

THE FORENSIC ANALYSIS OF HUMAN CANINE TEETH FOR GENDER  
DETERMINATION

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This dissertation specially dedicated to...  
My beloved parents, Abu Bakar Bin Bachik and Fatimah Binti Ngah Ahmad, and my  
family.

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## ABSTRACT

Identification of the deceased is an important aspect in forensic dentistry, particularly in cases of unusual circumstances. Gender determination on the deceased may be achieved by analysis on teeth due to identify differential sexual dimorphism corresponding to a specific gender. The study focused on measuring the width of canine teeth between Malaysian male and female human subjects using a divider caliper the mandibular canine index (MCI) method according to the MCI method. The MCI method calculates the ratio value of maximum crown over the width at mesio-distal (MD) and inter-canine width. Random sampling was performed in several dentistry clinics in Pontian, Skudai and Senai, whereby measurements on intraoral and dental casting on 100 males and 100 females were performed. Statistical analysis of one-sample t-test and descriptive analysis found patients both male and female gave higher significant differences of the MCI value. Male demonstrated larger volume of RMCI and LMCI than standard MCI as compared to the female. It was noted that the percentage of sexual dimorphism was significantly different in male, as much as 4.88% but only 1.52% in female. Interestingly, the size of the right mandibular canine showed greater variety between both genders as compared to the one on the left for both methods. The study discovered that male and female subjects were distinguishable by the width of their mandibular canine. The male exhibited width of  $> 0.7$  cm, whereas the female was  $< 0.7$  cm. Age factor had a relatively insignificant effect on the MCI while the size of canine teeth was inconclusive. Hence, it can be concluded that the MCI method is applicable for gender determination.

## ABSTRAK

Pengecaman mayat adalah sesuatu aspek yang penting dalam bidang forensik pergigian terutamanya di dalam kes-kes luar biasa. Penentuan jantina pada si mati boleh dijalankan melalui analisis gigi kerana terdapat perbezaan dimorfisme seksual mengikut jantina tertentu. Kajian ini bertumpu pada pengukuran lebar gigi taring antara subjek lelaki warganegara Malaysia dan perempuan dengan menggunakan angkup pembahagi. Kaedah MCI mengira kadar nilai terbesar mahkota kepada lebar di bahagian mesio-distal (MD) dan jarak antara dua gigi taring. Kaedah pensampelan secara rawak dijalankan di beberapa klinik gigi di sekitar daerah Pontian, Skudai dan Senai, dimana ukuran pada intraoral dan model gigi terhadap 100 orang lelaki dan 100 orang perempuan telah dijalankan. Analisis secara statistik mendapati kedua-dua jantina iaitu lelaki dan perempuan mempunyai variasi yang signifikan terhadap nilai MCI. Lelaki menunjukkan nilai yang besar terhadap RMCI dan LMCI berbanding nilai standard MCI dan perempuan mempunyai nilai RMCI dan LMCI yang rendah daripada standard MCI. Peratusan dimorfisme seksual bagi lelaki telah menunjukkan nilai perbezaan yang signifikan sebanyak 4.88% dan hanya 1.52% bagi perempuan. Menariknya, saiz gigi taring kanan menunjukkan kepelbagaian di antara kedua – dua jantina jika dibandingkan dengan bahagian kiri bagi kedua-dua kaedah. Kajian ini mendapati subjek lelaki dan perempuan dibezakan melalui kelebaran gigi taring bahagian bawah mereka. Lelaki mempunyai lebar  $> 0.7$  cm, manakala perempuan telah menunjukkan lebar  $< 0.7$  cm. Dalam kajian ini, faktor umur tidak mempengaruhi indeks gigi taring kerana saiz taring tidak meyakinkan. Oleh itu, ia dapat dirumuskan bahwa kaedah MCI ini boleh digunapakai bagi penentuan jantina.

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**LIST OF ABBREVIATIONS**

DNA	Deoxyribonucleic Acid
DOSM	Department of Statistic Malaysia
DVI	Disaster Victim Identification
FDI	Federal Dentaire Internationale
GWAS	Genome-wide association study
MCI	Mandibular canine index
MD	Mesia-distal
TTVI-MC	Thai tsunami victim identification-information management center
Xf	Mean value for female
Xm	Mean value for male

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## **CHAPTER 1**

### **INTRODUCTION**

#### **1.1 Background of Study**

In this contemporary situation, the world faces massive and fresh challenges, both from natural and also mankind. Less often, disaster happens without any sign and missing individuals from disasters need to be found and identified. In lieu of this, we rely on a lot of clues and signs that will lead to human identification. The condition of the evidence found and the importance of the clues will help complete the puzzle. Likewise, the existence of crime, violent and accidents are also occurrences that cannot be avoided. In fact, the rates of occurring crimes are increasing not only by day but then might be even in seconds. The forensic investigator needs to react and find the solution one step ahead from the criminal's mind. In order to solve a crime investigation, it takes many people with different jobs to give an answer of the crime. There are the experts from pathology, anthropology, toxicology and many more (Nelson and Ash, 2010). Forensic dentistry is also on of the many fields involved in forensic investigations. It is a field that relates knowledge in dental with the combination of legal aspects (Scheid and Weiss, 2012). This medico legal profession plays a vital role in human being, animals and also to nature.



The most important role for a forensic dentist is to identify the deceased in which the crucial part of identification involves sex identification (Kovacevic and Gruengold, 2010). Sex identification is part archeological and medico legal, and is achieved using two information. First, the details of dental information are obtained from the dental record of the decease before death (*ante mortem*). Second, the information to identify the decease can also be obtained after death (*post mortem*) by examining the characteristic of the individual (Pretty and Sweet, 2001). Gender determination can be performed using teeth as the teeth possess different sexual dimorphism according to gender. Sexual dimorphism can be explained in terms of the differences of the teeth based on size, appearance, color, and stature (Ashok *et al.*, 2007). The dimorphism of teeth is unique between male and female, and for every individual there are no two mouths are alike (Kaushal *et al.*, 2003; Boaz and Gupta, 2009 and Madhavi *et al.*, 2012).

In the forensic field, the clues and evidence that are strong enough to be tendered usually involve DNA. This is attributed to the fact that the DNA between individuals is unique and will not be the same as others. However, the uniqueness of a person is not only restricted to just DNA but also dimorphism of a fingerprint. Teeth and bones are the part of the body that can resist destruction as opposed to the skin. It is because the teeth have high resistance towards extreme trauma and extreme temperature. Thus, the morphology of teeth will not easily change or destroyed. Normally, in cases involving fire and body damaged due to natural disaster, the age and gender of a person could be determine according to the size of the teeth (Omar and Azam, 2009). A tooth has various features such as crown size, root length and morphology. Based on these features, the forensic odontologist can identify the gender of the victim by analyzing the tooth found and also the skull patterns. In human life, there are two sets of teeth known as primary (deciduous) teeth and permanent (succedaneous) teeth. The primary teeth are developed during prenatal phase while the permanent teeth starts to form since 6 years old. At this age, this is when the permanent teeth replaces the primary in sequence of eruption throughout the growing phase (Nelson *et al.*, 2010).

## **1.2 Problem Statement**

The purpose of this study is to aid clarification in forensic cases by putting together a gender-mandibular canine teeth profile that could be used for the identification of the body of victim or suspect found at crime scene or during disaster. In many cases, only the tooth is available for analysis when no flesh on the dead body or no blood was found at crime scene. In addition, the correlation between person's gender and the dimorphism of their mandibular canine is not very well studied and properly understood.

## **1.3 Aim of Research**

This study is focused on the measurement of the dimorphism of teeth to profile the differences in size between males and females. In previous study, it was found that the left canine gave highly significant difference rather than the right canine (Kaushal *et al.*, 2003; Kapila *et al.*, 2011; Rajbir *et al.*, 2011 and Dhara *et al.*, 2012). This study aims to obtain at least 200 patients for the measurement of the mandibular canine in order to accurately profile the differences of the teeth between the two genders. The findings of the study could be use in the development of standard database for forensic in sex determination in Malaysia.

## 1.4 Objectives

In order to achieve the goal of this study, the objectives were focused on:

- i. Measurement of the size of teeth using mandibular canine index.
- ii. Correlate the mandibular canine index to the gender of patient.
- iii. To demonstrate the differences in the dimorphism of teeth between males and females.

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