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AN ODONTOMETRIC ASSESSMENT OF PERMANENT MANDIBULAR CANINE AND MANDIBULAR FIRST MOLAR FOR SEXUAL DIMORPHISM - A COMPARATIVE STUDY.

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Abstract : **Introduction**: Sex determination is a crucial tool of forensic odontology and always plays an important role in solving medico-legal cases and in anthropological studies. It can be generally determined by an evaluation of tooth size in males and females. The purpose of this study is to determine the dimorphic status by assessing mesiodistal (MD) and bucco-lingual (BL) diameters of mandibular canine with mandibular first molar by odontometry. **Materials and methods**: 50 males and 50 females of age 18-25 years were assessed for standard morphometric measurements of the mandibular canine and first molar. With the help of study casts, mesiodistal and buccolingual dimensions of mandibular canine and first molar were taken using a digital Vernier calliper. The data obtained were subjected to statistical analysis using descriptive statistics and a t-test to compare MD and BL dimensions in male and female populations. **Results:** Sexual dimorphism can be predicted by measuring the buccolingual dimension of the mandibular canine and mandibular first molar. Buccolingual dimensions of the right canine showed more sexual dimorphism (11.82%) than the right mandibular first molar (5.85%) and the left canine showed more sexual dimorphism (10.35%) than the left mandibular first molar (5.27%). **Conclusion:** The level of sexual dimorphism could be well established with the mandibular canine than with the mandibular first molar. The right mandibular canine and its buccolingual dimensions are a helpful forensic tool for ensuing sexual dimorphism.

Key words: sexual dimorphism, odontometry, mandibular canine, forensic tool, tooth sizes.

INTRODUCTION

The man kind since from evolution had been facing lot many natural calamities which are unavoidable. The muddled event initiated by the destructive forces which results in multiple death toll known as mass disaster. Due to severe insults by charring, mutilation and putrefaction, the recognition of huge mass causalities become complex phenomenon. Many primary techniques of the routine identification data fall short in such situations[1].

Forensic odontology is of prime concern in the situations where there is a mass disaster in which identification became impossible with trauma. Sexual dimorphism is one of the crucial tools which plays a pivotal role in solving the medico-legal cases as well as anthropological studies. It is included in the initial steps employed to assist in the personal identification of an unknown cadaver consequently narrowing down the diagnosis toward a correct possibility[2].

In these circumstances, using dental remains such as teeth is a shred of excellent evidence that can be used to determine gender as they are very resilient to destruction and fragmentation in comparison with skeletal tissues. It is possible because the hard tissues are preserved after death and can even withstand a temperature of 1600^0C when heated without appreciable loss of microstructure. Skeletal remains like bones and skull provide a limit range of assessments when compared to the tooth remains. Tooth structurally and morphologically provide a vivid range for analysis in age and sex.[3]

Studies have revealed that measurements of teeth in mesiodistal and buccolingual dimensions are excellent indicators of sex which is being the easiest and most reliable method to analyse sexual dimorphism[1]. Canines play an essential role in identification and represent a satisfying range in gender determination. Molars are the first permanent teeth to erupt in the oral cavity; hence, they are available for sex assessment at an early age compared to other permanent teeth. It scores an advantage over canines, which have greater chances of being impacted and thus are unavailable for odontometric analysis[4].

The present study endeavours to determine the dimorphic status by assessing mesiodistal (MD) and buccolingual (BL) diameters of mandibular canine with mandibular first molar by odontometry.

MATERIALS AND METHODS

The study was conducted on 100 subjects (50 males and 50 females) between the age group of 18-25 years, considering antemortem insults such as regressive alterations (attrition and abrasion) affecting occlusal and approximal tooth surfaces are minimal. **Inclusion criteria:** Individuals having a complete set of fully erupted, morphologically well-formed, periodontally healthy, non-carious, unattired, non-hypoplastic, satisfactorily aligned mandibular teeth were included in the study. **Exclusion criteria:** Individuals having carious, restored, or hypoplastic teeth, as well as those having teeth with a prosthesis, attrition, abrasion, and/or mobility, were excluded from the study. **Procedure:** After explaining the procedure, written informed consent was obtained from the subjects. The subjects were comfortably seated on a dental chair and impressions of the upper and the lower arches were taken using irreversible hydrocolloid (alginate) material and casts were fabricated using dental stone. Mesiodistal and buccolingual dimensions of the right and left permanent mandibular canine and first molar were recorded using a digital Vernier caliper. For the buccolingual dimension, the greatest distance between the buccal and lingual surfaces of the crown was taken at a right angle to the plane in which the mesio-distal diameter was taken**.** Mesiodistal dimension is the greatest distance between the contact points on the approximate surfaces of the crown and is measured with the caliper beaks placed occlusally along the long axis of the tooth. The data obtained were subjected to statistical analysis using descriptive statistics and a t-test to compare MD and BL dimensions in male and female populations.

Sexual dimorphism % = $[(Xm/Xf) -1] \times 100$

Where Xm = mean male tooth dimension,

Xf = mean female tooth dimension.

RESULTS

The MD and BL dimensions for right and left mandibular canine and mandibular first molar was measured on study casts. The respective parameters were assessed and compared between male and female subjects. The mean BL width of right mandibular canine in males was 4.97±0.73374 mm and in females 4.45±0.58966 mm whereas in left mandibular canine among males it was 4.94±0.53102 mm and in females 4.47±0.55973 mm. Sexual dimorphism% of mandibular canine BL surface of right and left sides was 11.68% and 10.51%. The mean MD width of right mandibular canine in males was 6.83±0.54316 mm and in females 6.42±0.49584 mm whereas in left mandibular canine among males it was 6.83±0.54316 and in females 6.42±0.49584 mm. Sexual dimorphism% of mandibular canine MD surface of right and left sides was 6.38% and 5.59% **Table-1**. The mean BL width of right mandibular first molar in males was 10.31±0.46357mm and in females 9.74±0.76262 mm whereas in left mandibular first molar among males it was 10.22±0.39531mm and in females 9.71±0.75322mm. Sexual dimorphism% of mandibular first molar BL surface of right and left sides was 5.85% and 5.25%. The mean MD width of right mandibular first molar in males was 9.70±0.63061mm and in females 9.56±0.68028mm whereas in left mandibular first molar among males it was 9.83±0.54588mm and in females 9.59±0.61816 mm. Sexual dimorphism% of mandibular canine MD surface of right and left sides was 1.46% and 2.5% **Table-2**. A comparison was made on BL width parameter between mandibular canine and mandibular first molar on both sides among males and females using t-test and the p values were significant with $p < 0.005$. **Table -3.** A comparison was made on MD width parameter between mandibular canine and mandibular first molar on both sides among males and females using t-test. There exists a significant p value <0.005 for mandibular right and left canines whereas non-significant for mandibular first right and left molars. **Table -4.**

DISCUSSION

Human identification has always been of paramount importance to society. Accurate sex prediction is perhaps the most important step in the post-mortem reconstructive identification of skeletal remains. Correct sex identification limits the pool of missing persons to just one-half of the population[5].

There exist various studies pertaining to sexual dimorphism considering the odontometric variations in male and female subjects from different countries and varied cohort groups. Bucco-lingual cervical diameter followed by buccolingual crown diameter showed most dimorphic measurements. Many countries showed dimorphic variations within the geographic locations such as European population groups. Whereas lower dimorphic variations were observed in the native locations of South Americans. It is not uncommon in South Asian populations in particular India like countries. The studies presented in the literature regarding Indian cohorts were few and modern may be because of teeth maturity earlier than the skeletal maturity particularly in young subjects[6].

The studies of Dahlberg AA (1963)[7] Garn et al., (1967)[8], Nair et al., (1999)[9] presented that mandibular canine exhibited greatest sexual dimorphism when compared to all teeth in oral cavity of male and female subjects. Schields et al., (1990)[10] had conducted an odontometric analysis among American blacks, European and Mongoloid groups. The study presented that mandibular canine width was greater among Ohio Caucasians than the Tristanite and Pima Indian population. Concluded that mandibular canine as a tool with high degree of sexual morphism. Hashim and Murshid (1993)[11] constructed a study among males and females in Saudi with age group of 13-20 years to assess the high sexual dimorphism in both jaws. It was observed that only canines presented a significant dimorphism when compared to all teeth in oral cavity. Kaushal et al., (2003)[12] designed a study with 60 subjects of North Indian population found statistically significant sexual dimorphism in canines of mandible and left canine in particular with greater sexual dimorphism. The

present study revealed mandibular canine exhibits high degree of sexual dimorphism compared to mandibular first molar and it is in agreement with the above studies. Garn SM et al., (1967) conducted a study to assess the sexual dimorphism and stated that males had larger teeth compared to females. The mean width differences among males and females of the present study showed statistically significant values which is in consistent with the above study.

Agarwal A et al., (2015)[13] had conducted an odontometric study comparing the sexual dimorphism between mandibular canine and first molar. A total of 100 subjects study casts (50 males and 50 females) with age group of 17-25 years included. Concluded that sexual dimorphism of mandibular canine more significant than mandibular molar and MD dimensions of mandibular canine in particular. The present study is also in line with Agarwal A et al., study regarding the mandibular canine has significant sexual dimorphism feature than the mandibular first molar. But the BL dimension showed prominence which is not in line with the previous studies. A quote by de Vito emphasized that there was a quite earlier completion of calcification of crown structures in both the dentitions among the females. Among population, the male gender exhibits a greater tooth size with respect to buccolingual dimension when compared to female gender and underlying factor could be prolonged period of amelogenesis which finally results in differences in the enamel thickness[14].

CONCLUSION

The conditions where availability of teeth is a primary source of evidence for sex identification, odontometric analysis plays a pivotal role to narrow down the findings for accurate identification. Our study provides the element about permanent canine with mandibular first molar odontometric analysis for gender differentiation. The study emphasizes that a higher sexual dimorphism for mandibular canine with Buccolingual (BL) width in particular and can be used as an adjuvant with other parameters to differentiate the gender.

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TABLES:

Table-1: Mean values and sexual dimorphism% among male and female subjects in mandibular canine.

GENDER	Mandibular canine width(mm)			
	Right canine		Left canine	
	BL width	MD width	BL width	MD width
Male	4.97	6.83	4.94	6.79
Female	4.45	6.42	4.47	6.43
Sexual dimorphism (%)	11.68%	6.38%	10.51%	5.59%

Table-2: Mean values and sexual dimorphism% among male and female subjects in mandibular first molar.

GENDER	Mandibular first molar width(mm)			
	Right first molar		Left first molar	
	BL width	MD width	BL width	MD width
Male	10.31	9.70	10.22	9.83
Female	9.74	9.56	9.71	9.59
Sexual dimorphism (%)	5.85%	1.46%	5.25%	2.5%

Table- 3: Comparison of Buccolingual width of mandibular canine with mandibular first molar among males and females.

RT C BLW = Right Canine Bucco Lingual Width, LT C BLE = Left Canine Bucco Lingual Width, RT M BLW = Right Molar Bucco Lingual Width, LT M BLW = Left Molar Bucco Lingual Width.

Tooth	Gender	N	Mean width	Std. Deviation	P value
RT C BLW	Male	50	4.9760	0.73374	0.000*
	Female	50	4.4500	0.58966	
LT C BLW	Male	50	4.9424	0.53102	0.000*
	Female	50	4.4788	0.55973	
RT M BLW	Male	50	10.3132	0.46357	0.000*
	Female	50	9.7430	0.76262	
LT M BLW	Male	50	10.2226	0.39531	0.000*
	Female	50	9.7104	0.75322	

*p< 0.005

Table -4: Comparison of Mesiodistal width of mandibular canine with mandibular first molar among males and females.

RT C MDW = Right Canine Mesio Distal Width, LT C MDW = Left Canine Mesio Distal Width, RT M MDW = Right Molar Mesio Distal Width, LT M MDW = Left Molar Mesio Distal Width.

Tooth	Gender	N	Mean width	Std. Deviation	P value
RT C MDW	Male	50	6.8304	0.54316	0.000*
	Female	50	6.4230	0.49584	
LT C MDW	Male	50	6.8304	0.54316	0.000*
	Female	50	6.4230	0.49584	
RT M MDW	Male	50	9.7026	0.63061	0.300
	Female	50	9.5658	0.68028	
LT M MDW	Male	50	9.8390	0.54588	0.410
	Female	50	9.5970	0.61816	

*P < 0.005