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A pilot study on ethnic variations and reverse sexual dimorphism in permanent teeth dimensions of sub-adult Santhal population of India*

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Abstract

The teeth are resistant towards environmental and decomposition processes and can often be found in cases of mass disasters, charred or mutilated bodies. India is a land of diverse ethnicities and odontometric data of specific tribal populations is deficient. The Santhals are one of the largest tribal groups of India and exploring their dental traits will be useful in deciphering their biological profile, oral health and dietary patterns. The present study aims to explore sexual dimorphism in the tooth dimensions of sub-adult Santhal population and study their ethnic variations with other tribal population groups. A cross-sectional study was conducted on 100 participants (50M/ 50F) aged between 14-20 years of the Santhal origin. Direct measurements of 14 variables were taken intra-orally using digital vernier callipers. All the data was statistically analysed using SPSS.21.00. The mandibular canines showed the highest classification accuracy (MnRC=85%, MnLC=87%) in univariate discriminant function analysis. The mandibular left canine showed a sexing accuracy of 82.5% in the ROC Analysis. The maxillary and mandibular canine width of the Santhal females were smaller than those of the other north-eastern tribal groups. A statistically significant difference ($p<0.001$) was observed among the maxillary and mandibular canine width of the Santhals with the other tribal populations using one way-ANOVA. It can be concluded that population-specific data is important to aid in forensic investigations and orthodontic treatments and should be regularly updated because of secular and temporal changes.

Keywords: teeth dimensions; sexual dimorphism; population variation; sub-adult; Santhal

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Introduction

Ethnicity estimation remains as one of the most challenging tasks in the personal identification of unknown individuals. Also, association of any specific morphological or anatomical trait with a certain ethnicity is very difficult. Although, anthropologists and human biologists have established that all humans belong to the same species (Homo sapiens), still there are differences within the human groups (1). Studies related to human dentition can reveal substantial information regarding the nature and scope of such diversity as dental remains are highly resistant towards extreme weather conditions, decomposition processes and can often be found in archaeological and fossil remains (2). Previous studies have shown the differences of teeth dimensions even within the same demography (3-6). The crown dimensions among males are significantly larger than in females, which may be attributed to a longer duration of amelogenesis in males for deciduous and permanent teeth (6). However, a reverse sexual dimorphism was observed in the studies conducted on Indian and South-western Indian participants aged between 18-32 years, where the mesiodistal width of the mandibular canine, central incisor, premolars and molars were greater for females (7,8). This reversal is a consequence of reduced dimorphism and overlapping of sexes (9). Such differences of the permanent dentition can be useful from the forensic and anthropological perspectives.

The study of dental materials can also provide necessary insights in reconstructing phylogenetic relationships among different species, evolution of dentition patterns and impact of diet on dentition thereby calculating biological distance among communities (10). Numerous environmental, genetic and epigenetic factors cause differences in the dental crown and root surfaces. The size, shape, alignment and several morphological features of the permanent teeth can be useful in separating one group from the other (11). The mesio-distal, bucco-lingual and diagonal measurements of the teeth are some of the most frequently examined odontometric parameters for sex estimation. The linear and 3-dimensional measurements can be obtained using digital vernier callipers either intra-orally or

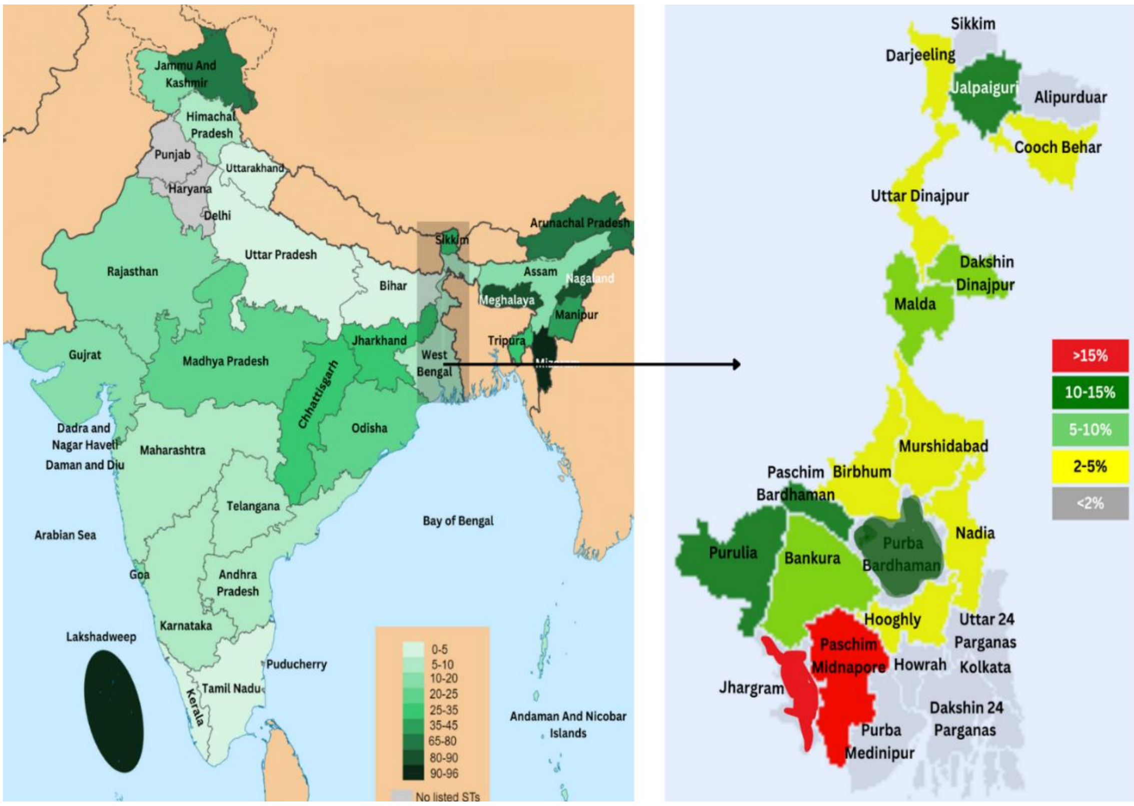

Figure 1. Map Reference of percentage-wise distribution of tribal population in different states of India and Santhal population in West Bengal following Census 2011.

from dental casts or from imaging (CBCT, MRI) and radiographic techniques. These measurements can be further analysed for personal identification using supervised learning algorithms (12). Various studies have used machine learning algorithms in sex estimation from dental metrics among adult and juvenile samples in diverse populations (13-15). However, it is important to update such algorithms for each population owing to the secular and temporal changes of the dental parameters.

With the diverse population and large number of ethnicities of India, the teeth dimensions depict a high variability. The Santals (Santhals) are the descendants of the Austro-Asiatic family and are one of the major ethnic groups of East India. The total number of Santhals in India is 7.4 million, and 2.5 million belong to the state of West Bengal. They are the third largest tribal community of India after the Bhil and Gond tribes (16). The Santhals are inhabitants of regions like Radha (in West Bengal), Jharkhand, Odisha, and Chhota Nagpur plateau. Some of them have also settled in the different states of India like Bihar, Meghalaya, Tripura and Assam (Figure 1). The state boundaries of India had been reorganized along linguistic and cultural lines under the "States Re-organisation Act, 1956". The administration of tribal populations within the North-eastern states of West Bengal, Assam, Meghalaya, Tripura and Mizoram has been mentioned in the Fifth and Sixth Schedule of Article 244, Constitution of India. These guidelines have helped in granting ethnic, legislative, judicial and financial autonomy to the regional councils to govern these scheduled areas (17,18). The primary occupation of the Santhals is agriculture, however, many of them are now employed in the steel factories and coal mines of Durgapur, Asansol and Jharkhand (19). The dental information of this ethnicity is scarce and can be useful in determining their age, sex, socio-economic status, work habits, oral and systemic health and nutritional quality. Previously, no studies have been conducted on the variation in teeth dimensions of sub-adult Santhals and between sexes and other tribal population groups. The present study aims to explore reverse sexual dimorphism and ethnic variations in the odontometric measurements of the Santhal population.

Materials and Methods

The present study has been conducted among the sub-adult population of Faridpur-Durgapur block of the Paschim Bardhhaman district of West Bengal. This area was chosen as the study region due to its dense Santhal population. A cross-sectional study has been done on 100 participants (50 of each sex) of Santhal origin with an age range of 14-20 years. Due to limited access to the remote locations of the Santhal establishment, financial and time constraints, the sample size was accordingly censored. A total of 14 variables were measured intra-orally using a digital vernier calliper (0.01 mm least count). An informed consent with the approval of the Institutional Ethics Committee (Ref No: SGTU/FOSC/2023/1481) in both English and Hindi languages was obtained from all the participants. The participants with abnormalities in teeth alignment, missing front teeth, excessive space between teeth, caries, macrodontia or microdontia and not of the Santhal origin were excluded from the study.

Data Management and Statistical Analysis

The odontometric measurements of 4 ethnic groups (Ao, Meitei, Miching and Singpho) of North-eastern India were used as a secondary source of data to compare them with the findings of the present study (6). All the measurements were statistically analysed using SPSS.21.00. Descriptive statistics was performed using the independent t-test to observe the variation between the sexes. The sexual dimorphism index was also obtained for all the variables. A paired t-test was conducted to determine the intra-observer error followed by discriminant function analysis.

Table 1. Descriptive statistics depicting mean values, t-value, p-value and sexual dimorphism index (SDI).

Variable (in mm)	Male (n=100) Mean+S.D	Female (n=100) Mean+S.D	t-value	p-value	SDI	Sexing Accuracy
MxRCI	8.37+0.268	7.88+0.278	6.226	<.001	6.21	77%
MxRLI	6.55+0.450	6.35+0.147	3.241	<.001	3.14	63%
MxRC	7.08+0.232	6.77+0.251	6.384	<.001	4.57	78%
MxLCI	7.37+0.221	6.79+0.213	5.808	<.001	8.54	72%
MxLLI	6.48+0.227	6.31+0.224	4.853	<.001	2.69	68%
MxLC	7.36+0.142	6.17+0.137	19.035	<.001	19.28	84%
MxICW	28.41+0.310	26.19+0.606	18.146	<.001	8.47	83%
MnRCI	5.84+0.230	5.62+0.210	6.803	<.001	3.91	78%
MnRLI	5.21+0.132	5.17+0.151	4.031	<.001	0.77	60%
MnRC	7.21+0.169	5.71+0.391	20.818	<.001	26.26	85%
MnLCI	5.45+0.145	5.36+0.203	3.161	<.001	1.67	61%
MnLLI	6.02+0.141	5.97+0.303	2.549	<.001	0.83	55%
MnLC	6.23+0.141	6.14+0.216	22.382	<.001	1.46	87%
MnICW	21.96+0.647	20.78+0.453	6.280	<.001	5.67	77.5%

Table 2. Paired t-test for intra-observer error.

Variables	Correlation	t-values	Significance (2-Tailed)
MxRCI	0.986	2.348	0.28
MxRLI	0.781	0.816	0.423
MxRC	0.982	3.421	0.242
MxLCI	0.979	5.046	0.316
MxLLI	0.991	1.232	0.234
MxLC	0.991	1.654	0.106
MxICW	0.989	1.647	0.121
MnRCI	0.976	2.603	0.214
MnRLI	0.858	2.000	0.471
MnRC	0.968	3.341	0.205
MnLCI	0.971	1.799	0.080
MnLLI	0.956	8.833	0.104
MnLC	0.989	4.803	0.131
MnICW	0.953	7.140	0.162

Table 3. Step-wise Discriminant Function Analysis.

Variables	Wilk's Lambda	Equivalent F. Ratio	Degree of Freedom
MnLC	0.202	769.855	1,198
MxLC	0.131	628.473	2,197
MnICW	0.106	539.627	3,196
MnRC	0.094	442.533	4,195
MnRCI	0.092	349.482	5,194
MxRC	0.090	303.281	6,193

Table 4. Canonical discriminant coefficients and sexing accuracy.

Variables and Functions	Unstandardized /Raw Co-efficient	Standardized Co-efficient	Structured Co-efficient	Centroids	Males (n=100)	Females (n=100)	Accuracy	
							Original	Cross-Validated
Step-wise Discriminant Function Analysis								
F1 MnLC MxLC MnICW MnRC MnRCI MxRC (Constant)	4.732 3.001 0.419 1.020 0.752 0.631 -88.343	0.601 0.583 0.426 0.302 0.171 0.148	0.549 0.431 0.265 0.242 0.117 0.102	M= 2.186 F= -2.186 S.P=0	83%	85%	84%	84%
Direct Discriminant Analysis								
F2 MxRC MxLC MnRC MnLC MxICW MnICW (Constant)	0.503 1.302 0.549 3.026 0.754 0.318 -75.384	0.119 0.374 0.186 0.543 0.581 0.232	0.154 0.489 0.163 0.406 0.507 0.296	M=2.825 F= -2.623 S.P=0.202	81%	80 %	80.5%	80.5%
F3 MxLLI MnLC MnICW MxRC MnRLI (Constant)	0.624 0.198 0.843 1.096 0.775 -52.129	0.174 0.186 0.459 0.508 0.107	0.246 0.161 0.541 0.483 0.167	M= 1.178 F= -1.178 S.P= 0	77%	80%	78.5%	78.5%
F4 MxRCI MxRLI MnRC MnRLI (Constant)	1.429 0.704 1.086 0.531 -47.154	0.723 0.284 0.437 0.157	0.626 0.185 0.385 0.231	M= 1.061 F= -1.061 S.P= 0	74%	72%	73%	73%
F5 MxLLI MnLC MnICW (Constant)	1.021 1.031 1.285 -32.121	0.280 0.186 0.631	0.312 0.206 0.818	M=0.827 F= -0.827 S.P=0	70%	65%	67.5%	67.5%

Table 5. ROC Analysis with AUC, cut off value, sensitivity and specificity.

Variables	AUC	Cut-off Value	Sensitivity	1-Specificity	Male Identified (n=100)	Females identified (n=100)	Total (n=200)
					%	%	%
MxRCI	0.923	♂≥7.85<♀	0.935	0.730	73	71	72
MxRLI	0.616	♂≥6.23<♀	0.712	0.720	68	72	70
MxRC	0.821	♂≥6.62<♀	0.868	0.780	82	80	81
MxLCI	0.945	♂≥7.18<♀	0.959	0.610	78	80	79
MxLLI	0.689	♂≥6.24<♀	0.760	0.550	76	72	74
MxLC	0.989	♂≥7.24<♀	0.960	0.780	81	79	80
MxICW	0.988	♂≥27.14<♀	0.946	0.760	78	75	76.5
MnRCI	0.737	♂≥5.05<♀	0.900	0.680	72	69	70.5
MnRLI	0.626	♂≥6.88<♀	0.730	0.610	73	61	67
MnRC	0.943	♂≥6.54<♀	0.953	0.720	84	76	80
MnLCI	0.612	♂≥5.21<♀	0.850	0.610	67	70	68.5
MnLLI	0.521	♂≥5.84<♀	0.530	0.480	61	63	62
MnLC	0.983	♂≥6.06<♀	0.960	0.770	85	80	82.5
MnICW	0.828	♂≥20.35<♀	0.930	0.600	72	78	75

Table 6. Comparison of mesiodistal width of canines among five ethnic groups.

Variables		Santhal	Ao	Meitei	Miching	Singpho	F-statistic	P-value
Males	MxCW	7.22± 0.19	7.33±0.34	7.45±0.21	7.16±0.20	7.65±0.19	35.0956	<0.001
	MnCW	6.72±0.16	6.38±0.38	6.78±0.53	6.41±0.59	6.68±0.34	9.3976	<0.001
Females	MxCW	6.47±0.19	6.60±0.38	6.84±0.27	6.58±0.41	6.70±0.14	11.0066	<0.001
	MnCW	5.92±0.30	5.96±0.47	6.00±0.31	6.04±0.28	6.04±0.28	1.0536	0.038

#*p* value for one-way ANOVA

Table 7. Maxillary canine width, mandibular canine width and sexual dimorphism index of national and international tribal groups.

Author	Samples	Region	Ethnicity	WMxC			WMnC		
				M	F	SDI	M	F	SDI
Lukacs 1993	M=103, F=105 (15 years)	Gujarat	Bhills	7.78+0.44	7.39+0.42	5.27	6.89+0.37	6.42+0.38	7.32
	M=107 F=99 (18 years)	Gujarat	Garasias	7.67+0.48	7.28+0.43	5.35	6.84+0.48	6.38+0.39	7.21
Bhasin et al. 1985	M=24	Himachal Pradesh	Bodhs	7.84+0.07	7.64+0.55	2.61	7.09+0.05	6.94+0.49	2.16
	M=60	Rajasthan	Dangi	8.11+0.04	-		7.18+0.07	-	
	M=70	Maharashtra	Kunbi	7.39+0.04	-		6.51+0.05	-	
	M=45	Maharashtra	Varli	7.89+0.04	-		6.88+0.05	-	
Majumdar et al. 2023	M=50 F=50 (20-30 years)	Nagaland	Ao	7.33+0.34	6.60+0.38	11.06	6.38+0.38	5.96+0.47	7.04
	M=50 F=50 (20-30 years)	Manipur	Meitei	7.45+0.21	6.84+0.27	8.91	6.78+0.53	6.00+0.31	13
	M=50 F=50 (20-30 years)	Assam	Miching	7.16+0.20	6.58+0.41	8.81	6.41+0.59	6.04+0.40	6.12
	M=50 F=50 (20-30 years)	Arunachal Pradesh	Singpho	7.65+0.19	6.70+0.14	14.17	6.68+0.34	6.04+0.28	10.59
Sravya et al. 2016	M=50 F=50	Andhra Pradesh	Gond	10.01+0.06	9.21+0.01	8.68	-	-	
Sharma et al. 2019	M=32, F=29 (18-57 years)	Assam	Dimasa Kachari	8.41+0.05	7.6+0.07	10.65	5.8+0.11	5.6+0.09	3.57
Haeussler et al. 1989	M=31, F=36 (15-60 years	South Africa	San	7.50+0.03	6.9+0.4	8.69	-	-	
	M= 91, F=95 (15-60 years	South Africa	Central Sotho	7.70+0.5	7.4+0.5	4.05	-	-	
Alanazi et al. 2022	M= 12, F=18 (20-45 years)	Arabia	Native Arabian	7.70+0.46	7.57+0.531	1.71	-	-	
Santoro et al. 2000	54 (14-40 years)	Dominician Republic	Dominician American	8.15+0.51	7.84+0.48	3.95	7.12+0.55	6.82+0.40	4.39
Kieser et al. 1985	M=100, F=102 (14-60 years)	Paraguay, South America	Lengua Indian	9.05+0.32	8.11+0.44	11.59	7.68+0.41	6.98+0.41	10.02
Mayhall et al. 1981	91	Amazonian Region, Ecuador	Waorani	8.70+0.40	8.17+0.35	6.48	9.00+0.58	8.12+0.45	10.83
Yemitan et al. 2022	M=25, F=25 (15-25 years)	North Nigeria	Hausa	7.65+0.52	7.48+0.54	2.27	6.43+0.54	6.10+0.44	5.40
	M=15, F=35 (15-25 years)	West Nigeria	Yoruba	8.51+0.72	7.74+0.78	9.94	7.51+0.67	6.90+0.53	8.84
	M=16, F=16 (15-25 years)	East Nigeria	Igbo	8.20+1.00	7.81+0.62	4.99	7.26+1.01	6.91+0.74	5.06
Togoo et al 2019	M=15 F=15 (avg. 23.3 years)	Southern Saudi Arabia	Asir	6.90+0.54	6.48+0.62	6.48	5.33+0.76	5.22+0.63	2.10
	M=15 F=15 (avg. 33.3 years)	Southern Saudi Arabia	Najran	7.81+0.63	7.48+0.55	4.41	5.79+0.59	5.52+0.63	4.89
	M=15 F=15 (avg. 24.1 years)	Southern Saudi Arabia	Jizan	7.59+0.40	7.45+0.65	1.87	5.60+0.31	5.35+0.50	4.67

A stepwise discriminant analysis, univariate and multivariate direct discriminant function analyses (DFA) were performed to calculate the discriminant functions and obtain maximum separation of the sexes. The “leave one out classification” was applied to obtain cross-validated results of sexing accuracy. The Receiver Operating Curve (ROC Analysis) was performed to obtain the cut-off points having the optimum sensitivity (true positive rate) and specificity (true negative rate). The variable having the highest area under the curve (AUC) is considered to have the highest classification accuracy. One way analysis of variance was performed at a 95% confidence interval to compare the Santhal teeth dimensions with 4 different tribal populations within India.
A map reference of percentage of tribal populations in different states of India and Santhals in West Bengal has also been generated using “Filled Maps” tool in MS-Excel from the Census data 2011 (50).

Results

Table 1 depicts the findings of the descriptive analysis which include the mean, standard deviation, t-value, P-value and sexual dimorphism index (SDI). The sex classification accuracy (between 55 and 87%) has also been depicted using univariate analysis. Mandibular left canine (MnLC) has shown to have the highest sexing accuracy. All the variables are significantly larger among males (p<0.05).
Table 2 depicts the results of the paired t-test, where a strong correlation exists between the readings taken at two different instances by the same observer. The p-value also exhibits a non-significant difference between the measurements.
Table 3 shows the results of stepwise discriminant function analysis (DFA) where six variables (MnLC, MxLC, MnICW, MnRC, MnRCI and MxRC) were selected which gave the maximum classification accuracy.
Table 4 shows the canonical discriminant coefficients and sexing accuracy for step-wise and direct discriminant functions. In the stepwise analysis, the classification accuracy reached 84% (M= 83%, F=85%) after cross-validation. In the direct discriminant analysis, a combination of three variables MxLLI, MnLC and MnICW have provided a sexing accuracy of 67.5% (M=70%, F= 65%).
The ROC analysis findings are shown in Table 5, where the cut-off points, sensitivity and specificity of each variable are displayed. MnLC demonstrated the greatest are under the curve (AUC) with a sexing accuracy of 82.5% (M=85%, F=80%). The ROC plot and reference line are shown in Figure 2, where most of the variables are in the upper left corner of the plot, indicating a model with high sensitivity and specificity.
Table 6 depicts the one-way ANOVA, for the mesiodistal dimensions of the maxillary and mandibular canines since the canines showed a higher classification accuracy as compared to the other teeth dimensions. A statistically significant difference (p<0.001) was observed between the Santhal population and 4 tribal groups (Ao, Miching, Meitei and Singpho) from the North-eastern states of India.
Table 7 depicts the comparative mean values and sexual dimorphic index (SDI) for mandibular and maxillary canine measurements in different national and international tribal populations.

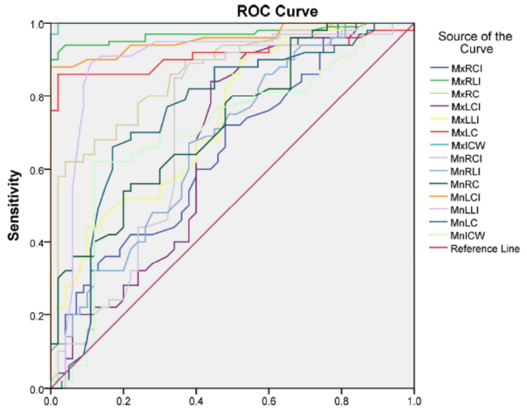

Figure 2. Receiver Operating Curve (ROC) with reference line depicting sensitivity and 1-specificity.

Discussion

Sexual dimorphism in dental metrics

The study of teeth is always considered to be important in the field of anthropology, paleodontology and archaeology. The measurements of linear dimensions of the teeth can be useful in personal identification owing to its simplicity, reliability and inexpensive nature. In the present study, 14 odontometric variables of the sub-adult Santhal population have been examined. All the variables have exhibited sexual dimorphism and this is in accordance with the previously conducted studies (20-23). Our findings are in contrast with the studies conducted on Nepalese, Iraqi and South American Ticuna populations where the mesiodistal width of maxillary central and lateral incisors, 1st and 2nd premolars and mandibular lateral incisors and canines are larger in females (24-26). A reduction in the degree of sexual dimorphism has been found in modern humans due to convergence of the roles of males and females. These roles are complex and involve more than just food procurement and its preparation. An economic adaptation for efficient allocation of resources has been observed in the chimpanzees and hominids thereby causing a decline in competition between the sexes. Thus, an increased inclination towards "monomorphism" has been observed in human evolution where both males and females together utilize a greater proportion of the resources available to the population (9). However, there is no evidence of reverse sexual dimorphism in this study.

The maxillary and mandibular canines have shown relatively greater classification accuracy as compared to the maxillary and mandibular incisors. This may be associated with the distinct nature of the canines from the other teeth according to their survival and evolution as well as their functional aspects. From the evolutionary perspective, the canines were initially used to depict aggressive behaviour in apes which was eventually transferred to fingers in humans during the primate evolution (27,28). Several biological, hormonal and genetic factors affect the diameter of the tooth crown. According to Bossert and Marks, the permanent mandibular and maxillary canines are least affected by any periodontal disorders (29). The shape of the crown, location in the mouth and well-developed roots make the mandibular canines more stable and likely to survive severe trauma. Hence, canines can be used as the "key teeth" in personal identification (30). The sexual dimorphism of canines is attributed to the influence of the Y-chromosome which affects the thickness of the dentine. In cases of permanent dentition, the calcification of the crown completes earlier in females than males. The prolonged duration of calcification in males result in a thicker enamel as compared to females (1). Garn et al. 1964 had correlated sexual dimorphism of canines to different variables like weight, stature, subcutaneous fat and suggested the influence of steroidal hormones in the early dental development of females (31). In this study, mandibular canines (MnRC=85%, MnLC=87%) have shown greater sexing accuracy as compared to the maxillary canines using univariate discriminant function analysis. This is in accordance with the studies where classification accuracy was 97% in the South Indian population (32), 73.5% in Croatian population (33) and 69.6%, in Karnataka population (34).

For this study, participants aged between 14-20 years were chosen because the eruption and growth of canines are completed before the adolescent growth changes. Also, the inter-canine width does not increase after 12 years of age (35). The inter canine width in females was less as compared to the males. The sexing accuracy of maxillary and mandibular inter-canine width is 83% and 77.5% respectively. This is in accordance with the studies by (36-39).

To further analyse the sexing accuracy, ROC Analysis was performed which depicted a classification accuracy ranging between 62-82.5%. The sexing accuracy provided were 80% and 82.5% for the right and left mandibular canines respectively. The results were consistent with the previous studies showing classification accuracy of 85.8% for both right and left mandibular canines in Portuguese participants aged between 16-30 years (40) and 93.3% and 96.7% in left and right mandibular canines respectively of participants aged between 19-30 years in Western Uttar Pradesh (41).

Population Variation of dental traits

The demographic settlement of the Santhals extends up to a considerable amount in north-eastern states of West Bengal, Assam, Meghalaya, Tripura and Mizoram (17,18). Geographically, closely related population groups have the tendency to resemble one another because of either gene flow or common ancestry. Other reasons for such similarities may be attributed to common elements in the dietary habits and subsistence patterns (23). Although the genetic pool of the north-eastern tribes is pure to a certain extent, the present study indicates that a significant difference exists between the odontometric parameters of these groups. The maxillary and mandibular canine width of Santhal females is smaller than those of the four north-eastern tribal groups i.e. Ao, Meitei, Miching and Singpho. These findings are consistent with the previous research conducted among the indigenous Japanese, Egyptian and 72 major human population groups. (42-44). The smaller dimensions may be due to the reduced impact of natural selection on their teeth size over the last years associated mainly with cultural differences in food preparation practices. The development of cooking and pottery among the Santhals have resulted in consumption of softer food and relaxation of selective pressure for larger teeth thereby resulting in random mutations and structural reduction in teeth size (45). Historically and by natural designs the main occupation of the Santhal population is agriculture and livestock rearing. The staple food is rice and its other preparations like watered rice (baskemandidaka) with boiled green leaves and vegetable curry and drinks like rice beer (handia) prepared from fermented rice (46). Such diet has reduced the need for a robust masticatory anatomy and favoured the adaptive selection of smaller jaw and teeth dimensions. The dental size may also be influenced through ontogeny by tooth wear and malnutrition (23). Due to a wide range variation in the dental traits, they are imperative in distinguishing and identifying different tribal communities. The results of the present study helped to obtain the regional or ethnic variation in the dental metrics of the Santhal population compared to other tribal groups. The results of multiple additional studies support the present findings, implying that different ethnic communities have distinct morphometric parameters of the teeth, thus, prompting the need to compile population-specific data (47-49).

Conclusions

The present study has shown that all the variables are significantly larger for males, thereby depicting the absence of reverse sexual dimorphism. The mandibular canines have higher sexual dimorphism among all the teeth. The mandibular left canine has the highest classification accuracy according to the univariate discriminant function analysis and ROC analysis. The mediodistal width of the maxillary and mandibular canines have shown significant difference with the tribal communities of the north-eastern regions. Also, the mean mesiodistal width and SDI of the canines vary among different tribal communities within India and abroad. Hence, more studies should be conducted on regional ethnic groups as there is a shortage of such odontometric data. The inferences made from such data can be crucial in forensic and clinical practices.

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Declaration of Interest

No potential conflict of interest was reported by the authors.

Author Contributions

AD contributed in conceptualization, data curation, formal analysis, investigation, methodology development and implementation of SPSS Software. VS contributed in supervision, validation, visualization, writing -original draft, review and editing of the paper.

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