
														53.8	50.7	35.4	34	106.2	101.7
														53.9	50.3667	35.533	33.8667	106.233	101.37
P289	25	M	I	vertical	vertical			A	A			i	i	72.9	72.2	38.2	35.2	104.6	102.8
														72.8	72.9	38.4	35.4	104.2	102.6
														72.5	72.8	38.1	35.9	104.3	102.3
														72.7333	72.6333	38.233	35.5	104.367	102.57
P290	29	M	B	mesio	horizontal			A	B			i	ii	75.1	71	33.4	32.3	114.4	122
														75.4	71.5	33.1	32.4	114.3	121.9
														75.7	71.3	33.5	32.9	114.2	122.1
														75.4	71.2667	33.333	32.5333	114.3	122
P291	26	F	B	vertical	vertical	vertical	vertical	A	A	A	A	i	i	63.2	67.2	43.4	29.8	115.9	111.9
														63.4	67.3	43.1	29.5	115.4	111.4
														63.5	67.5	43.3	29.7	115.3	111.5
														63.3667	67.3333	43.267	29.6667	115.533	111.6

P292	23	F	B	vertical				A				i		65.7	67	38.4	29.9	115.6	112.6
														65.4	67.4	38.1	29.4	115.4	112.2
														65.3	67.1	38.2	29.5	115.2	112.1
														65.4667	67.1667	38.233	29.6	115.4	112.3
P293	28	F	B	vertical	buccal	vertical	vertical	A	C	A	A	i	iii	61	66.2	38.6	30	115.7	102.2
														61.4	66.4	38.4	30.4	115.4	102.4
														61.2	66.2	38.1	30.9	115.3	102.9
														61.2	66.2667	38.367	30.4333	115.467	102.5
P294	19	M	B	mesio	mesio	vertical	vertical	B	B	A	A	ii	ii	75	72.1	34.4	36.2	118.9	116.7
														75.5	72.4	34.2	36.1	118.4	116.2
														75.1	72.5	34.1	36.3	118.2	116.3
														75.2	72.3333	34.233	36.2	118.5	116.4
P295	27	F	I	horizontal	mesio		vertical	B	B		A	ii	ii	61.5	62.6	35.7	31.1	98.1	95.8
														61.4	62.4	35.4	31.4	98.4	95.4
														61.2	62.1	35.2	31.5	98.7	95.3
														61.3667	62.3667	35.433	31.3333	98.4	95.5
P296	19	M	I	horizontal	horizontal	vertical	disto	B	B	A	A	ii	ii	80.3	78.8	38.4	32	104	94.5
														80.4	78.4	38.4	32.4	103.8	94.9
														80.6	78.3	38.2	32.9	104.2	94.3
														80.4333	78.5	38.333	32.4333	104	94.567

P297	27	M	B	mesio	mesio	vertical	vertical	B	A	A	A	ii	i	74	78.1	40.2	38.4	106.9	103.3
														74.3	78.3	40.4	38.1	106.4	103.4
														74.6	78.5	40.3	38.2	106.5	103.2
														74.3	78.3	40.3	38.2333	106.6	103.3
P298	22	M	B	mesio	vertical			A	B			i	ii	60.1	71.8	38.2	34.9	128.1	109.9
														60.4	71.4	38.4	34.8	128.4	109.5
														60.5	71.9	38.9	34.2	128.3	109.4
														60.3333	71.7	38.5	34.6333	128.267	109.6
P299	30	M	B	vertical	vertical			A	A			i	i	67.5	65.8	36.4	34	123.4	109.7
														67.4	65.7	36.3	34.2	123.5	109.3
														67.7	65.4	36.9	34.9	123.9	109.2
														67.5333	65.6333	36.533	34.3667	123.6	109.4
P301	17	M	B	mesio	mesio	disto	disto	C	C	A	A	iii	iii	71	70.2	42.5	39.5	111	109
														71.3	70.4	42.4	39.4	110.8	109.5
														71.5	70.5	42.1	39.3	111.3	109.3
														71.2667	70.3667	42.333	39.4	111.033	109.27
P302	19	F	B	mesio	mesio			B	A			ii	i	60.2	63.3	39.6	34.2	109.4	103.4
														60.5	63.5	39.2	34.5	109.2	103.4
														60.9	63.8	39.4	34.7	109.7	103.9
														60.5333	63.5333	39.4	34.4667	109.433	103.57

P305	23	F	I	mesio	mesio	mesio	vertical	B	A	A	A	ii	i	65.2	72.3	38.8	32.4	100.2	87.2
														65.4	72.1	38.1	32.1	100.4	87.4
														65.1	72.4	38.4	32.5	100.5	87.7
														65.2333	72.2667	38.433	32.3333	100.367	87.433
P306	22	F	I	mesio	mesio		vertical	B	B		A	ii	ii	63	65.4	33.9	34.9	102	100.1
														63.4	65.5	33.4	34.5	101.8	100.4
														63.5	65.1	33.5	34.2	101.7	100.5
														63.3	65.3333	33.6	34.5333	101.833	100.33
P309	20	F	I	vertical	vertical	vertical	vertical	A	A	A	A	i	i	66.4	67.9	34.9	31.2	106.8	100.7
														66.1	67.5	34.5	31.4	106.4	100.4
														66.3	67.4	34.1	31.9	106.5	100.2
														66.2667	67.6	34.5	31.5	106.567	100.43
P310	26	M	I	vertical	vertical			A	A			i	i	64.6	65.6	35.4	38.1	108.5	108.7
														64.1	65.4	35.1	38.4	108.4	108.4
														64.3	65.1	35.4	38.2	108.2	108.5
														64.3333	65.3667	35.3	38.2333	108.367	108.53
P312	30	M	I	horizontal	mesio	mesio	mesio	C	C	C	C	iii	iii	77.6	90.3	31.2	34.5	98.3	103.8
														77.4	90.5	31.4	34.9	98.5	103.6
														77.5	90.6	31.5	34.7	98.4	103.5
														77.5	90.4667	31.367	34.7	98.4	103.63

P313	17	M	I	vertical		mesio	vertical	A		A	A	i		57	61.3	29.7	30.9	88.8	90.3
														57.4	61.4	29.5	30.1	88.4	90.1
														57.4	61.5	29.2	30.5	88.3	90.4
														57.2667	61.4	29.467	30.5	88.5	90.267
P314	30	F	B	vertical	vertical			A	A			i	i	59.5	57.2	35.9	35.5	116.7	114.6
														59.1	57.4	35.4	35.4	116.3	114.3
														59.4	57.5	35.1	35.2	116.2	114.2
														59.3333	57.3667	35.467	35.3667	116.4	114.37
P317	21	F	B	horizontal	vertical	disto	disto	B	B	A	A	ii	ii	66.7	68	39.4	39.9	119.2	106.9
														66.4	68.4	39.2	39.4	119.4	106.2
														66.1	68.1	39.1	39.1	119.5	106.4
														66.4	68.1667	39.233	39.4667	119.367	106.5
P318	16	M	B	buccal	buccal	disto	disto	C	C	C	C	iii	iii	52.1	54.6	35.6	35.1	121	117.5
														52.4	54.2	35.5	35.4	120.8	117.4
														52.5	54.3	35.1	35.6	120.9	117.3
														52.3333	54.3667	35.4	35.3667	120.9	117.4
P320	19	M	I	mesio	mesio	vertical	vertical	C	C	C	C	iii	iii	65.3	69.4	36.7	35.9	101.5	92.7
														65.4	69.2	36.4	35.4	101	92.4
														65.1	69.5	36.1	35.7	101.4	92.2
														65.2667	69.3667	36.4	35.6667	101.3	92.433

P321	20	F	I	vertical	vertical		disto	B	B		A	ii	ii	58.6	60.6	31.5	29.4	106	103.1
														58.1	60.4	31.4	29.5	106.4	103.5
														58.4	60.1	31.5	29.5	106.2	103.5
														58.3667	60.3667	31.467	29.4667	106.2	103.37
P322	17	F	I	mesio	buccal	vertical	vertical	C	C	A	A	iii	iii	68.5	71.5	35.5	35.2	99.2	93.9
														68.2	71.4	35.1	35.4	99.4	93.4
														68.4	71.5	35.2	35.1	99.5	93.7
														68.3667	71.4667	35.267	35.2333	99.3667	93.667
P323	17	F	I	vertical	mesio	disto	disto	C	C	C	C	iii	iii	72.3	76.2	31.9	34.1	101.6	94.9
														72.4	76.4	31.4	34	101.4	94.2
														72.9	76.1	31.5	34.9	101.5	94.1
														72.5333	76.2333	31.6	34.3333	101.5	94.4
P324	24	F	I	horizontal	horizontal	disto	mesio	C	C	C	C	iii	iii	59.9	69.3	33.8	36.8	97.1	102.1
														59.4	69.8	33.1	36.1	96.8	102.4
														59.1	69.4	33.4	36.4	96.7	102.3
														59.4667	69.5	33.433	36.4333	96.8667	102.27
P325	28	M	I	horizontal	vertical			B	A			ii	i	76.6	78.3	37.6	29.3	103.2	90.1
														76.1	78.4	37.4	29.4	103.4	90.4
														76.4	78.1	37.1	29.1	103.1	90.5
														76.3667	78.2667	37.367	29.2667	103.233	90.333

P326	19	F	I	mesio	vertical	vertical	vertical	A	A	A	A	i	i	62.9	63	38.2	31	95.8	92
														62.4	63.1	38.4	31.4	95.4	92.4
														62.1	63.4	38.4	31.4	95.1	92.1
														62.4667	63.1667	38.333	31.2667	95.4333	92.167
P327	25	F	I	horizontal	mesio	buccal		C	B	A		iii	ii	73.3	72.5	33.7	26.8	96.6	94.7
														73.4	72.5	34.1	26.4	96.4	94.3
														73.6	72.9	34.9	26.5	96.2	94.5
														73.4333	72.6333	34.233	26.5667	96.4	94.5
P328	16	F	B	vertical	vertical	vertical	disto	B	B	A	A	ii	ii	59	57.5	34.3	26.8	96.6	94.7
														59.4	57.4	34.1	26.4	96.4	94.3
														59.9	57.9	34.9	26.5	96.2	94.5
														59.4333	57.6	34.433	26.5667	96.4	94.5
P329	16	F	B	mesio	mesio	vertical	vertical	B	B	A	A	ii	ii	74.6	74.9	36.3	37.9	112.8	109.5
														74.5	74.1	36.4	37.4	112.3	109.5
														74.1	74.8	36.7	37.5	112.5	109.2
														74.4	74.6	36.467	37.6	112.533	109.4
P330	18	M	I	mesio	mesio	vertical	vertical	B	B	A	A	ii	ii	67.7	75.4	30	25.5	99.3	96.2
														67.4	75.3	30.4	25.7	99.4	96.4
														67.3	75.2	30.2	25.4	99.8	96.7
														67.4667	75.3	30.2	25.5333	99.5	96.433

P334	16	M	B	mesio	mesio	disto	disto	B	B	A	A	ii	ii	66.2	76.9	39	38.4	112.6	100.9
														66.1	76.4	39.4	38.2	112.4	100.4
														66.4	76.2	39.2	38.1	112.1	100.1
														66.2333	76.5	39.2	38.2333	112.367	100.47
P335	16	M	I	mesio	mesio	disto	disto	B	B	A	A	ii	ii	68	62.5	37.4	37.1	108.9	88.8
														68.1	62.4	37.2	37.4	108.3	88.4
														68.4	62.5	37.4	37.3	108.4	88.1
														68.1667	62.4667	37.333	37.2667	108.533	88.433
P336	16	M	I	vertical	vertical	disto	disto	C	C	A	A	iii	iii	71.9	63.4	35.9	33.4	102	101.8
														71.4	63.1	35.4	33.1	102.3	101.5
														71.8	63.5	35.1	33.4	102.1	101.2
														71.7	63.3333	35.467	33.3	102.133	101.5
P337	16	F	B	vertical	mesio	vertical	vertical	A	A	A	A	i	i	63.6	69.4	37.3	30.5	124.3	107.8
														63.1	69.1	37.4	30.4	124.9	107.6
														63.4	69.3	37.9	30.2	124.5	107.1
														63.3667	69.2667	37.533	30.3667	124.567	107.5
P338	30	F	I				disto				A			72	75.3	33	32.6	91.6	97.2
														72.4	75.4	33.4	32.1	91.4	97.5
														72.1	75.1	33.6	32.4	91.3	97.1
														72.1667	75.2667	33.333	32.3667	91.4333	97.267

P339	30	F	I	Vertical	vertical			B	B			ii	ii	73.2	70.3	42.4	38.2	106.4	91.4
														73.4	70.4	42.1	38.4	106.1	91.3
														73.1	70.9	42.6	38.1	106.3	91.5
														73.2333	70.5333	42.367	38.2333	106.267	91.4

MEAN RESULTS

Results_Mean Data_Impacted third molars

No. of x-ray	Age	Sex	Race	Type of angulation of the third molar				Depth of the third molar				Relation to mandible		Length of ramus		Width of ramus		Length of body	
				Mandible Right	Mandible left	Maxilla Right	Maxilla Left	Mandible Right	Mandible Left	Maxilla Right	Maxilla Left	Right	Left	Right	Left	Right	Left	Right	Left
P1	23	F	I	mesio	mesio	vertical	vertical	A	A	A	A	i	i	55.7667	50.5667	31.6	28.8333	79.3	76.7667
P3	20	F	I	mesio	mesio	vertical	vertical	C	C	B	B	iii	iii	46.3333	47.2667	30.3	28.2	84.1667	85.4
P7	20	F	I	mesio	mesio	vertical	vertical	B	B	A	A	ii	ii	53	51.4333	30.2	27.5667	86.6333	86.6
P8	21	F	I	mesio	vertical	vertical	vertical	B	B	A	A	ii	ii	53	51.4333	30.2	27.5667	86.6333	86.6
P9	16	F	C	mesio	mesio	disto	disto	C	C	A	A	iii	iii	49.5333	50.1333	31.2	31.5	79.4667	80.3333
P10	26	F	I		horizontal				B				ii	52.5333	54.3667	28.6667	27.4	81.4333	83.3667
P13	23	M	I	horizontal	mesio	vertical	vertical	B	B	A	A	ii	ii	62.6	71.5333	31.9667	34.6333	77.3333	78.5167
P14	16	M	C	mesio	mesio	vertical	vertical	B	B	A	A	ii	ii	53.7667	54.6667	37.5667	36.2667	92.0667	89.4
P15	21	F	I	mesio	mesio	disto	disto	C	C	B	B	iii	iii	47.5	51.6	35.7667	35.6333	88.3667	89.4
P16	22	F	I	vertical	vertical	vertical	vertical	B	B	A	A	ii	ii	33.5667	32.2333	55.5667	55.5667	82.2667	84.7
P17	21	M	I	mesio	mesio	mesio	mesio	A	B	A	A	i	ii	30.4	30.2333	60.6	63.4333	73.4	71.5667
P18	16	F	I	mesio	mesio	vertical	vertical	C	C	A	A	iii	iii	30.5	27.7	54.1667	56.6667	64.3667	62.4333
P19	18	F	C	mesio	mesio	vertical	vertical	A	A	A	A	i	i	29.4333	29.1333	47.7	47.7333	71.5667	73.2333
P21	17	F	W	mesio	mesio	vertical	disto	B	B	A	A	ii	ii	34.7	36.3667	57.1333	58.2667	83.9333	82.3667
P24	19	M	I	mesio	mesio	vertical	vertical	B	B	A	A	ii	ii	30	27.4667	60	60.6667	78.4333	74.6
P25	19	F	I	mesio	mesio	vertical	vertical	B	B	A	A	ii	ii	25.6	23.5	53.9	53.5333	86.5333	84.7667

P26	25	F	I	vertical	vertical			B	B			ii	ii	32.8333	30.0667	56.7333	58.1333	77.1333	76.2333
P27	25	F	I	horizontal				B				ii		30.8667	30	45.6	45.5667	66.1	67.6667
P28	23	F	I				vertical				A			29.4667	28.6667	59.5333	59.4667	75.6667	73.6333
P29	29	M	C	horizontal			vertical	B			A	ii		32.2333	39.6667	65.4667	66.2667	85.6667	90.4
P30	24	F	C	mesio	mesio			B	B			ii	ii	31.3333	30.5333	44.9	51.7333	74.6	75.5333
P32	19	F	I	mesio	mesio	vertical	disto	B	B	A	A	ii	ii	28.5333	32.2333	52.8667	59.2	89.3	90.4333
P33	23	F	I	vertical	vertical			B	B			ii	ii	30.1667	31.0667	55.15	58.7833	85	85.8
P34	22	M	I	mesio	mesio	vertical	vertical	B	C	A	A	ii	iii	30.6333	28.3667	60.0667	56.5333	72.5	65.6
P35	25	F	I	mesio	mesio	vertical	buccal	C	C	A	A	iii	iii	34.6333	31.5333	53.6	53.2667	81.5333	81.5
P38	29	M	I	mesio	horizontal			B	C			ii	iii	39.2333	32.5333	59.4667	59.3667	77.4667	74.6
P39	27	F	I	vertical	vertical			A	A			ii	ii	33.2333	32.9667	64.3	60.8333	75.3	78.3
P40	18	M	I	mesio	mesio	vertical	disto	C	C	A	A	iii	iii	30.7	32.4333	48.5333	49.5333	87.5333	84.4333
P41	16	M	B	buccal	buccal	vertical	vertical	B	B	A	A	ii	ii	28.5667	25.5	49.6	49.4667	67.6	67.4667
P43	27	F	I	vertical	vertical			B	B			ii	ii	31.6333	28.3667	52.6333	57.1667	72.4667	73.4
P45	29	M	I	vertical	horizontal	disto	horizontal	B	B	B	A	ii	ii	66.2667	65.4667	38.6333	35.7	79.2667	80.8
P46	25	F	I	vertical	vertical			A	A			i	i	51.1333	52.5	35.4	34.5	83.4667	85.5333
P47	27	M	I	horizontal	horizontal			B	A			ii	i	60.1667	58.4333	35.5667	34.6	83.5333	86.3667
P48	30	M	C	horizontal	mesio	vertical	disto	B	C	A	A	ii	iii	63.7667	66.4	41.6667	32.6333	88.0333	84.3
P49	20	M	I		mesio	vertical	vertical		C	B	B		iii	58.7	60.4667	40.6	38.5	92.3667	90.4667
P50	21	M	B		mesio				B				ii	66.2	62.9333	38.2	42.7	89.6667	93.4

P52	18	F	I	mesio	mesio	vertical	vertical	C	C	C	C	iii	iii	49.2667	50.5333	34.7	31.5	79.4333	83.3667
P53	27	M	I		mesio				B				ii	65.5333	64.5	31.3333	30.4667	76.6	78.4
P54	29	M	B	horizontal	horizontal	vertical	vertical	C	B	A	A	iii	ii	64.0333	65.2	34.7	35.8	79.5333	76.8
P55	25	F	I	vertical	vertical			B	B			ii	ii	50.5	53.4333	28.5333	26.2333	82.5667	81.3333
P56	17	F	B	mesio	mesio	vertical	vertical	B	B	A	A	ii	ii	52.6333	54.5667	37.2667	33.5333	74.7	75.6333
P58	30	F	I	vertical	mesio			A	B			i	ii	62.4667	64.4333	33.8667	30.8667	81.3667	75.4667
P59	17	M	I	mesio	mesio	vertical	vertical	C	C	C	C	iii	iii	53.5	56.5667	32.3667	33.6	78.1	84.3333
P61	28	M	B	vertical	vertical	vertical	vertical	B	B	A	A	ii	ii	53.4333	58.4667	30.6667	30.4667	79.5333	78.3667
P62	23	M	B	vertical	vertical			B	B			ii	ii	74.5333	71.3	29.5333	31.4667	103.9	102.2
P63	17	M	B	buccal		disto	disto	B		A	A	ii		54.3667	53.3667	30.4333	29.5	96.4333	95.3667
P64	16	M	B	mesio	mesio	vertical	vertical	B	B	A	A	ii	ii	47.2667	47.3333	39.2333	37.4333	74.5	69.3667
P65	16	M	I	mesio	mesio	vertical	vertical	C	C	A	A	iii	iii	56.3667	59.4333	33.4	34.3667	84.5	81.3333
P66	21	M	I	mesio	mesio			B	B			ii	ii	69.4333	74.2333	35.6	34.4667	85.3	82.3333
P67	25	M	I	horizontal	mesio			B	A			ii	i	68.5	70.3	30.4333	33.3333	82.2	74.4667
P68	20	M	I	mesio	mesio	vertical	vertical	B	B	A	A	ii	ii	57.5667	56.0667	32.2	34.3667	82.5	79.4667
P69	23	M	I	vertical	mesio	vertical	vertical	B	B	A	A	ii	ii	70.5667	76.2	34.3	34.4333	92.4	91.2333
P70	27	F	I	vertical	vertical	vertical	vertical	B	B	A	A	ii	ii	54.5333	50.5333	29.3333	29.7	67.5	68.4667
P71	27	M	I	vertical	mesio		vertical	B	B		A	ii	ii	61.5	62.4	31.3333	33.4333	73.4333	75.2
P72	21	F	I	vertical	vertical		vertical	A	B		A	i	ii	59.6667	62.2667	30.3667	26.7667	85.4	83.4667
P75	21	M	B	horizontal	horizontal	vertical	vertical	B	B	A	A	ii	ii	55.5667	55.3333	37.4333	33.4	92.2667	88.3333

P76	17	F	B	mesio	mesio	disto	disto	C	C	A	A	iii	iii	59.5	60.4333	38.5333	37.5333	98.7333	95.2333
P77	16	F	I	mesio	mesio	vertical	vertical	B	C	C	C	ii	iii	55.5333	54.5	28.5	26.6	59.3667	63.3333
P79	29	M	I	vertical	vertical		disto	B	B		A	ii	ii	61.4	66.4333	33.2667	30.2	83.4	87.3
P80	23	M	I	vertical	vertical	vertical	vertical	B	A	A	A	ii	i	60.4	60.0333	33.4667	33.6333	78.2333	71.3
P81	24	F	I	mesio	mesio			B	B			ii	ii	44.1	52.3	32.9667	33.2	74.0333	71.3
P82	21	F	I	mesio	mesio	mesio	mesio	B	B	A	A	ii	ii	47.3	58.4	29.5333	31.3667	77.3667	75.1667
P83	21	M	I	vertical	mesio	vertical	vertical	B	B	A	A	ii	ii	64.2333	66.0333	30.4	31.4333	77.3667	75.1667
P84	17	F	I	vertical	mesio	vertical	vertical	A	B	A	A	i	ii	49.4667	55.4	31.5	31.4333	82.4333	79.4
P85	22	M	I	horizontal	horizontal			B	B			ii	ii	58.8667	62.2333	26.3	24.2667	76.3	71.5
P86	22	F	I	horizontal	mesio			B	B			ii	ii	54.5667	59.8	31.2	28.8	78.1667	75.3
P87	16	M	I	mesio	mesio	vertical	vertical	C	C	A	A	iii	iii	54.6333	54.3667	30.5667	30.2333	78.2333	79.3
P88	29	M	I	horizontal	horizontal	vertical	vertical	B	B	A	A	ii	ii	66.4	67.3667	33.5	31.3667	77.4667	73.7
P89	25	F	I	mesio		vertical		B		A		ii		56.5	58.4	28.2333	28.3333	77.3667	74.5333
P92	18	F	I	mesio	mesio	vertical	vertical	C	C	A	A	iii	iii	61.4333	63.4	33.4333	29.4	70.4333	65.6333
P93	26	F	I	mesio	mesio	buccal	disto	C	C	B	B	iii	iii	54.4	48.4667	29.4	28.3333	71.5	74.4333
P94	30	M	I	horizontal	vertical			B	A			ii	ii	62.4333	58.5667	33.1667	31.4333	82.2667	78.6333
P96	22	M	I	horizontal	vertical	vertical	vertical	B	A	A	A	ii	i	51.3	51.4667	34.2333	30.2	98.4333	93.4667
P98	22	M	I	horizontal	horizontal	vertical	vertical	B	C	A	A	ii	iii	59.4333	61.4333	35.4	35.4333	86.4333	83.2667
P99	18	F	I	buccal	horizontal	disto	disto	C	C	C	C	iii	iii	48.4	52.1667	31.2333	27.3333	88	78.2
P100	23	F	I	vertical	vertical	vertical	vertical	A	B	A	A	i	ii	58.3333	58.2667	31.3333	27.3	79.2333	73.4

P101	17	F	I	mesio	mesio			B	B			ii	ii	54.3	52.2333	30.4667	35.2333	68.9667	68.2333
P103	19	M	I	vertical	mesio	disto	vertical	A	B	A	A	i	ii	62.4333	64.2333	36.2333	35.4333	83.3333	77.6
P104	19	F	I	horizontal	mesio			B	A			ii	i	51.2333	48.3667	32.3	32.4333	88.4333	88.5667
P105	17	M	I	mesio	mesio	vertical	vertical	C	C	A	A	iii	iii	64.2333	64.3	36.4333	32.3	76.3333	72.4667
P106	25	M	I	horizontal	horizontal			B	B			ii	ii	67.4667	69.2	27.4333	29.4667	81.3	71.4667
P107	29	F	I	horizontal	mesio	disto	disto	B	B	C	C	ii	ii	52.4	50.6	25.1667	27.2333	64.3333	66.2
P108	18	M	I	mesio	mesio	vertical	vertical	C	C	B	B	iii	iii	55.4667	56.3333	35.4333	29.9667	64.2667	66.4667
P109	29	F	I		horizontal				B				ii	54.3667	60.4667	29.4333	29.4333	71.6	73.5333
P110	29	M	I	horizontal	mesio		vertical	B	A		B	ii	ii	55.5	58.3	32.8	29.6667	86.1667	83.6
P111	29	M	I	horizontal	vertical			C	A			iii	i	55.3667	55.6667	30.1667	24.3333	79.1667	82.3
P112	22	F	I	mesio	mesio	vertical	vertical	B	B	A	A	ii	ii	52.5	55.2667	25.4333	24.3333	79.1667	82.3
P113	20	M	B	mesio	mesio	vertical	vertical	B	B	A	A	ii	ii	56.3	51.2	32.1667	28.2667	101.467	96.5667
P114	26	F	W	mesio	mesio	vertical	vertical	C	C	A	A	iii	iii	60.5333	59.3333	36.5333	36.0667	83.4333	78.3
P115	29	M	I	horizontal	horizontal			B	B			ii	ii	61.4333	61.6	39.3333	36.4667	79.4	72.5333
P116	20	M	B	vertical	vertical		vertical	A	A		A	i	i	54.4667	54.5	36.3	34.8333	86.2333	80.3333
P118	29	F	I			buccal	vertical			A	A			55.5	54.5	34.4	33.4333	72.4	69.4333
P121	16	M	I	mesio	mesio	vertical	vertical	B	B	A	A	ii	ii	52.3667	58.3	34.2333	32.5667	78.3	80.4333
P122	17	M	I	mesio	mesio	vertical	vertical	C	C	A	A	iii	iii	62.3333	60.3667	34.2667	33.2	75.3	67.3
P123	18	F	I	mesio	mesio	disto	disto	C	C	A	A	iii	iii	46.5333	55.3	32.6667	25.6	73.2	71.4667
P124	20	F	I	vertical	vertical	vertical	vertical	A	B	A	A	i	ii	50.4	49.3333	28.2333	28.5667	71.3333	64.4333

P125	27	F	I	mesio	mesio	vertical	disto	B	C	A	A	ii	iii	52.4	53.3667	28.8333	32.3667	74.4	80.4667
P126	30	M	I	vertical	horizontal	vertical	disto	A	B	A	A	i	ii	72.4333	73.2667	33.3667	32.3333	90.2333	84.6333
P127	17	F	I	mesio	mesio	disto	disto	C	C	A	A	iii	iii	61.4333	60.3	32.4	31.3667	72.1667	65.2333
P128	21	F	I	horizontal	mesio	vertical	vertical	C	B	A	A	iii	ii	51.4333	52.4333	30.1667	26.4333	68.4	66.4667
P129	17	F	I	Buccal	Buccal	disto	disto	B	B	A	A	ii	ii	68.4333	67.4333	35.1667	31.2333	56.3667	57.1667
P130	25	M	I	horizontal	horizontal			B	B			ii	ii	62.4	64.4	39.4333	32.4333	94.3333	93.3333
P131	18	F	I	vertical	mesio	vertical	vertical	C	C	A	A	iii	iii	52.4667	54.3	26.5	26.2333	67.4	64.3667
P132	25	F	I	mesio	mesio	buccal	vertical	B	C	A	A	ii	iii	57.4667	49.4	35.1667	32.4667	74.3	61.6667
P133	17	M	I	mesio	mesio	vertical	vertical	C	C	A	A	iii	iii	58.3333	63.5	33.5667	31.6333	85.3667	72.4
P134	19	F	I	horizontal	horizontal	vertical	vertical	B	B	A	A	ii	ii	57.2	56.4333	26.2667	27.3333	88.2667	82.4667
P135	24	M	I	horizontal	horizontal		vertical	C	C		A	iii	iii	57.3667	59.9	30.4667	31.4333	86.2	77.5667
P136	16	M	I	mesio	mesio	disto	disto	C	C	C	C	iii	iii	54.4	59.9	30.4667	31.4333	86.2	77.5667
P138	24	M	I	horizontal	horizontal			B	B			ii	ii	63.3	65.3333	34.7333	32.6	88.4	82.5333
P139	16	M	I	mesio	mesio	vertical	vertical	C	C	C	C	iii	iii	54.5	52.4	33.4667	27.4333	84.5	78.3333
P140	26	M	I	horizontal	horizontal	vertical	vertical	B	A	A	A	ii	i	61.3667	57.7	30.5667	29.3	78.4	69.4333
P141	18	M	I	mesio	mesio	vertical	vertical	A	A	A	A	i	i	68.4667	65.3667	32.6667	30.6333	77.2667	76.3333
P142	22	M	I	mesio	mesio			B	B			ii	ii	63.7333	62.6	35.3667	33.2	72.4333	68.2667
P144	19	F	I	vertical	vertical	vertical	vertical	B	A	A	A	ii	i	58.4333	55.2	33.4	29.4	81.3333	76.3
P145	23	M	I				disto				A			50.4333	54.4	30.4	28.3333	80.4333	75.3
P146	22	F	I	horizontal	horizontal	mesio	disto	C	C	C	C	iii	iii	52.4333	52.3333	30.4333	28.4667	73.3	69.4667

P147	21	F	I	mesio	mesio	vertical	vertical	B	B	A	A	i	ii	52.4667	55.4333	29.3	25.6333	74.0333	69.4333
P148	17	F	I	mesio	mesio	vertical	disto	B	B	A	A	ii	ii	55.1667	49.2667	30.4333	32.4	73.4667	69.4333
P149	23	F	i	vertical	mesio	disto	vertical	A	B	C	A	i	ii	53.2333	52.3667	35.1667	31.5	100.1	91.1667
P150	22	M	I	horizontal	horizontal	disto	disto	B	B	C	C	ii	ii	62.1667	61.4667	28.6667	31.2	75.3667	72.5
P151	27	M	I	mesio	mesio	vertical		A	B	A		i	i	62.2667	63.4667	37.2	37.3667	86.2	88.2667
P152	23	F	I	mesio	mesio	mesio	mesio	C	C	C	C	iii	iii	59.1667	58.4667	28.6	28.3667	76.6	75.3667
P153	17	M	I	mesio	mesio	vertical	vertical	B	B	A	A	ii	ii	53.3333	52.5	26.2333	25.2667	74.4667	68.2667
P155	30	M	I	horizontal				B				ii		60.3333	60.5	35.6	37.5	65.4	63.3667
P156	16	F	I	mesio	mesio	disto	disto	C	C	C	C	iii	iii	51.2667	51.5	29.1667	22.4667	84.1333	86.4667
P157	22	M	I		horizontal				A				i	69.4	69.3667	27.3667	28.3667	83.7	83.4
P158	29	M	I	vertical	vertical			A	B			i	ii	65.2	62.4333	31.2333	32.0333	82.2667	76.3667
P162	23	M	I		horizontal	mesio			B	A			ii	59.4	59.0667	34.2	29.4	76.4333	70.3667
P163	18	F	I	mesio	mesio	disto	disto	B	B	A	A	ii	ii	54.4333	55.3667	35.3667	36.3	84.5	82.6333
P165	19	M	I			vertical	vertical			A	A			65.3	64.5333	35.2333	34.4333	81.3	79.4
P166	22	F	I	mesio	buccal		vertical	B	A		A	ii	i	55.5	52.9667	31.2667	27.5667	77.2667	76.5
P167	16	F	I	mesio	mesio	vertical	vertical	B	B	A	A	ii	ii	52.5	54.3667	43.4	40.6	91.5667	86.5333
P168	19	M	I	mesio	mesio	mesio	vertical	C	C	C	C	iii	iii	63.4333	62.5	37.3667	35.4667	79.2	73.4333
P169	21	M	I	vertical	vertical	vertical	disto	B	B	A	A	ii	ii	60.3	61.5333	36.3	37.5	80.4333	79.2667
P170	17	F	I	mesio	mesio	vertical	vertical	A	A	A	A	i	i	55.6333	53.5	34.6	32.4667	83.4	82.4667
P171	17	M	I	mesio	mesio	vertical	vertical	C	C	B	B	iii	iii	48.5	51.6667	32.4333	32.4333	73.2333	74.4667

P172	24	M	I	mesio	mesio	vertical	vertical	B	B	A	A	ii	ii	56.6333	59.5	29.3667	31.4667	88.4	86.1667
P173	21	F	I				vertical				A			56.1667	56.4	37.4667	36.4667	84.5333	83.3333
P174	19	F	I	horizontal	mesio	vertical	vertical	C	B	A	A	iii	ii	58.5	59.2	32.6667	33.4	75.4333	71.6333
P175	30	F	I	mesio		vertical		B		A		ii		56.4	53.4667	29.6	29.6667	83.4	63.4
P176	20	F	I	horizontal	horizontal	mesio	vertical	C	C	A	A	iii	iii	61.4667	59.3667	33.2	29.6667	70.2667	69.7
P177	26	F	I				vertical				A			55.6667	57.1	27.1333	26.4333	80.7333	78.5
P178	30	F	I	vertical	vertical		vertical	B	B		B	ii	ii	53.4	49.3333	31.4667	31.6333	75.3667	73.5
P179	17	F	I	mesio	mesio	vertical	vertical	B	B	B	A	ii	ii	52.4	52.3	28.4333	29.1	71.5333	68.3
P180	17	F	I	mesio	mesio	vertical	vertical	C	C	A	A	iii	iii	55.0667	52.3667	30.3333	29.3333	66.4333	68.4667
P182	30	F	I		horizontal				C				iii	54.4333	58.4333	29.4	28.4333	99.1667	98.2
P184	22	M	I	horizontal	horizontal	vertical	disto	B	B	A	A	ii	ii	62.2333	63.4667	31.1	30.4	79.1	73.4333
P185	29	M	I			vertical	disto			B	A			63.4333	61.5333	34.4333	37.1667	75.5333	72.5667
P186	22	M	I		horizontal				B				ii	63.4667	60.2	31.5	36	76.4667	82.6667
P188	20	F	I	mesio	mesio	mesio	vertical	B	B	A	A	ii	ii	62.3333	59.5	29.4667	34.6333	79.2333	82.2
P189	21	M	I	horizontal	horizontal	disto	disto	B	B	A	A	ii	ii	61.2667	60.4333	35.3333	30.4	86.2333	82.3667
P190	23	F	I	mesio	mesio			B	B			ii	ii	56.4333	58.2333	31.5667	31.4667	70.4667	72.3667
P191	17	M	I	mesio	mesio	vertical	vertical	C	C	A	A	iii	iii	58.3667	51.5667	35.2333	29.4667	60	65.1667
P192	22	F	I	mesio	mesio	vertical	vertical	B	B	B	B	ii	ii	57.6667	68.1667	31.5667	29.5	72.5	74.5
P194	28	F	I	horizontal	horizontal	vertical	disto	B	B	A	A	ii	ii	55.5667	55.1667	31.3667	26.4667	86.2667	82.5
P196	18	M	I	mesio	mesio	vertical	vertical	C	C	A	A	iii	iii	51.4333	51.3333	30.3667	31.3667	72.4333	73.4333

P198	19	F	I	mesio	mesio	vertical	vertical	B	B	A	A	ii	ii	64.4667	58.5333	38.3333	34.4	86.2667	78.4
P199	17	M	I	vertical	vertical	vertical	vertical	C	C	B	B	iii	iii	50.4667	45.5333	27.0667	26.4667	76.3333	70.3667
P200	19	F	I	vertical	vertical	vertical	vertical	B	B	A	A	ii	ii	52.6333	54.4667	33.2	31.2333	67.2333	65.5333
P201	22	M	I				horizontal				C			67.4	67.4667	41.2333	36.4667	79.1667	75.4667
P202	19	M	I		horizontal				B				ii	68.4333	65.1667	36.2333	34.2667	78.2667	75.4333
P204	30	F	I		horizontal				B				ii	60.3	58.5	33.6667	33.5333	79.2667	75.6667
P205	21	F	I	vertical	horizontal	vertical	vertical	A	B	A	A	i	ii	57.4333	60.4333	27.3	28.6	66.2667	70.4
P206	30	M	I	horizontal	horizontal		buccal	B	B		A	ii	ii	66.4667	66.2333	27.4667	31.3333	72.5333	75.2333
P207	29	F	I	mesio	mesio			A	A			i	i	54.3333	53.4667	31.5	27.2333	83.5333	76.3667
P211	24	M	I	horizontal	horizontal			B	B			ii	ii	68.4	68.4333	37.4333	33.1667	83.5	82.3333
P212	28	F	I				vertical				A			58.3333	55.4333	29.4667	29.1667	77.6	85.4667
P214	21	M	I	mesio	mesio	vertical	disto	B	B	A	A	ii	ii	48.5	53.5333	27.1333	25.4333	75.1667	73.3667
P215	16	F	I	mesio	mesio	disto	disto	C	C	C	C	iii	iii	42.4333	43.1333	27.4	28.3333	80.4667	74.2667
P216	30	M	I	mesio	mesio	disto	disto	C	B	B	B	iii	ii	63.1667	59.3667	38.4	33.4667	79.3333	72.3333
P217	16	F	I	mesio	mesio	vertical	vertical	C	C	C	C	iii	iii	55.4667	50.3667	53.3333	31.4333	81.6	75.4333
P218	16	M	I	vertical	vertical	vertical	vertical	B	A	A	A	ii	i	48.4333	49.3667	32.1667	28.5333	78.4	73.4
P220	18	F	I	mesio	mesio	vertical	vertical	B	A	A	A	ii	i	58.2333	51.3333	32.4667	30.2	80.4667	71.3
P221	30	F	I	vertical	horizontal	disto	vertical	B	B	A	A	ii	ii	58.4333	59.1667	33.2	30.5	80.2333	76.6
P222	30	F	I	mesio		vertical	vertical	B		A	A	ii		45.4667	50.4333	35.4333	29.7667	75.7667	78.4667
P224	26	M	I	horizontal	mesio			B	A			ii	i	67.5667	64.6	26.6333	25.7	80.4333	77.2667

P225	27	F	I	horizontal				B				ii		52.4667	52.4667	32.1667	30.6	75.7	72.4667
P226	16	M	I	mesio	mesio	vertical	vertical	C	C	C	C	iii	iii	47.5	46.5667	37.4667	31.4667	74.4333	73.5
P227	16	M	I	vertical	mesio	vertical	disto	B	C	A	A	ii	iii	61.4667	62.5333	41.7	36.6333	89.2667	85.3333
P228	30	M	I	vertical	vertical			A	A			i	i	62.6333	59.4	32.5667	33.4667	86.8667	80.5333
P229	30	M	I	mesio	mesio	vertical	vertical	B	B	A	A	ii	ii	69.4333	65.2667	33.5	33.1667	79.9	83.1667
P230	16	M	B	mesio	mesio	vertical	vertical	C	C	C	C	iii	iii	48.2333	46.4	31.5	32.5667	90.4333	93.4667
P231	16	M	I	mesio	mesio	disto	disto	C	C	C	C	iii	iii	38.3667	32.2667	37.4667	34.5	87.2333	90.5333
P232	30	F	I	mesio	mesio	disto	disto	C	C	B	B	iii	iii	57.2667	54.3667	30.2667	30.1667	72.4333	66.0333
P233	16	M	I	mesio	mesio	disto	disto	C	C	B	C	iii	iii	61.3	59.3667	32.4333	32.4	79.5	83.1667
P234	30	F	I	horizontal	mesio		vertical	B	A		B	ii	i	59.5667	60.4667	31.4333	32.4667	81.5667	82.3
P235	30	F	I		horizontal				B				ii	56.3	58.2333	32.4667	29.5	71.5	78.5
P236	22	F	I	horizontal	horizontal			B	B			ii	ii	60.2	54.6333	26.4	26.5	59.2333	57.5333
P237	28	M	I	mesio	mesio	vertical	vertical	C	C	A	A	iii	iii	61.6667	60.5	32.4333	30.5667	85.4	79.4333
P238	25	F	I		vertical		vertical		A		A		i	51.6	52.4	34.5667	32.7	74.0333	76.1667
P241	17	F	I	mesio	mesio	vertical	disto	C	C	C	C	iii	iii	80.6	85.8333	31.4333	33.2	52.2333	51.5333
P242	18	F	I	horizontal	mesio	vertical	disto	B	B	A	A	ii	ii	60.1667	53.6667	31.4333	28.4667	68.4667	64.5333
P243	29	M	I	horizontal	mesio	vertical	disto	B	C	A	A	ii	iii	62.4	68	41.3	36.5	89.2667	80.5
P245	25	F	I	mesio	vertical	vertical	disto	B	A	A	A	ii	i	50.3667	52.2667	34.2333	33.5	73.3	60.3333
P246	20	M	I	vertical	vertical		vertical	A	A		A	i	i	61.3667	64.4333	35.7	35.4667	72.2333	80.2667
P247	29	M	I		horizontal	vertical	vertical		B	A	A		ii	59.4333	59.4333	34.3333	29.4333	81.3333	75.4333

P248	21	F	I	vertical			vertical	A			A	i		53.1667	51.2	30.4667	31.2333	64.4333	61.4667
P249	27	F	I		vertical	buccal			B	A			ii	51.4667	49.5	30.5333	29.4333	65.5	60.4667
P250	25	F	I	vertical	mesio	buccal	vertical	B	B	A	A	ii	ii	50.4667	54.4333	35.2	36.4667	79.5	80.2333
P252	23	M	I	horizontal	horizontal	vertical		B	B	A		ii	ii	61.6	63.5333	34.7667	32.4333	81.6	70.2333
P253	16	F	I	vertical	mesio	vertical	vertical	B	B	B	B	ii	ii	55.4333	56.2	32.4667	28.3667	62.4	60.3333
P254	27	F	I	vertical	horizontal	mesio	mesio	A	B	A	A	i	ii	58.3333	59.5667	27.2333	28.2667	75.4667	78.1667
P256	18	F	I	mesio	mesio	disto	disto	C	C	B	B	iii	iii	53.8667	50.5667	34.1667	37.2333	89.4333	89.1667
P258	16	F	I	vertical	mesio	vertical	vertical	C	C	A	A	iii	iii	57.3333	57.3333	35.4	38.4667	75.3	82.2
P261	23	F	I	vertical	buccal	disto	vertical	A	C	A	A	i	i	49.3	48.5	32.4667	32.6333	77.4	84.4667
P262	22	F	I	mesio			vertical	A			A	i		54.6	55.3667	30.5	35.5	77.6	74.4
P263	24	F	I	mesio	mesio	disto		B	B	A		ii	ii	50.4333	55.4	34.2667	35.3667	72.4333	68.4333
P264	17	F	B	mesio	mesio	vertical	vertical	B	B	A	A	ii	ii	41.1667	43.3333	26.7667	31.4333	76.5667	78.5667
P266	21	M	I	horizontal	vertical	vertical		B	B	A		ii	ii	48.2333	50.5333	28.3333	35.5	69.3667	72.4667
P267	24	M	I	mesio	mesio			B	B			ii	ii	32.4333	34.1667	57.6	62.2333	91	82.3667
P268	26	M	I	vertical	vertical			B	B			ii	ii	37.2333	33.4667	63.2333	70.3	92.4667	83.2
P270	29	M	B	vertical	vertical	vertical	vertical	B	B	A	A	ii	ii	21.3667	26.2667	56.2333	54.4	102.467	82.4
P272	26	F	I	mesio	mesio	vertical	vertical	C	C	A	A	iii	iii	26.2667	26.5	46.4333	48.3	71.4667	71.5333
P273	19	F	B	vertical	vertical	vertical		A	B	A		i	ii	30.2667	33.2333	56.2667	54.3333	100.433	100.167
P274	18	F	I	mesio	mesio	disto	disto	C	C	C	C	iii	iii	61.2333	66.4667	37.4333	33.8667	111.4	106.367
P275	16	M	I	mesio	mesio	vertical	vertical	B	B	A	A	ii	ii	65.2333	64.6	37.5	35.5	111.367	109.2

P276	18	M	I	vertical	vertical	disto		B	B	A		ii	ii	81.0667	81.9667	29.9	40.2333	110.3	95.5
P277	30	F	B	mesio	vertical			B	A			ii	i	66.3667	57	42.2667	42.6	111.567	108.367
P279	28	F	I		horizontal				B				ii	46.2667	37.3667	67	63.2333	98.1667	99.2
P280	21	F	B		mesio				B				ii	58.3333	67.3667	35.4	39.3667	111.433	95.3
P282	28	F	I	vertical	mesio			A	A			i	i	65.3333	65.2333	36.2667	35.4	103.233	110.367
P283	18	F	I	mesio	mesio	vertical	vertical	B	B	A	A	ii	ii	70.5333	71.3	38.4667	40.4667	90.6	108.433
P284	20	F	I	mesio	mesio	vertical	disto	B	B	A	A	ii	ii	56.3333	56.3667	40.4667	36.3333	96.6	93.5333
P285	23	M	I	vertical	vertical			A	A			i	i	94.4333	97.2333	42.5667	45.4333	115.333	119.533
P286	22	M	I	vertical	vertical	disto	disto	B	B	A	A	ii	ii	71.4333	72.6	32.5333	33.5667	103.633	101.6
P287	21	F	I	horizontal	mesio	vertical	vertical	B	C	A	A	ii	iii	53.9	50.3667	35.5333	33.8667	106.233	101.367
P289	25	M	I	vertical	vertical			A	A			i	i	72.7333	72.6333	38.2333	35.5	104.367	102.567
P290	29	M	B	mesio	horizontal			A	B			i	ii	75.4	71.2667	33.3333	32.5333	114.3	122
P291	26	F	B	vertical	vertical	vertical	vertical	A	A	A	A	i	i	63.3667	67.3333	43.2667	29.6667	115.533	111.6
P292	23	F	B	vertical				A				i		65.4667	67.1667	38.2333	29.6	115.4	112.3
P293	28	F	B	vertical	buccal	vertical	vertical	A	C	A	A	i	iii	61.2	66.2667	38.3667	30.4333	115.467	102.5
P294	19	M	B	mesio	mesio	vertical	vertical	B	B	A	A	ii	ii	75.2	72.3333	34.2333	36.2	118.5	116.4
P295	27	F	I	horizontal	mesio		vertical	B	B		A	ii	ii	61.3667	62.3667	35.4333	31.3333	98.4	95.5
P296	19	M	I	horizontal	horizontal	vertical	disto	B	B	A	A	ii	ii	80.4333	78.5	38.3333	32.4333	104	94.5667
P297	27	M	B	mesio	mesio	vertical	vertical	B	A	A	A	ii	i	74.3	78.3	40.3	38.2333	106.6	103.3
P298	22	M	B	mesio	vertical			A	B			i	ii	60.3333	71.7	38.5	34.6333	128.267	109.6

P299	30	M	B	disto	disto			A	A			i	i	67.5333	65.6333	36.5333	34.3667	123.6	109.4
P301	17	M	B	mesio	mesio	disto	disto	C	C	A	A	iii	iii	71.2667	70.3667	42.3333	39.4	111.033	109.267
P302	19	F	B	mesio	mesio			B	A			ii	i	60.5333	63.5333	39.4	34.4667	109.433	103.567
P305	23	F	I	mesio	mesio	mesio	vertical	B	A	A	A	ii	i	65.2333	72.2667	38.4333	32.3333	100.367	87.4333
P306	22	F	I	mesio	mesio		vertical	B	B		A	ii	ii	63.3	65.3333	33.6	34.5333	101.833	100.333
P309	20	F	I	vertical	vertical	vertical	vertical	A	A	A	A	i	i	66.2667	67.6	34.5	31.5	106.567	100.433
P310	26	M	I	vertical	vertical			A	A			i	i	64.3333	65.3667	35.3	38.2333	108.367	108.533
P312	30	M	I	horizontal	mesio	mesio	mesio	C	C	C	C	iii	iii	77.5	90.4667	31.3667	34.7	98.4	103.633
P313	17	M	I	vertical		mesio	vertical	A		A	A	i		57.2667	61.4	29.4667	30.5	88.5	90.2667
P314	30	F	B	vertical	vertical			A	A			i	i	59.3333	57.3667	35.4667	35.3667	116.4	114.367
P317	21	F	B	horizontal	vertical	disto	disto	B	B	A	A	ii	ii	66.4	68.1667	39.2333	39.4667	119.367	106.5
P318	16	M	B	buccal	buccal	disto	disto	C	C	C	C	iii	iii	52.3333	54.3667	35.4	35.3667	120.9	117.4
P320	19	M	I	mesio	mesio	vertical	vertical	C	C	C	C	iii	iii	65.2667	69.3667	36.4	35.6667	101.3	92.4333
P321	20	F	I	vertical	vertical		disto	B	B		A	ii	ii	58.3667	60.3667	31.4667	29.4667	106.2	103.367
P322	17	F	I	Mesio	buccal	vertical	vertical	C	C	A	A	iii	iii	68.3667	71.4667	35.2667	35.2333	99.3667	93.6667
P323	17	F	I	Vertical	mesio	disto	disto	C	C	C	C	iii	iii	72.5333	76.2333	31.6	34.3333	101.5	94.4
P324	24	F	I	Horizontal	horizontal	disto	mesio	C	C	C	C	iii	iii	59.4667	69.5	33.4333	36.4333	96.8667	102.267
P325	28	M	I	Horizontal	vertical			B	A			ii	i	76.3667	78.2667	37.3667	29.2667	103.233	90.3333
P326	19	F	I	Mesio	vertical	vertical	vertical	A	A	A	A	i	i	62.4667	63.1667	38.3333	31.2667	95.4333	92.1667
P327	25	F	I	Horizontal	mesio	buccal		C	B	A		iii	ii	73.4333	72.6333	34.2333	26.5667	96.4	94.5

P328	16	F	B	Vertical	vertical	vertical	disto	B	B	A	A	ii	ii	59.4333	57.6	34.4333	26.5667	96.4	94.5
P329	16	F	B	Mesio	mesio	vertical	vertical	B	B	A	A	ii	ii	74.4	74.6	36.4667	37.6	112.533	109.4
P330	18	M	I	Mesio	mesio	vertical	vertical	B	B	A	A	ii	ii	67.4667	75.3	30.2	25.5333	99.5	96.4333
P334	16	M	B	Mesio	mesio	disto	disto	B	B	A	A	ii	ii	66.2333	76.5	39.2	38.2333	112.367	100.467
P335	16	M	I	Mesio	mesio	disto	disto	B	B	A	A	ii	ii	68.1667	62.4667	37.3333	37.2667	108.533	88.4333
P336	16	M	I	Vertical	vertical	disto	disto	C	C	A	A	iii	iii	71.7	63.3333	35.4667	33.3	102.133	101.5
P337	16	F	B	Vertical	mesio	vertical	vertical	A	A	A	A	i	i	63.3667	69.2667	37.5333	30.3667	124.567	107.5
P338	30	F	I				disto				A			72.1667	75.2667	33.3333	32.3667	91.4333	97.2667
P339	30	F	I	Vertical	vertical			B	B			ii	ii	73.2333	70.5333	42.3667	38.2333	106.267	91.4

APPENDIX THREE

SCIENIFIC RESEARCH

SCIENTIFIC RESEARCH BASED ON THIS REASEARCH TO DATE

A. Paper delivered at scientific conference

Prevalence of the impacted third molar in the Greater Durban Metropolitan population

S. Ishwarkumar, P. Pillay, M.R. Haffajee and K.S. Satyapal

College of Health Science Research Symposium, Nelson Mandela School of Medicine, University of KwaZulu-Natal, 11-12 September 2014.

B. Manuscripts in preparation

Prevalence of the impacted mandibular third molar: Greater Durban Metropolitan population

S. Ishwarkumar, P. Pillay, M.R. Haffajee and K.S. Satyapal

Prevalence of the impacted maxillary third molar: Greater Durban Metropolitan population

S. Ishwarkumar, P. Pillay, M.R. Haffajee and K.S. Satyapal

Morphometry analysis of the mandible in the Greater Durban Metropolitan population

S. Ishwarkumar, P. Pillay, M.R. Haffajee and K.S. Satyapal