Original Article

Determination of gender using odontometric measurement of maxilla

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Abstract

Introduction: Gender pertains to characteristics that distinguish females from males. A number of researches have been conducted to determine gender by calculating femoral length, inter-acromial distance and so on. Forensic odontology is a branch of dentistry which focuses on the identification of deceased individuals, it is significant in determining the gender with the application of dental principals. With the application of forensic odontology, age estimations of both living and deceased person, analysis of bite marks found on victims or identification of bite marks on substances can be done.

Aim: In this study, the odontometric measurements of inter distance between maxillary second premolar was used in order to determine the gender of individuals.

Materials and methods:

A total of 60 individuals participated in this study, who included 30 males and 30 females. This study was conducted on individuals of the age group 18-19 years. The maxillary second interpremolar distance was measured between the buccal sides using a digital vernier caliper after getting informed consent from the participants.

Results: The results of the study revealed that the mean value of odontometric measurements of interpremolar distance in males was greater than that of females. Wilcoxon signed rank test was done. The p value was 0.001 ($p<0.05$). So, it is statistically significant,

Conclusion : From this study it can be concluded that odontometric measurements of maxillary inter-premolar distance was a reliable parameter for analysing the gender of individuals, showing statistical significance using Wilcoxon signed rank test hence sexual dimorphism was determined.

KEYWORDS: Novel Gender determination, maxillary odontometry, forensic odontology, interpremolar distance

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INTRODUCTION:

Gender pertains to characteristics that differentiate masculine from feminine. Gender determination is characterised by physiological differences such as there is less muscular hypertrophy of muscular movements in females as compared to males. Sexual dimorphism pertains to physical differences which are the key differences for distinguishing females and males. Development of mammary glands has a greater prominence in females than males, females have a broader pelvis as compared to males for facilitating parturition. The volume of cranial cavity plays an important role in differentiating the two genders, the cranial cavity of males are heavier and broader, with thick skeletal development and the areas of attachment of muscles are more prominent and well defined as compared to females. (Lee, 1999)The laryngeal problem for to famously referred to as Adam's apple can easily be used to distinguish females and males, the two lovely of thyroid cartilage meet at 120° in females and in the laminae meet at 90° which makes a prominence in the neck region.('Sexual Dimorphism', no date) Various previous research studies have been conducted to determine gender by calculating the intracranial distance in males and females, by analysing the length of femur and by taking measurements of skull anthropometry in the two genders.('Odontometrics: A Useful Method for Gender Determination in Udaipur PopulationTM Identity Panel', 2015).

Gender determination is associated with forensic odontology. Forensic odontology plays an important role in gender determination with the application of dental principles and subdivisions in legal cases. Examinations of dental evidence for identification of victims or suspects that are classified into civil and criminal cases. Sex determination is the prior aspect of identification when information pertaining to the deceased is not available or clear. Criminal

investigations, nuclear explosions, crash landing of aircraft, mishaps and chemical explosions. Sex determination analysis have been performed using odontometric measurements of oral regions, this is done by determining the shape and size of the tooth. Analysis of tooth size can be done during early permanent dentition due to its stability. ('Introduction to Forensic Odontology', 2011)There are various aspects of measurement of tooth which involves the mean canine index (MCI), Mesio- distal dimensions and bucco- lingual dimensions, out of which bucco- lingual and mesio- distal dimensions are the easiest to record for analysis of sex determination. Odontometric measurements comprise dental features that contribute greatly to sexual dimorphism in unknown individuals for determining degree of sexual dimorphism in medicolegal cases for general survey and analysis of different dimensions of teeth and distance between tooth alignment.(Acharya and Mainali, 2008)

Previous researches conducted related to odontometric measurements have calculated the inter-canine and inter-molar distance for sex determination, morphometric analysis of odonto metric parameters, mesio- distal dimension of permanent maxillary incisors and canines, analysis of permanent maxillary first molar in general determination.(Hartomo *et al.*, 2019).Our team has extensive knowledge and research experience that has translate into high quality publications (Dinesh *et al.*, 2013; Krishnan and Lakshmi, 2013; Muthukrishnan and Warnakulasuriya, 2018; Sekar *et al.*, 2019; Gomathi *et al.*, 2020) (Sathivel *et al.*, 2008; Panda *et al.*, 2014; Govindaraju, Neelakantan and Gutmann, 2017; Johnson *et al.*, 2020; Saraswathi *et al.*, 2020).There have been no previous researches which have been conducted to calculate interpremolar distance of second premolar for gender determination therefore this study is conducted to determine gender using second premolar maxillary measurements.

MATERIALS AND METHODS:

The study population was taken from the dental students of Saveetha dental College and hospitals, Chennai. The sample size chosen for the study was 60, which included 30 females and 30 males. This study was conducted on individuals of the age group 18-19 years. A digital verniers caliper, with accurate adjustments was used to measure the inter-2nd premolar maxillary distance of the participants with their prior consent. The premolar distance was taken by inserting the digital vernier caliper into the oral cavity of the subjects and measuring the distance from the buccal surface of the maxillary right second premolar to the buccal surface of the maxillary left second premolar. Separate measurements were taken for males and females to use the data collected for analysing whether the second maxillary premolar odontometric measurement can be useful for determination of gender. The data collected was then subjected to statistical analysis using the statistical package for social sciences (SPSS) software and related sample Wilcoxon signed rank test was done.

RESULTS:

Table 1- Range, mean and standard deviation of maxillary 2nd interpremolar width in males and females

	N	MINIMUM WIDTH in mm	MAXIMUM WIDTH in mm	MEAN WIDTH in mm	STANDARD DEVIATION
Male maxillary 2nd inter premolar width	30	43.57	53.92	49.28	2.81
Female maxillary 2nd inter premolar width	30	38.24	51.43	45.5	3.49

*Related sample Wilcoxon signed rank test, p value was 0.001 ($p<0.05$)

The mean width between the right and left 2nd maxillary premolars was found to be 49.28 mm in males and 45.5 mm in females (Table 1). Related sample Wilcoxon signed rank test was done. The p value was 0.001 ($p<0.05$). So, it is statistically significant, hence sexual dimorphism can be determined using maxillary 2nd inter premolar width.

DISCUSSION:

From the study conducted it was found that the inter- second premolar maxillary odontometric distance can be used to determine the gender of the individual. In the previous researches conducted related to odontometric maxillary

measurements, they have used different teeth of the oral cavity for analysing whether it can be used to determine gender. In a study conducted by Litha, Girish it was found that maxillary teeth were more discriminant as compared to mandibular teeth. The buccolingual aspects of teeth provide greater accuracy for determining gender as compared to the mesio-distal aspect of the teeth, since the buccolingual variables were 99.8% accurate and mesiodistal variables were 69.9% accurate and the anterior teeth were less discriminant as compared to posterior teeth for identification.(Litha *et al.*, 2017) In another study conducted by Srivastava et al, it was found that gender determination using odontometric measurements of teeth and less expensive- cost friendly method, the results concluded that maxillary central canines and incisors showed high significance in gender determination due to greater sexual dimorphism.(Srivastava *et al.*, 2014; Litha *et al.*, 2017).

In a study conducted by Larissa chaves, he found that the male teeth were larger as compared to female teeth when first molars were taken into consideration, highest mesio-distal width of mandibular left first molar what is shown in males as compared to females, measurements of the play a very significant role in determination of sex. In another previous research which was conducted by Ibeachu chinagorom found that the length of maxillary canine was greater in males as compared to females. Including the odontometric measurements for determination of sex increases the rate of gender determination from 55.8% to 86%, which increases the success rate of determining sex by 30.2%. In another study conducted it was found that maxillary canines show significant sexual dimorphism and can be used for gender determination in cases of mass disasters.(Vodanović *et al.*, 2007). Intercanine width, interpremolar width, arch length and combined width were the odontometric parameters taken into consideration and it showed significant sexual dimorphism with an accuracy level of 70%. (Grewal, 2017).

Forensic odontology can play a major role in identification of gender when only the remains of the body of the deceased is available, in such cases the forensic odontologist can play a major role (Litha *et al.*, 2017). In a study conducted on 60 participants by Gupta it was concluded that in the branch of forensic odontology, odontometric measurements have a strong role in determination of gender, the mesiodistal diameter of anterior tooth along with the mandibular canine index was was calculated to determine gender (Gupta *et al.*, 2014). Gupta et al conducted their study on 106 participants of puducherry population, they used various odontometric parameters in their study such as mandibular canine index and pont's index to determine gender (Gupta and Daniel, 2016), it was found that the mandibular canine index was more accurate as compared to the molar index and could be used to identify the identity of the individual. In another study conducted using variations in the odontometric dimension of the left and right arch for determination of gender. Buccolingual and mesio distal dimensions were analysed from 132 participants with the use of digital vernier calipers, the odontometric parameters such as MD (mesiodistal) and BL (buccolingual) dimensions indicated sexual dimorphism with variation in mean values in males, however females showed non significant variations of the odontometric parameters in the left and right side of maxillary and mandibular arches (Babu, 2016).

Larissa Chaves conducted a study to analyse the sexual dimorphism between first and second molars by using 50 plaster casts from undergraduate students, the mesiodistal and buccolingual dimensions were measured and the results were analysed using student's t test which concluded that the width of molars in males were larger than females and the first molar was more significant as compared to the second molar for analysing sexual dimorphism (Fernandes *et al.*, 2016). The odontometric parameters such as mesio distal dimension of the mandibular first molar and mesio distal and buccolingual dimension of maxillary first molar can be used to determine gender which was indicated in a study conducted by Ramandeep Singh (Narang, Manchanda and Singh, 2015).

LIMITATIONS: The sample size taken for the study was considerably small and the results of the study can not be generalized.
FUTURE SCOPE: To increase the sample size and also to include people with various age group and race,

CONCLUSION:

Odontometric measurements of teeth in both maxilla and mandible have been previously used to determine stature and gender. From the present study conducted it was concluded that odontometric measurements of second maxillary inter-premolar distance was a reliable parameter for determining gender.

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CONFLICT OF INTEREST: The authors reported the conflict of interest while performing the study to be nil.

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