Journal of Advanced Medical and Dental Sciences Research

@Society of Scientific Research and Studies ***NLM ID:*** *101716117*

Journal home page: www.jamdsr.com doi: 10.21276/jamdsr Index Copernicus value = 85.10

(e) ISSN Online: 2321-95 (p) ISSN Print: 2348-6805

Original Research

Gender identification using mandibular intercanine width measurement

[1]Navin Kumar, [2]Nutan Tyagi, [3]Akansha Misra, [4]Yulia L. Mathias

[1]PG 3rd year, [2]Professor, [3]Reader, [4]Professor and HOD

[1-4]Deptt. of Oral Pathology and Microbiology IDST College, Modinagar, U.P., India

ABSTRACT:

Aim: To assess the reliability of mandibular intercanine width in gender determination in western Uttar Pradesh population. **Materials and method:** The study was carried out on the archival material obtained from both the private practices and colleges in and around Modinagar, Western Uttar Pradesh. A total of 400 casts were collected, out of which 200 casts were mandibular casts of males and 200 mandibular casts of females. All the dental casts were collected, duplicated and later analyzed and recorded. . The measurements were done by a digital VernierCaliper, with the instrument held perpendicular to the long axis of the tooth. Mandibular inter canine arch width was measured between the cusp tips of the right and left canines using the scale. **Result:** The present study is based on metric method, where the MESIO-DISTAL width of the mandibular canine and the intercanine distance were analyzed for gender verification, Our study showed a significant difference in mandibular intercanine width, right canine showed more sexual diamorphism than left. **Conclusion:** Mandibular canine index acts as another important tool in sex identification of an individual, The present study supports the usefulness of the MCI(mandibular canine index) in gender determination.

Key words: Metric method, Sexual diamorphism, Mandiblar canine index

Received: 24 June, 2021 Accepted: 26 July, 2021

Corresponding author: Navin Kumar, PG 3rd year, Deptt. of Oral Pathology and Microbiology IDST College, Modinagar, U.P., India

This article may be cited as: Kumar N, Tyagi N, Misra A, Mathias YL. Gender identification using mandibular intercanine width measurement. J Adv Med Dent Scie Res 2021;9(8):35-44.

INTRODUCTION

One of the challenges faced by humansin earlier days was to establish the identity of an individual.The establishment of identity is accomplished by age, sex, race and communal characters, footprint, complexion, features, hair, stature, deformities, tattoo marks, scars, occupational stigmata, anthropometry, race evidence factors, etc.[1]Sex determination is one of the prime factors employed to assist with the identification of an individual. Correct sex identification limits the pool of missing persons to just one half of the population. In forensic contexts, however, it is not uncommon to recover partial remains, with fragmentary skull and pelvic bones.[2]

Human teeth are the hardest and chemically the most stable tissues in the body, and are extremely durable even at higher temperatures. Teeth can be identified even when the rest of the body has undergone decomposition as in the case of using soft tissue structures for gender identification. They are therefore invaluable for identification on the fragmentary adult skeleton.[3,4]

Sex determination using dental features is mainly based on the comparison of tooth dimensions in males and females.[3,5]Mandibular canines are found to exhibit the greatest sexual dimorphism among all teeth because of the following reasons:

- Canines are less exposed to plaque and calculus, so less severely affected by periodontal disease
- Lesser pathological migration of mandibular canines than other teeth
- Canines are the last teeth to be extracted with respect to age
- Canines are more likely to survive in conditions such as air disasters and hurricanes.[6,7]

- In the current study we aim to analyze the intercanine distance for the purpose of gender evaluation.

MATERIALS AND METHOD

The study was carried out on the archival material obtained from both the private practices and colleges in and around Modinagar, Western Uttar Pradesh. A total of 400 casts were collected, out of which 200 casts were mandibular casts of males and 200 mandibular casts of females. All the dental casts were collected, duplicated and later analyzed and recorded.

SAMPLE SIZE

Study group = 400 mandibular casts comprising of:
Group A: 200 male casts
Group B: 200 female casts

STUDY DESIGN

Retrospective cross sectional study

Mandibular stainless steel perforated impression trays were selected according to the shape and size of the mandibular arches and tested by checking the extension of the trays on the casts. Alginate was used as an impression material. Dental stone was used for making the cast.On the mandibular cast the greatest mesiodistal crown width of the mandibular permanent canines was measured between the contact point of the tooth on either side of the jaw. The measurements were done by a digital VernierCaliper, with the instrument held perpendicular to the long axis of the tooth. Mandibular inter canine arch width was measured between the cusp tips of the right and left canines using the scale.

RESULT

On these mandibular casts, the greatest mesiodistal crown width of the mandibular permanent canines along with mandibular inter canine arch width was measured.The mandibular canine index of each individual was derived as a ratio between the above two parameters by Rao et al(1989)[9]

The above measurements were done by two observers who independently evaluated the data to eliminate any subjective bias. All the data were collected and analyzed. The statistical software SPSS 16.0 was used for analysis of data. The descriptive statistics like mean, median, S.D and frequency distribution of data were calculated. The normality of data was tested by Shapiro Wilks test and found normally distributed. The significance of difference of means of parameters between groups (Inter group comparison) was tested by Independent t-test and with in groups (Intra group comparison) was done by paired t-test. The agreement between actual and calculated gender was done by Kappa test. The prediction of gender was done by linear regression method. The 95% C.I. and 5% level of significance was used for analysis.

Table1: Inter observer variation for estimation of MCI

	1st Observer					**2nd Observer**					**Inter class correlation(p value)**
	MCI (Right)		**MCI (Left)**		**Standard MCI**	**MCI (Right)**		**MCI (Left)**			
Sex	Male	Female	Male	Female		Male	Female	Male	Female		
Mean	0.25507	0.24180	0.25360	0.24041	.243	0.25187	0.24462	0.25094	0.24294	.239	.993 (0.000)**
Std. D.	.02429	.02406	.023510	.023553		.024940	.023703	.024538	0.02391		

The Inter class correlation between observers is .993, is significant, p<.01. Therefore a significant strong agreement between two observers was noted.

Table 2: Distribution of Mean ±Std. Deviation of parameters of male and female and comparison (inter group) of parameters among male and female by Independent t-test

	Gender	N	Mean ±Std. Deviation	Difference Mean ±S.E.M	t (d.f.)	P value
Canine width (Right)	Male	200	6.7898±.42715	.60625±.04315	14.049(398)	0.000**
	Female	200	6.1835±.43584			
Canine width (left)	Male	200	6.7535±.42193	.60025±.04316	13.906(398)	0.000**
	Female	200	6.1533±.44114			
Inter Canine Distance	Male	200	26.805±2.4179	1.0950±.2217	4.939(398)	0.000**
	Female	200	25.710±1.9965			
MCI (Right)	Male	200	.2550±.02429	.01319±.00239	5.520(398)	0.000**
	Female	200	.2418±.02351			
MCI (Left)	Male	200	.2536±.02406	.01301±.00238	5.466(398)	0.000**
	Female	200	.2406±.02355			

Not significant p>0.05, *Significant p<0.05, ** highly significant p<.01

Table 3: Intra group comparison of Canine width and MCI of male and female between Right and Left side by paired t-test

Gender		Mean	Difference Mean ±S.E.M.	t value	p value
Male	Canine width (Right)	6.7898 ±.42715	.036250± .010746	3.373	.001**
	Canine width (left)	6.7535 ±.42193			
	MCI (Right)	.2550 ±.02429	.001359± .000405	3.355	.001**
	MCI (Left)	.2536 ±.02406			
Female	Canine width (Right)	6.1835 ±.43584	.030250± .011012	2.747	.007**
	Canine width (left)	6.1533 ±.44114			
	MCI (Right)	.2418 ±.02351	.001176± .000437	2.689	.008**
	MCI (Left)	.2406 ±.02355			

Not significant p>0.05, *Significant p<0.05, ** highly significant p<.01

Table 4: Frequency distribution of actual gender in comparison with that calculated

		Gender Actual		Total
Gender Calculate by MCI		Male	Female	
	Male	156(79.5%)	44(21.6%)	200(50%)
	Female	40(20.4%)	160(78.4%)	200(50%)
Total		196(100%)	204(100%)	

Not significant p>0.05, *Significant p<0.05, ** highly significant p<.01

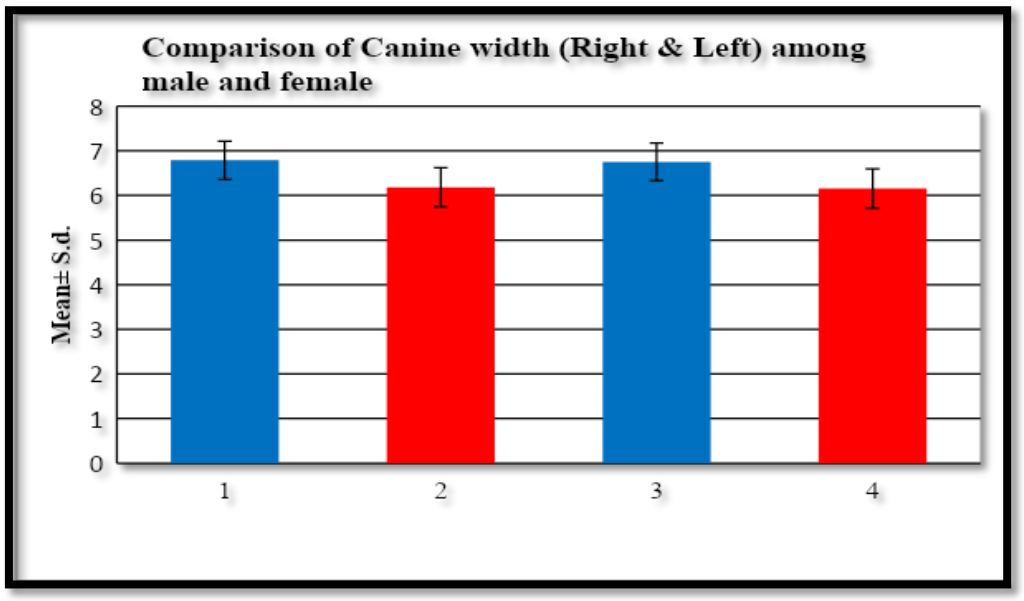
Table 5: Indices for sex determination by MCI

PARAMETER	VALUE
Sensitivity	79.6%
Specificity	78.4%
Overall Accuracy	79%
Pearson Chi-Square	134.6138
p- value	.000**

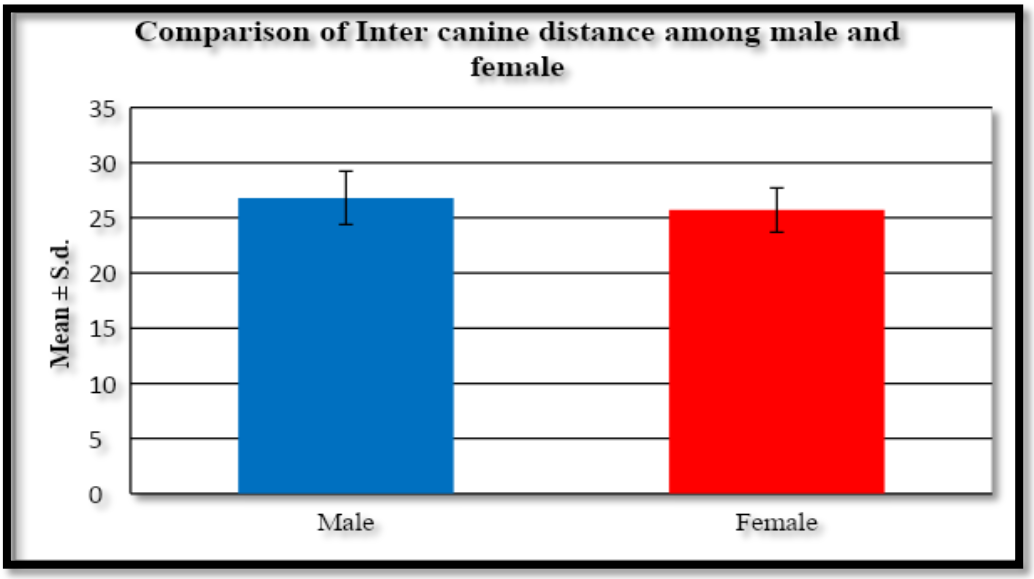
Table 6: Correlation and Coefficient of determination ofPrediction of gender by linear regression (stepwise) with MCI (Right), MCI (Left) and Inter Canine Distance as independent variables

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.267[a]	.071	.069	.483
2	.578[b]	.334	.331	.410
a. Predictors: (Constant), MCI (Right)				
b. Predictors: (Constant), MCI (Right), Inter Canine Distance				

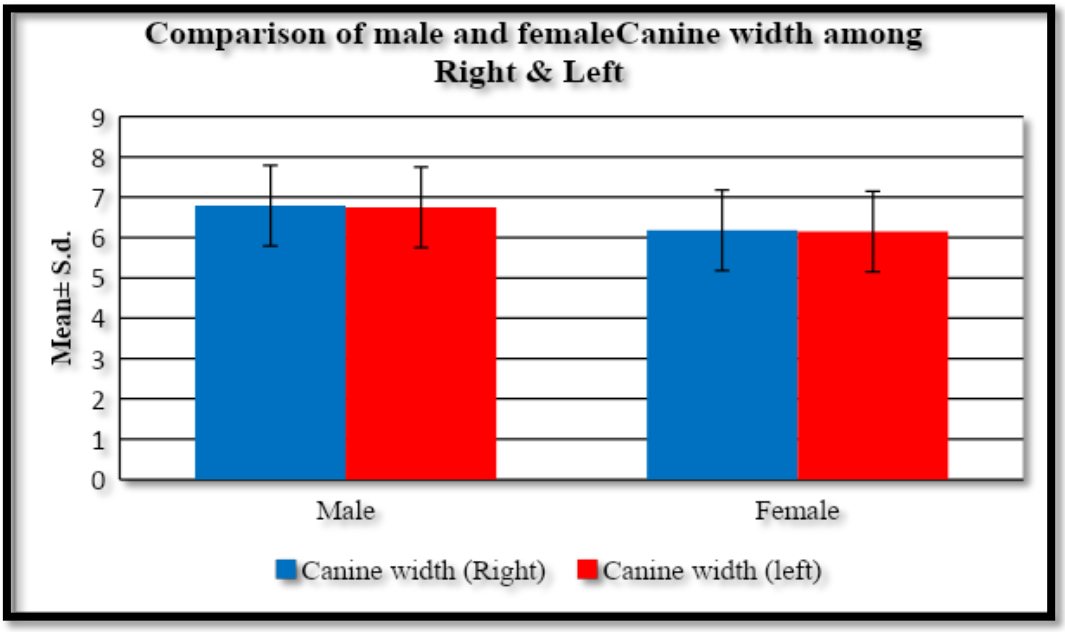
Graph 1: Comparison of Mean ±Std. Deviation of Canine width (Right) and Canine width (Left) between male and female



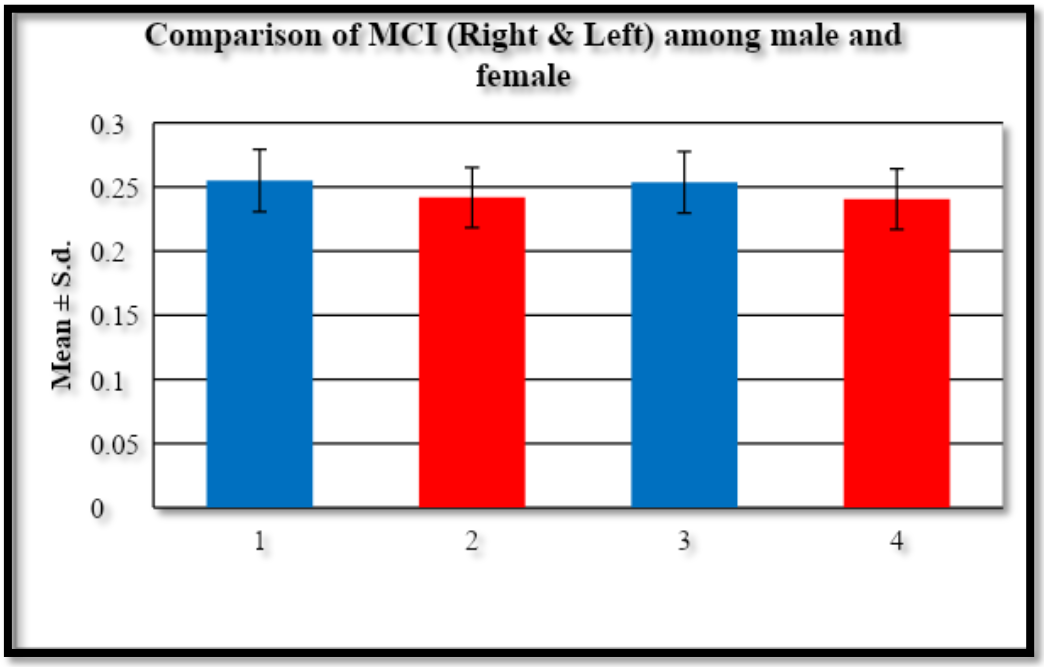
Graph 2: Comparison of Mean ±Std. Deviation of Inter canine distance between male and female



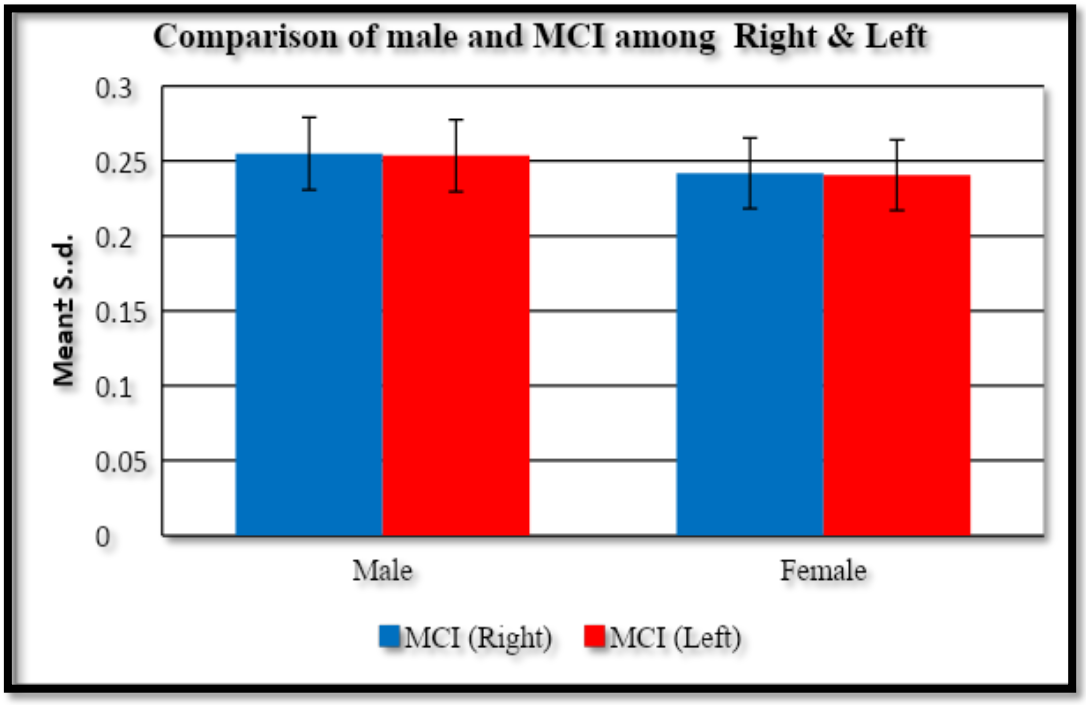
Graph 3: Comparison of Mean ±Std. Deviation of male and female Canine width among Right and Left



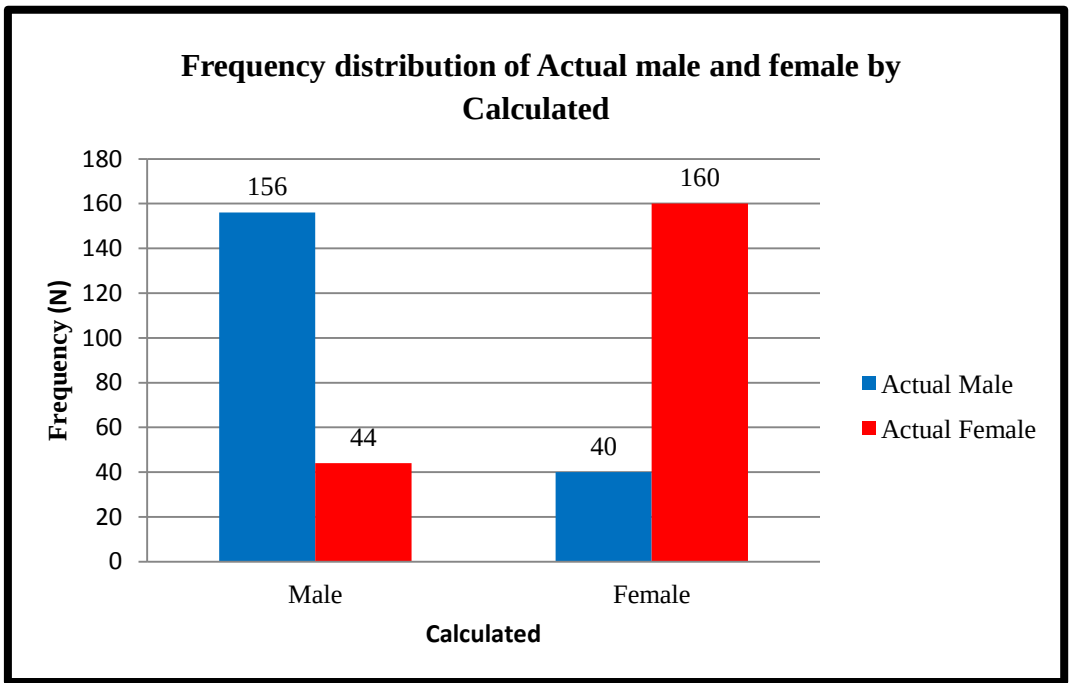
Graph 4: Comparison of Mean ±Std. Deviation of MCI (Right) and MCI (Left) between male and female



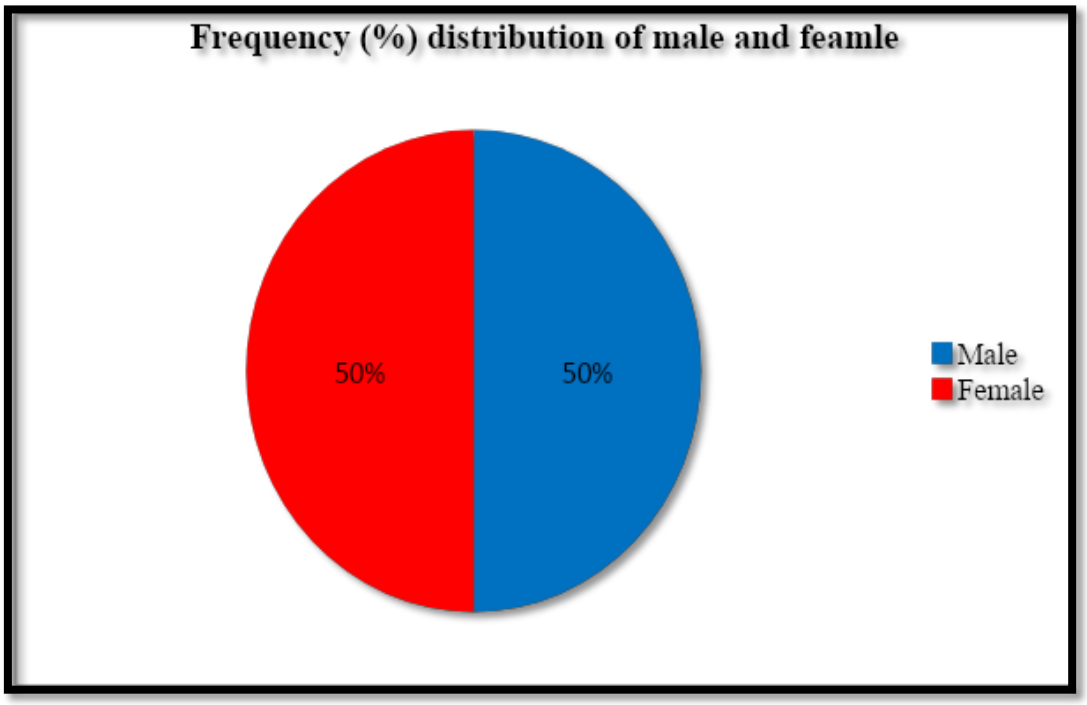
Graph 5: Comparison of Mean ±Std. Deviation of male and female MCI among Right and Left



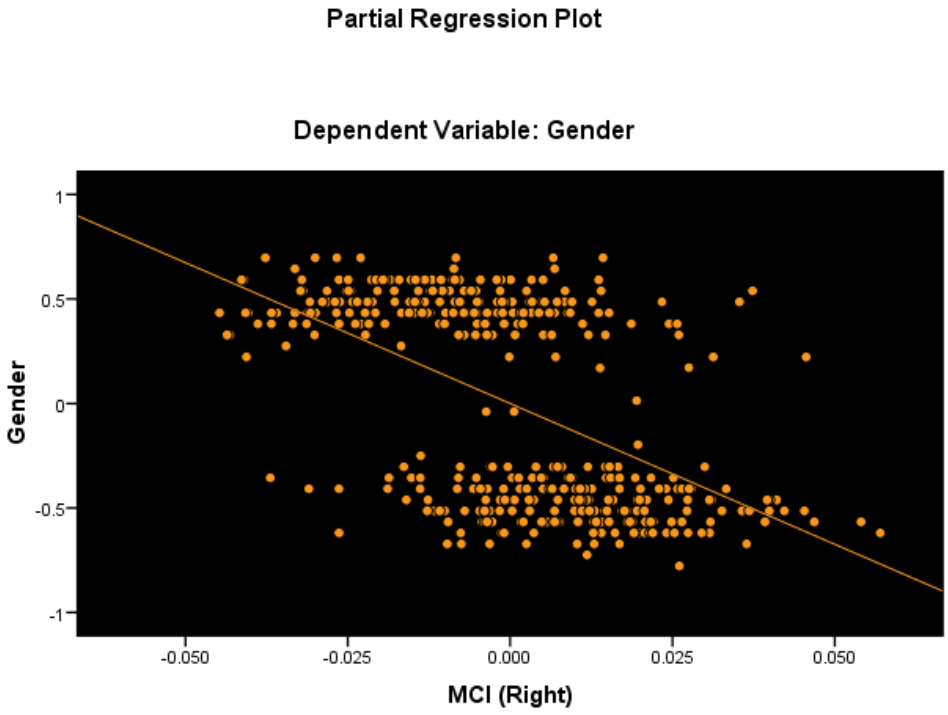
Graph 6: Frequency distribution of actual male and female by calculated value



Graph 7: Frequency distribution of male and female



Graph 8: Partial regression plot w.r.t. MCI



Graph 9: Partial regression plot w.r.t. Intrecanine distance

DISCUSSION

The present study is based on metric method, where the MD width of the mandibular canine and the intercanine distance were analyzed for gender verification. This was aimed considering the fact that there are differences in odontometric features in specific populations, even within the same population; hence, it is necessary to determine specific population values to make identification possible on the basis of dental measurement. Our study showed a significant difference in mandibular intercanine width. The mesiodistal diameter of canine was found greater in males than in females (Tables 4 and graph 2).

Similar findings were noted by Singh SK et al (1989)[10] who demonstrated mandibular intercanine width as a useful parameter in differentiating the gender.Abdulla M et al (1998)[18] showed mandibular intercanine width was significantly greater in males than in females in Saudi Arabian population.

Contrary to results of current study Kaddah M et al (1998)[11] stated that no statistically significant difference were obtained between males and females while measuring the mandibular intercanine width.

In the present study significant difference was observed between the right canine width and left canine width of males and females. The mesiodistal width of right and left canines were larger in males than in females (Tables 5 and graph 3). Similar results were obtained by Kaushal et al (2004)[12] and Reddy et al (2008)[13]. It is also consistent with the findings of Rifaiy et al (1997)[14] who conducted a study on Saudi males and females and found that canines in both jaws exhibited a significant sexual difference. It is the Y chromosome which intervenes most in the size of teeth by controlling the thickness of dentin where as X chromosome responsible for the thickness of enamel. The sexual diamorphism in mandibular canines can be expected to be based on functional activity due to evolution and socialization as mentioned by Butler E, Li R (2014)[15].

On the contrary according to the study conducted by Acharya AB, Mainali S (2008)[2] found reverse sexual diamorphism, where females showed larger teeth than males has been noted.

In the present study right canine showed more sexual diamorphism than left. Similar results were seen in the study of Duraiswamy et al (2009)[16]. On the contrary according to the study conducted by Reddy et al (2008)[13] conducted the study on the population of Uttar Pradesh, Boaz et al (2009)[17], Kapila et al (2011)[3] stated that mandibular left canine showed more sexual diamorphism than left canine.

Table 7. Shows the standard MCI values obtained in various studies in Indian populations

Study	Standard MCI value
Rao et al (South Indian population Karnataka)	0.274
Yadav et al (South Indian population Karnataka)	0.298
Kaushal et al (North Indian population Patiala)	0.256
Latif et al (North Indian population)	0.257
Srivastava et al (North Indian population Uttar Pradesh)	0.257
Agarwal et al (North Indian population)	0.274
Patel et al (North Indian population Gandhi Nagar)	0.254
Present study (North Indian population Malwa Madhya Pradesh)	0.262

CONCLUSION

Mandibular canine index acts as another important tool in sex identification of an individual. The mandibular canines are so important as they are last to be affected by caries and periodontal disease and show significant sexual dimorphism has been reported in various studies. The present study supports the usefulness of the MCI in gender determination. The method of using mandibular canine indices is advantageous as it is easy, rapid, and cost-effective, requires no elaborate apparatus, and is suited for situations where a large number of samples have to be analyzed. Using the derived standard MCI for the present study population, 156 out of 200 males and 160 out of 200 females were correctly predicted. In the overall sample, sex of 316 out of 400 subjects was correctly predicted. The overall accuracy of the method, when applied to combined data of the present study population, was 79%. Hence, the present study supports the usefulness of the MCI in gender determination and it also establishes a statistically significant sexual dimorphism in mandibular canine width through which we were able to conclude that right canine shows more sexual dimorphism than left canine.

BIBLLIOGRAPHY

1. WadhwanV, Urs AB, Manchanda A. Sex determination using three methodologies as a tool in forensic dentistry. J Ind Dent Assoc. 2011;5:77‑80.
2. Acharya AB, Mainali S. Limitations of the mandibular canine index insex assessment. J Forensic Leg Med. 2009;16(2):67-9.
3. Kapila R, Nagesh KS, R Iyengar A, Mehkri S. Sexual dimorphism in human mandibular canines: A radiomorphometric study in South Indian population. J Dent Res Dent Clin Dent Prospects. 2011;5:51-4.
4. Muller M, Lupi PL, Quatrehomm G, Bolla M. Odontometrical method useful in determining gender and dental alignment. Forensic Sci Int. 2001;121:194-7
5. 5. Parekh DH, Patel SV, Zalawadia AZ. Odontometric study of maxillary canine teeth to establish sexual dimorphism in Gujarat population. Int J Bio Med Res. 2012;3:1935-7
6. Vodanovic M, Demo Z, Njemirovskij V, Keros J, Brkic H. Odontometrics: A useful method for sex determination in an archaeological skeletal population. J Arch Sci. 2007;34:905-13
7. Ibeachu PC, Didia BC, OrishCN. Sexual dimorphism in mandibular canine width a and intercanine distance of university of port-harcourt student, Nigeria. Asian J Med Sci. 2012;2:166-9.
8. Vishwakarma N, Guha R. A study of sexual dimorphism in permanent mandibular canines and its implications in forensic investigations. Nepal Med Coll J. 2011;13:96-9.
9. Rao NG, RaoNN, Pai ML, KotianMS. Mandibular canine index: A clue for establishing sex identity. Forensic Sci Int. 1989;42:249-54
10. Singh SK, Gupta A, Padmavathi B, Kumar S, Roy S, Kumar A. Mandibular canine index: A reliable predictor for gender identification using study cast in Indian population. Indian J Dent Res. 2015;26:396-9.
11. Kaddah M. A cluster analysis of a group of Egyptian adults having normal occlusion. Cairo Dent J. 1998;14:283-92
12. Kaushal S, PatnaikVVG, Sood V, Agnihotri G. Sex determination in North Indians using mandibular canine index. Journal of Indian Academy of Forensic Medicine. 2004;26(2):45-9.
13. Reddy VM, Saxena S, Bansal P. Mandibular canine index as a sex determinant: A study on the population of western Uttar Pradesh. JOMFP. 2008;12:56-9.
14. RifaiyMQA, Abdullah MA, Ashraf I, Khan N. Dimorphism of Mandibular and Maxillary Canine Teeth in Establishing Sex identity. Saudi Dental Journal. 1997;9(1):17-20.
15. Butler E, Li R. Genetic markers for sex identification in forensic DNA analysis. J Forensic Investigation. 2014;2(3):1-10
16. Duraiswamy P, Tibdewal FT. Sex determination using mandibular canine index in optimal flouride and high fluoride areas. Journal of Forensic Dental Sciences. 2009;1(2):99-103.
17. Karen B. Dimorphism in human maxillary and madibular canines in establishment of gender. Journal of Forensic Dental Sciences.2009;1:40-2.

18. Abdullah M. A cross sectional study of canine tooth dimorphism in establishing sex identity: A comparison of two different populations. Cairo Dent J. 1998;14:191-6.