

*Original Article*

# Sexual Dimorphism in Superadded Teeth - A Cross Sectional Study Conducted among Students of South Indian States

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## Abstract

The present cross sectional study was conducted on students of south Indian states of SSIMSRC, Davangere. A study casts of 200 was taken (104 males and 96 females) in the age group of {18-25} years. The Mesiodistal and Buccolingual diameters of first and second permanent molars of both maxillary and mandible were measured on the study casts, using sliding vernier callipers.

The buccolingual and mesiodistal dimensions measured, in both maxillary and mandibular molars, showed higher values in males compared to that of females. Amongst the parameters studied, the buccolingual dimensions of maxillary molars showed highest sexual dimorphism with an accuracy of 82.1% and the mesiodistal dimension exhibited least sexual dimorphism. In present study showed that the maxillary molars exhibited highest percentage of dimorphism, compared to the dimensions of mandibular molars, the existence of statistically significant sexual dimorphism in maxillary molars especially the first maxillary molars.

**Keywords:** Sexual dimorphism; Buccolingual; Mesiodistal; Molars.

## Introduction

Identification of dead is an essential part of post-mortem examination, for various reasons that include ethical, humanitarian need to know which individual has died, to allow legal investigations and to facilitate police enquiries into overtly criminal or suspicious deaths, as the identity of deceased person is vital factor in initiating investigations. In case of decomposed corpses

and human remains many features may be partially or wholly lost, but more information can be obtained than from a skeleton<sup>1</sup>. The most commonly used techniques for sex determination are based on the assessment of the morphological characteristics of the pelvis and skull<sup>2</sup>. However, it is not uncommon to recover the pelvis and the skull in a fragmentary state in forensic settings. In this case, teeth can be used as an additional tool for sex determination. Their durability in the case of fire, trauma and bacterial decomposition makes them invaluable for identification<sup>3</sup>. Teeth play a very important role in identification as the dental characteristics are unique to each individual; moreover the teeth are not destroyed in extreme conditions as they can withstand temperatures upto 11000 celcius<sup>4</sup>. Teeth are unique as individual as fingerprints. Even when there is a lack of antemortem records, evaluation of the dentition is a worthwhile aid

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for investigations to provide information regarding the age, sex, socioeconomic grouping, race, food habits and cultural heritage from which we can identify the person<sup>5</sup>. Present study was carried out to know the Sexual dimorphism among maxillary and mandibular superadded teeth's (Molars).

### Materials and Methods

A cross sectional study consisting of about 200 South Indian subjects divided into 106 males and 94 females between the age groups of 18-25 years among the students of SSIMS&RC, Davangere was conducted. Informed written consent from the subjects is obtained prior to taking the collection of specimen. Impressions of both maxillary and mandibular arches are made with irreversible hydrocolloid (alginate) material and cast poured immediately in type II dental stone to minimize dimensional change. After taking the alginate impressions of both maxillary and mandibular arches it would be molded into plaster models. Using a sliding vernier caliper, the mesio-distal and bucco-lingual diameters of first and second molar teeth will be determined from the plaster models of both maxillary and mandibular arches obtained from the subjects, by indirect anthropometric measurement.<sup>6</sup>

#### MD [MESIODISTAL] diameter of the crown:

This measurement is the greatest mesiodistal dimension between the contact points of teeth on either side of jaw (FIGURE 1).

#### BL [BUCCOLINGUAL] diameter of the crown:

This measurement is the greatest distance between buccal and lingual surfaces of the crown, taken at right angles to the plane in which the mesiodistal diameter is taken (FIGURE 2).

The measurements, Mesiodistal and Buccolingual dimensions of both maxillary and mandibular, first and second molars on both right and left side were taken using Sliding Vernier callipers and tabulated. Data was entered in master chart in terms of numbers and percentages. Results are presented as mean, standard deviation, percentage of sexual dimorphism for each first and second molar tooth. Unpaired 'T' test was used to compare the means between males and females. P value of 0.05 or less was considered as statistically significant. The mean values of BL and MD dimensions of males

and females were subjected to the formula to calculate sexual dimorphism.<sup>7</sup>

$$\text{Sexual dimorphism} = \frac{X_m - 1}{X_f} \times 100$$

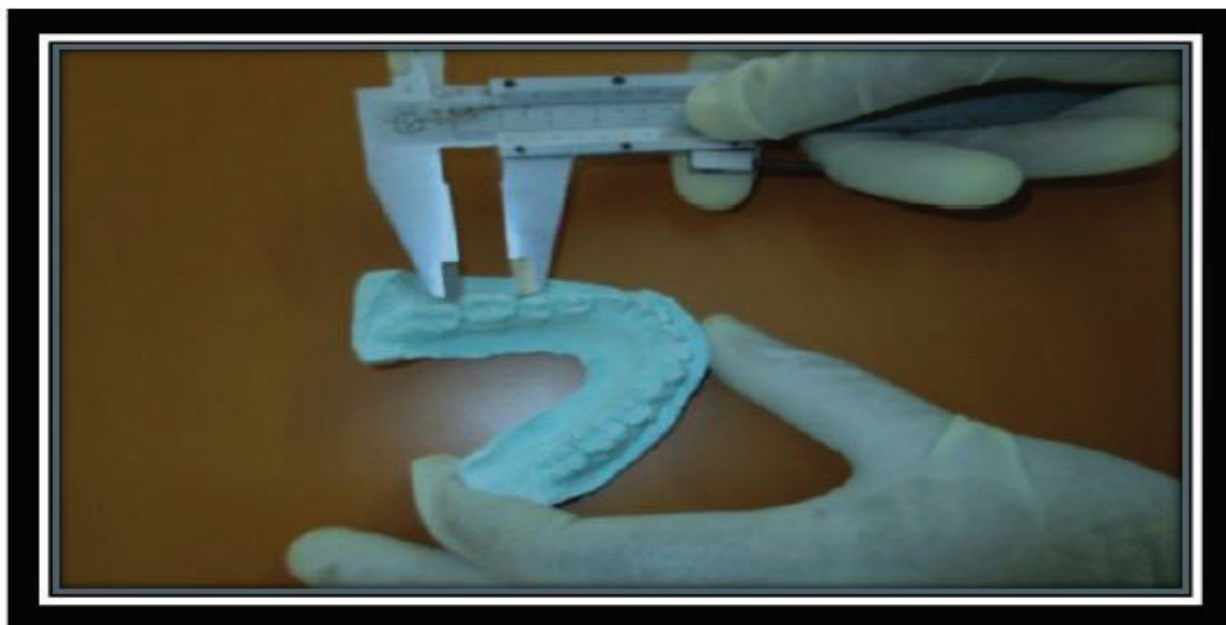
Xf

Where X<sub>m</sub> = mean values for males and X<sub>f</sub> = mean values for females.

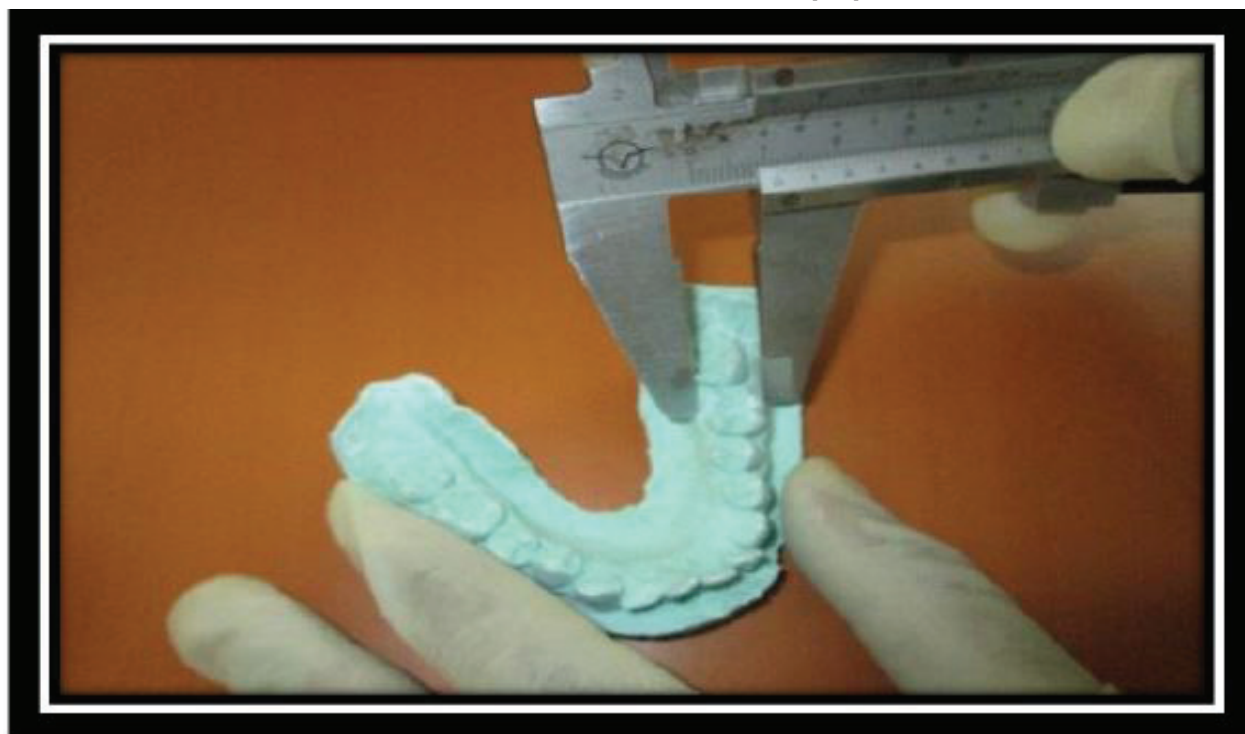
### Results and Observation

In the present cross sectional study about 200 South Indian subjects studied of which 106 males and 94 females between the age groups of 18-25 years, the parameters, the Mesio-distal and Bucco-lingual diameters of both maxillary and mandibular molars were higher in males compared to females with p<0.001. Among the molars, the left maxillary first molar (M1) was found to exhibit the greatest sexual dimorphism (82.1%) in terms of buccolingual dimensions while the least dimorphic value was that for right mandibular first molar (M1) (8.8%) in terms of mesiodistal dimensions. Among the maxillary molars, the left maxillary first molar (M1) was found to exhibit the greatest sexual dimorphism (82.1%) in terms of buccolingual dimensions while the least dimorphic value was that for left maxillary second molar(M2) (13.1%) in terms of mesiodistal dimensions. Among the mandibular molars, the right mandibular first molar (M1) was found to exhibit the greatest sexual dimorphism (75.5%) in terms of buccolingual dimensions while the least dimorphic value was that the same teeth ( 8.8 %) in terms of buccolingual dimensions. Comparing the linear measurements, the buccolingual dimensions of maxillary first molars were found to exhibit greater sexual dimorphism than mesiodistal dimensions of the same teeth (Table 1).

ABBREVIATION	FULL FORM
BL	Bucco-lingual
LTMD	Left mesio-distal
LTBL	Left Bucco-lingual
MD	Mesio-distal
M1	First molar
M2	Second molar
RTMD	Right mesio-distal
RTBL	Right bucco-lingual



**FIG 1: MESIODISTAL MEASUREMENT [MD]**



**FIG 2: BUCCOLINGUAL MEASUREMENT [BL]**

**TABLE NO 1: COMPARISON OF THE MEAN VALUES OF DIFFERENT PARAMETERS IN MALES AND FEMALES USING UNPAIRED T-TEST.**

ToothType			Males		Females		Diff (M - F)	% Dimorphism	Rank
			Mean	SD	Mean	SD			
UPPER M1	RT MD	UPM1RTMD	0.80	0.08	0.66	0.08	0.14	17.2	8
	RT BL	UPM1RTBL	4.92	4.56	0.90	0.95	4.02	81.7	15
UPPER M1	LT MD	UPM1LTMD	0.80	0.08	0.69	0.07	0.11	14.2	6
	LT BL	UPM1LTBL	4.92	4.56	0.88	0.95	4.04	82.1	16
UPPER M2	RT MD	UPM2RTMD	0.75	0.07	0.63	0.07	0.12	15.4	7
	RT BL	UPM2RTBL	3.36	4.10	0.88	0.96	2.48	73.8	13
UPPER M2	LT MD	UPM2LYMD	0.74	0.07	0.65	0.07	0.10	13.1	5
	LT BL	UPM2LTBL	2.31	3.38	0.89	0.95	1.42	61.4	12
LOWER M1	RT MD	LOWM1RTMD	0.83	0.07	0.76	0.06	0.07	8.8	1
	RT BL	LOWM1RTBL	7.16	4.24	1.74	2.70	5.42	75.7	14
LOWER M1	LT MD	LOWM1LTMD	0.81	0.08	0.74	0.08	0.07	9.2	2
	LT BL	LOWM1LTBL	5.18	4.57	2.11	3.18	3.07	59.3	10
LOWER M2	RT MD	LOWM2RTMD	0.84	0.90	0.75	0.97	0.09	10.9	3
	RT BL	LOWM2RTBL	3.58	4.24	1.39	2.26	2.19	61.1	11
LOWER M2	LT MD	LOWM2LTMD	0.77	0.07	0.67	0.08	0.10	13.0	4
	LT BL	LOWM2LTBL	3.01	3.90	1.37	2.27	1.64	54.4	9

\*\* Using Unpaired t test,  $p < 0.001$ , HS

## Discussion

The present study established the significant impact of sex factor on the morphometry of both maxillary and mandibular first(M1), second(M2) molars. Buccolingual and mesiodistal diameters of right and left maxillary and mandibular first, second molars in males and females were measured on study casts. The comparison of mean values of parameters measured between males and females showed highly statistically significant differences with  $p < 0.001$  and these results are in agreement with the studies done by Perzigian AJ<sup>8</sup>, Ghose LJ *et al.*<sup>9</sup>, Stroud JL *et al.*<sup>10</sup>, A Study conducted by Hattab FN *et al.*<sup>11</sup> on 198 Jordanians (86 males and 112 females), showed the BL width of 1st maxillary and mandibular molars was observed and significant sexual dimorphism was only observed in the maxillary molar which is in agreement to present study. A Study conducted by Rai B *et al.*<sup>12</sup>, and Ghodosi A *et al.*<sup>13</sup>, in which they have observed that the males had larger teeth than females in all the dimensions as our studies are in agreement with that, A study conducted by Joseph PA *et al.*<sup>14</sup> showed that the odontometric sex assessment in Indians found that the extent of sexual dimorphism in Indians of all tooth variables being statistically larger in Indian males, which are in agreement with the present study, with accuracy rate of odontometric sex assessment is 72%, and the present study

showed 82.1% accuracy. Acharya AB and Mainali S<sup>15</sup> in their study on Nepalese subjects found that MD dimensions had recognizable greater accuracy in sex identification than BL measurements contrast to that in the present study BL dimensions had more accuracy than MD dimensions. Sonika V *et al.*<sup>16</sup> in their study on Haryana population found that the greater accuracy of dimorphism was shown by maxillary molars than mandibular molars which is in agreement with the present study. The present study showed that the left buccolingual dimensions of maxillary first molar are greater than its counterparts. Similar results were obtained by study done by Lund H and Mörnstad H<sup>17</sup>, Zarringhalam M<sup>18</sup>, who found that dimensions of all permanent teeth were greater on the left than the right in upper jaw.

## Conclusion

Forensic Odontology is an emerging field in India. It relies a lot on inexpensive and easy means of identification of persons from fragmented jaws and dental remains. The present cross sectional study was conducted on study casts of 200 was taken (104 males and 96 females) in the age group of 18-25years. the Mesio-distal and Bucco-lingual diameters of both maxillary and mandibular molars were higher in males compared to females with  $p < 0.001$  by using unpaired t test. The maxillary molars showed

highest sexual dimorphism when compared to the mandibular molars. Bucco-lingual dimensions of maxillary molars showed highest sexual dimorphism of 82.1%, compared to the mandibular molars. It was concluded from the study that the metric analysis of teeth can be of immense help in determining the sex of an individual, the results also showed that bucco-lingual diameters of first maxillary molars exhibited significant sexual dimorphism among the students of South Indian states and thus can be used as an additional tool in sex determination, even in absence of antemortem data, genetic and medicolegal purposes.

**Conflict of Interest:** None.

**Source of Funding:** Self.

**Ethical Clearance:** Ethical clearance was obtained from the Institutional Ethical Committee.

### References

- 1) Saukko P, Knight B, KNIGHT'S Forensic Pathology, 3rd ed.2012:98-112.
- 2) Krogman WM, Iscan MY. The Human Skeleton in Forensic Medicine. Springfield: Charles C. Thomas;1986. p189-26.
- 3) William PL, Bannister LH, Dyson M, Berry MM, Collins P, Dussek JE, et al. The Teeth in: Grays Anatomy, 3th ed.London: Churchill Livingstone;2006.50-602.
- 4) Fereira JL, Fereira AJ, Ortega AF, Methods for the analysis of hard dental tissues exposed to high temperatures Forensic Sci Int. 2008; 178(2-3):119-24.
- 5) Prabhu S, Acharya AB. Odontometric sex assessment in Indians. Forensic Sci Int. 2009;192:129e1-5.
- 6) Moorrees CF, Reed RB. Correlations among crown diameters of human teeth. Arch Oral Biol. 1964;115:685-97.
- 7) Garn SM, Lewis AB, Swindler DR, Kerewsky RS. Genetic Control of Sexual Dimorphism in Tooth Size. J Den Res.1967;46:963-72.
- 8) Perzigian AJ. The dentition of the Indian Knoll skeletal population: odontometrics and cup number. Am J Phys Anthropol. 1976;44(1):113-21.
- 9) Ghose LJ, Baghdady V. Analysis of the Iraqi Dentition: Mesiodistal crown diameters of permanent teeth. J Dent Res 1979;58(3):1047-54.
- 10) Stroud JL, Buschang PH, Goaz PW. Sexual dimorphism in mesiodistal dentin and enamel thickness. Dentomaxillofac Radiol. 1994;23:169-71.
- 11) Hattab FN, al-Khateeb S, Sultan I. Mesiodistal crown diameters of permanent teeth in Jordanians. Arch Oral Biol. 1996;41(7):641-5.
- 12) Rai B, Dhatarwal SK, Anand SC. Sex determination from tooth. Medico-legal update. 2008;8(1):3-5.
- 13) Ghodosi A, Mosharraf R, Nia FF. Sexual variation in bucco-lingual dimensions in Iranian dentition. Inter. J. Dental Anthropol.2008;12:1-7.
- 14) Joseph PA, Harish RK, Mohammed PKR, Vinod KRB. HOW RELIABLE IS SEX DIFFERENTIATION FROM TEETH MEASUREMENTS. Oral Max Path J, jan-2013,vol.4(1),:289-91.
- 15) Acharya AB, Mainali S. Sex discrimination potential of buccolingual and mesiodistal tooth dimensions. J Forensic Sci. 2008;53(4):790-2.
- 16) Sonika V, Harshaminder K, Madhushankari GS, Sri Kennath J a. A. Sexual dimorphism in the permanent maxillary first molar: a study of the Haryana population (India). J Forensic Odontostomatol. 2011 Jul;29(1):37-43.
- 17) Lund H, Mörnstad H. Gender determination by odontometrics in a Swedish population. J Forensic Odontostomatol. 1999 Dec;17(2):30-4.
- 18) Zarringhalam M. A comparison on the mesiodistal width of right and left side teeth in people with normal occlusion. Journal of Dental Medicine. 2004;17(3):5-11.