

Odontometric Evaluation of Maxillary Dentition in South Indian Population for The Assessment of Sexual Dimorphism -A Descriptive Cross-Sectional Study.

Soma Susan Varghese¹, Pramod Philip Mathews¹, Deepa Jose¹, Joby Paulose², Joseph Sebastin C¹, Jayan Jacob Mathew³

ABSTRACT

Introduction: The gender identification from human remains is an imperative and significant area pertained to forensics. Tooth odontometry plays a decisive role in sexual dimorphism. Tooth being the hardest and chemically stable structure of the human body are resistant to various destructive effects caused by trauma and incineration while the other skeletal parameters are more inclined to such effects. Maxilla being a direct part of skull bone, maxillary tooth odontometry plays a pivotal role in sex assessment.

Aim: Odontometric analysis maxillary anterior and posterior teeth to analyse which teeth odontometric measurement is best for the gender assessment from maxillary cast.

Materials and Method: The study group comprised 80 maxillary casts (40 male and 40 female subjects respectively) of dental stone. Digital vernier caliper was used to measure tooth dimensions. These measurements were then subjected to statistical analyses including descriptive analysis (mean), independent t-test (sexual dimorphism), using SPSS software version 11 [p value <0.05].

Result: It was observed that when the average teeth Odontometric index of male and female maxillary casts were statistically analysed (independent t-test), a statistically significant result was obtained (p value <0.05) with increased value in Odontometric measurement for males compared to females.

Conclusion: The results observed in this study led us to conclude that the variations in the dimensions of maxillary canine index, maxillary central incisors and maxillary molar among male and female population can be used as reliable tool of sexual dimorphism and gender determination in forensic analysis.

Key words: Odontometry, Gender identity, Gender Dimorphism

Oral and Maxillofacial Pathology Journal (2023): <https://www.ompj.org/archives>

INTRODUCTION

Forensic odontology is defined as “that branch of forensic dentistry that in the interest of justice deals with the proper handling and examination of dental evidence and the proper evaluation and presentation of dental findings. Dental identification plays a pivotal role in the recognition and identification of skeletonized, decomposed, burned remains of deceased individuals¹. Teeth being the hardest and strongest structures in the body are found to be resistant to post mortem decomposition. Restoring materials and materials for teeth replacement are also ascertained to be resistant to post-mortem decomposition². Scope of forensic odontology encompasses the Identification of unknown dead bodies from dental traits, estimation of the age of a person from dentition, establishment of sex from teeth by odontometry and investigation of various crimes by bitemark analysis, lip print patterning and pulpal DNA analysis.

The gender identification from human remains is an imperative and significant area pertained to forensics. Tooth plays a decisive role in sexual dimorphism being the

¹Department of Oral Pathology and Microbiology, Mar Baselios dental college, Kothamangalam, Kerala State, India; ²Department of Orthodontics, Al-Azar Dental College, Thodupuzha, Kerala, India; ³Department of Periodontology, Mar Baselios Dental College, Kothamangalam, Kerala State, India

Corresponding Author: Soma Susan Varghese, Department of Oral Pathology and Microbiology, Mar Baselios dental college, Kothamangalam, Kerala State, India. Email: drsomassusan@gmail.com

How to cite the article: Varghese SS, Mathews PP, Jose D, Paulose J, Sebastin C J, Mathew JJ. Odontometric Evaluation of Maxillary Dentition in South Indian Population for The Assessment of Sexual Dimorphism -A Descriptive Cross Sectional Study. Oral Maxillofac Pathol J 2023; 14(2). Page number 176-179

Source of Support: Nil

Conflict of Interest: None

strongest structure of the human body while the other skeletal parameters are inclined to various destructive effects caused

by trauma and incineration^{3,4,5}. As the mandibular skeleton has temporomandibular joint attachment with the skull it poses an increased chance to get dislodged and damaged during trauma. Maxilla being a direct part of the skull bone, maxillary tooth odontometry plays a pivotal role in sex assessment. Eventhough Cheiloscropy osteometry, palatal rugae pattern are the other methods used in human identification, tooth odontometry gives accurate result in a heavily decomposed human body. The aim of the present study is the Odontometric analysis maxillary anterior and posterior teeth to analyse which teeth odontometric measurement is best for the gender assessment and from maxillary cast.

MATERIALS AND METHODS

The study was conducted in the Department of Oral and Maxillofacial Pathology of Mar Baselios Dental college, Kothamangalam after obtaining Institutional Ethical clearance. The study group comprised 80 maxillary casts (40 male and 40 female subjects respectively)of dental stone. Maxillary casts of subjects without tooth fracture, anomalies of tooth, dental caries and other tooth Pathologies were included in the study. Subjects who had undergone orthodontic treatment and Orthognathic surgeries were excluded from study.

Digital vernier calliper was used to measure maxillary canine index, mesiodistal dimension of right and left maxillary central incisors, mesiodistal and buccolingual dimension of

right and left maxillary molars. The mesiodistal dimension of both right and left maxillary canines were measured as the distance between the mesial and distal highest point of contact and the average value was taken for calculations. The intercanine arch width was measured by placing digital Venier calipers at the distal contact points of right and left maxillary canine and the linear distance was measured between the canines.(figure 1, figure2)

Maxillary canine index was calculated using the below formula

Maxillary Canine Index = Average of Mesio-distal crown width of right and left maxillary canine / intercanine canine arch width.

Mesiodistal dimension of right and left maxillary central incisors; mesiodistal and buccolingual dimension of right and left maxillary first molars were measured using digital vernier calipers. The distance between the mesial and distal highest point of contact of maxillary central incisors and molars were measured respectively.(figure 3)

RESULTS

These measurements were then subjected to statistical analyses including descriptive analysis (mean), independent t-test (sexual dimorphism), using SPSS software version 11 [p value <0.05]. Mean of the average of mesiodistal dimension

Table 1: Mean of average of the buccolingual dimension of maxillary right and left first molar

Gender	Mean of the average of mesiodistal dimension of right and left canine	Mean Canine index	Mean of average of the mesiodistal dimension of maxillary right and left central incisors	Mean of average of the mesiodistal dimension of maxillary right and left first molars	Mean of average of the buccolingual dimension of maxillary right and left first molars
Female	7.608883794	0.202340464	8.631282051	10.63025641	10.96423077
Males	8.078108108	0.211015433	8.967258065	10.64832344	11.31274194



Fig. 1: Canine mesiodistal width



Fig. 2: Intercanine width

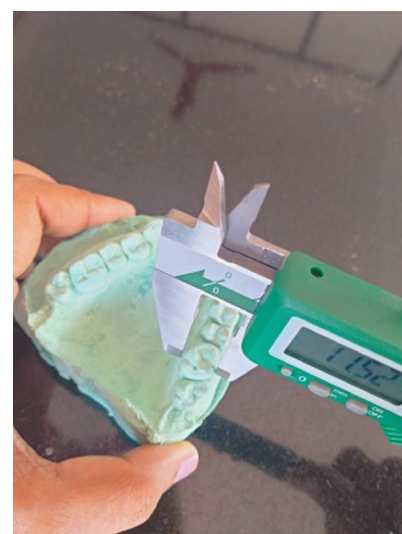


Fig. 3: Buccolingual dimension

of right and left maxillary canines of males casts were found to be 8.078 and 7.608 for female casts. Mean of average of the mesiodistal dimension of maxillary right and left central incisors were 8.9672 and 8.6312 for male and female casts respectively. Mean of average of the mesiodistal dimension of maxillary right and left first molars for male casts were found to be 10.6483 and 10.6302 for female casts. Mean of average of the buccolingual dimension of maxillary right and left first molar were 11.3127 for male casts and 10.9642 for female casts (Table 1).

It was observed that when the average canine index of male and female maxillary casts were statistically analyzed (independent t-test), a statistically significant result was obtained (p value 0.03) with increased canine index for male. Average of the mesiodistal dimension of maxillary central incisors of male and female casts on comparison (independent t-test) shows a significant result (p value 0.0001) with more measurement for males. No statistically significant result was obtained when the average of the mesiodistal dimension of maxillary first molars of male and female subjects were compared (p value 0.409). Average of the buccolingual dimension of maxillary first molars of male and female casts shows a significant result (p value 0.031).

DISCUSSION

Forensic odontology encompasses the Identification of unknown dead bodies from dental traits. Sex determination is the first step towards human identification. Cheiloscopy, osteometry, palatal rugae pattern and DNA analysis are the other methods used in human identification⁶. In situations wherein the body is badly decomposed and damaged osteometry and cheiloscopy poses problems in human identification⁷. DNA analysis the most accurate method for gender determination but involves difficult DNA extraction technique and is expensive. Odontometry acts as a promising tool for gender determination⁸. Ditch and Rose (1972) were the first to prove that teeth diameters can be successfully used in determining sex in poorly preserved and fragmentary skeletal remains in archaeology⁹. Chromosomes responsible for the sexual difference are in direct connection to growth and development of teeth. Gary T Schwartz et al suggested that sexual dimorphism is likely due, in part, to the presence of relatively more dentine in the crowns of male teeth¹⁰. In our present study when the average dimension of canine index of male and female maxillary casts were statistically analysed (independent t-test), a statistically significant result was obtained [(p value 0.03) (mean canine index for males are 8.078 and females are 7.608)] with increased canine index for males.

A concurrent result for sexual dimorphism was obtained by Amit G et al when the maxillary canine index of both genders were compared with a p value 0.0001 respectively.¹¹ It was suggested by Phulari R G et al that inter-canine distance and canine index are useful parameters of sexual dimorphism. Various theories have been given to explain canine dimorphism¹². Tanya M et al suggested that, the greater thickness of enamel in males are due to the long period of amelogenesis compared to females.¹³

In our study, the average of the mesiodistal dimension of maxillary central incisors of male and female casts on comparison (independent t-test) shows a significant result (p

value 0.0001) with more measurement for males. Rajbir Kaur et al in his study also revealed that permanent maxillary incisors exhibited larger mean values of mesiodistal dimension in males compared to females.¹⁴ Abhay et al, in their study analysed that average mesiodistal dimension of male teeth is found to be more compared to females.¹⁵

In our study, the average of the buccolingual (B-L) dimension of maxillary first molars of male and female casts shows a significant result (p value 0.031). No statistically significant result was obtained when the average of the mesiodistal dimension of maxillary first molars of male and female subjects were compared (p value 0.409). Larissa Chaves et al in their study found that the maxillary and mandibular left second molars did not differ in their MD widths whereas mandibular left and right second molars showed statistically different BL widths.¹⁶

Whankade et al in their study concluded that males showed greater B-L dimensions of teeth in comparison to females which is consistent with our study.¹⁷ Odontometric Studies are done on various human populations and ethnic groups. Deepak V et al compared permanent teeth mesiodistal (MD) and buccolingual crown dimensions between four ethnic groups and found distinct differences in the patterns of crown size between the groups¹⁸. When Mesiodistal and buccolingual crown diameters of all teeth recorded in major human population groups, it was found that the largest teeth are found among Australians, followed by Melanesians, Micronesians, sub-Saharan Africans, and Native Americans. Philippine Negritos, Jomon/Ainu, and Western Eurasians have small teeth, while East/Southeast Asians and Polynesians are intermediate in overall tooth size.¹⁹

CONCLUSION

Odontometry plays a decisive role in sexual dimorphism. Tooth being the hardest and chemically stable structure of the human body are resistant to various destructive effects caused by trauma and incineration while the other skeletal parameters are more inclined to such effects. The results observed in this study led us to conclude that the variations in the dimensions of maxillary canine index, maxillary central incisors and maxillary molar among male and female population can be used as reliable indicators of sexual dimorphism and gender determination in forensic analysis.

REFERENCES

1. Bhoopathi V, Mashabi SO, Scott TE, Mascarenhas AK. Dental professionals' knowledge and perceived need for education in bioterrorism preparedness. *J Dent Educ.* 2010 Dec;74(12):1319-26. [PubMed]
2. Khangura R, Sircar K, Grewal D (2015) Four odontometric parameters as a forensic tool in stature estimation. *J Forensic Dent Sci* 7(2):132
3. Mehta S, Kaur S, Verma P, Khosa R, Sudan M, Kaur H. Evaluation of sexual dimorphism using permanent maxillary first molar in Sri Ganganagar population. *Indian J Dent Res.* 2017;28:482-6.
4. Acharya AB, Mainali S (2007) Univariate sex dimorphism in the Nepalese dentition and the use of discriminant functions in gender assessment. *Forensic Sci Int* 173(1):47-56
5. Acharya AB, Prabhu S, Muddapur MV (2011) Odontometric sex assessment from logistic regression analysis. *Int J Legal Med* 125(2):199-204
6. Reddy LV. Lip prints: An overview in forensic dentistry. *J Adv Dent Res.* 2011;2(1):17-20.
7. Kazzazi SM, Kranioti EF. Odontometric analysis of sexual



- dimorphism in permanent maxillary and mandibular molars. *J Forensic Sci Criminol.* 2017;5(1):102.
8. Iwamura E, Vieira J, Muñoz D. Human identification and analysis of DNA in bones. *Rev Hosp Clin Fac Med S Paulo.* 2004;59(6):383-88.
 9. Ditch LE, Rose JC. A multivariate dental sexing technique. *Am J Phys Anthropol* 1972;37:61-4.
 10. Schwartz, G.T., Dean, C., 2001. Ontogeny of canine dimorphism in extant hominoids. *American Journal of Physical Anthropology* 115, 269–283.
 11. Amit G, Kiran K, Devi Charan Shetty. Stature and gender determination and their correlation using odontometry and skull anthropometry. *Journal of forensic dental sciences* 2016.6(2):101-6
 12. Phulari RG, Rathore R, Talegaon T, Jariwala P. Comparative assessment of maxillary canine index and maxillary first molar dimensions for sex determination in forensic odontology. *J Forensic Dent Sci* 2017;9:110.
 13. Tanya M, Anthony J, Donald J. Modern human molar enamel thickness and enamel-dentin junction shape. *Archives of oral biology*
 14. Rajbir Kaur Khangura, Keya Sircar, Sanjeet Singh, Varun Rastog. Sex determination using mesiodistal dimension of permanent maxillary incisors and canines. *Journal of Forensic Dental Sciences* 2011;3
 15. Abhay Kumar Jain, Nishita Garg, Jaspal Singh, Akram Ansari. Mesiodistal crown dimensions of the permanent dentition of a North Indian population. *Indian Journal of Dentistry* 2011;2
 16. Larissa Chaves, Carolina Vieira Lucena, Julyana de. Odontometric analysis of molars for sex determination. *Brizilian Journal of Oral Sciences* 2016;15
 17. Wankhede PK, Munde AD, Shoeb SS, Sahuji S, Niranjan VR, Meka NJ. Buccolingual dimension of teeth: A sensitive odontometric parameter in gender differentiation. *J Indian Acad OraMed Radiol* 2017;29:70-3
 18. Deepak V, Goryawala SN, Reddy Y, Chhabra RJ, Nandaprasad, Shah NK. Assessment of Ethnicity in Indian Population using Tooth Crown Metric Dental Traits. *J Int Oral Health.* 2015 Sep;7(9):83-7
 19. Tsunehiko Hanihara et al. Metric dental variation of major human populations. *American Journal of Biological Anthropology.* 2005;128:287-290.

