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Comparision of mesiodistal and bucco-lingual dimensions of permanent teeth in North-Indians and North-East Indians: Racial dimorphism as an identification parameter

Harjeet Kaur Sekhon, Priyanka Sharma, Jyoti Sharma, Harmanpreet Singh, Simranjit Singh

ABSTRACT

Aims: Racial dimorphism refers to those differences in size, stature and appearance between two races among females and males which can be utilized to aid in identification based on dental records. Racial determination forms one of the important aspects of forensic odontology. The study evaluated the permanent teeth to assess and compare the mesiodistal and buccolingual dimensions of permanent teeth in the North Indian and North-East Indian populations. Methods: The study sample comprised of 100 subjects (50 males and 50 females). One group comprised individuals from North India, whereas, second group included individuals with ethnic origin in North-East India. Using the digital calliper, the mesiodistal and buccolingual diameters of each permanent tooth were determined. Measurements were tabulated and statistically analyzed. Using statistical program SPSS 19.0 for Windows descriptive statistics were calculated for each group independently, means were compared by sex of the mesiodistal and bucolingual dimensions of the pieces analyzed so intragrupal (Group of north Indian individuals and groups of northeast Indian individuals), significance in the mean differences were analyzed by unpaired t test for independent samples with p <0.01 and p <0.05. Results: Most of the permanent teeth examined had larger dimensions both mesiodistally and buccolingually in North-East Indians with the exception of maxillary central incisor, maxillary first premolar and maxillary second molar. In general, the group of North-East Indians showed higher racial dimorphism compared to the North Indian group. Conclusion: The study showed that there is a strong race-specific behavior in dimorphic dimensions of the teeth in both the populations.

Keywords: North East Indians, North Indians, Permanent teeth, Racial dimorphism

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INTRODUCTION

Racial gender determination using dental features involves either the estimation of dimensions of teeth in both the genders or comparision of occurrence of various non-metric dental traits like deflecting wrinkle of the mandibular first molars, Carabelli's trait of maxillary molars, distal accessory ridge of the maxillary and mandibular canines or shovelling of the maxillary central incisors [1]. This is based on the fact that, the tooth dimensions are not the same in males and females, although they have similar tooth morphology as the tooth size is determined by different factors that include environmental, genetic, cultural and racial variations [2].

Racial dimorphism refers to those differences in size, stature and appearance between two races among females and males that can be applied to dental identification. Racial determination forms one of the important aspects of forensic odontology [3].

Teeth are the mineralized tissues that are characterized by structures of extra-ordinary resistance to putrefaction and the effect of external agents (physical, trauma, heat, chemical or biological) that cause the destruction of soft parts of body structure. They are useful for odontological, forensic and genetic studies in living and dead populations, which also include evaluation of tooth dimensions for age estimation and gender determination [3-5]. Teeth being the central component of the masticatory apparatus of the skull are good source of material for civil and medicolegal identification [6]. The variety of teeth, number and morphology in each individual, is a fact, which increases its importance as an identifying element as well as an excellent material for various investigations [3].

The existence of dimorphism in permanent teeth is a well-known phenomenon. This behaviour morphologically determined that the shape and dimensions of tooth are fairly stable [2]. The magnitude and pattern of sexual dimorphism in the size of permanent teeth also differ from one population to another [3]. The size of teeth not only varies between sexes,races and populations, so does between generations. Ebeling et al. suggest that there is an upward trend in the mesiodistal size of the teeth. Even increase in size occurs between successive generations, in both the mesiodistal and in the vestibulolingual diameter [7].

A study conducted in southern Chinese population on mesiodistal dimension of primary as well as the permanent dentition reported sexual dimorphism that ranged from 0.06% - 1.97% and 0.36% - 5.27% in deciduous and the permanent dentition respectively [8].

Within this context, the aim of the present study was to assess and compare the mesiodistal (M-D) and buccolingual (B-L) dimensions of permanent teeth in the North Indian and North-East Indian populations.

MATERIALS AND METHODS

The study sample comprised of 100 study models prepared from students (50 males and 50 females) selected from D.J. College of Dental Sciences and Research, Modinagar belonging to two ethnic groups. One group comprised individuals from North India. The second group included individuals with ethnic origin in North-East India having distinct phenotypic characteristics such as high and shallow orbits with their upper and lower edges horizontal, high cheek bones, prominent chin, medial side corner of the eye having a crease (Mongoloid fold) and wide, straight and slightly shallow forehead. All the selected cases had complete set of fully erupted teeth without any history or clinical evidence of crown restoration, orthodontic treatment,no spacing or diastema, no crowding and without any trauma. The mean age of samples was 20-25 years.

After obtaining informed consent from each subject and approval from the institutional ethical committee, impressions were made with alginate and dental cast models were made in dental plaster. The models were numbered according to each group and gender of the individual.

The mesiodistal and buccolingual diameters of each permanent tooth were determined., using the digital vernier calliper accurate to 0.01 mm (Mitutoyo Digital Caliper). If it was difficult to place the vernier calliper, manual divider was used with fine tips to measure the mentioned dimensions. The measurements excluded the third molars, supernumerary teeth and various dental anomalies. All the measurements were done by a single examiner to eliminate interobserver error. Each reading was taken three times and the average of three values was obtained to minimize the intraobserver error. The data collected were subjected to statistical analysis. The SPSS software package version 19 was used for statistical analysis. The mean, range and standard deviation were calculated for the size of the tooth by using the unpaired t-test (Figure 1).

Figure 1: Measurements were done with the digital vernier calliper.

RESULTS

Most of the teeth examined had larger size in men in both groups. Most of the permanent teeth examined had larger dimensions both mesiodistally and buccolingually in North-East Indians with the exception of maxillary central incisor, maxillary first premolar and maxillary second molar.

A breakdown of the average size of the mesiodistal and bucolinguals diameters of all analyzed pieces of North Indians and North East Indians groups in Table 1-4. The probable values of mesiodistal and buccolingual dimensions for North Indian and North-East Indian males and females is discussed in Table 5-6.

Table 1: Mesiodistal and buccolingual dimensions of maxillary permanent teeth for North Indian males

S. No.	Tooth	Mean±S.D.	
		Mesiodistal Diameter	Buccolingual Diameter
1.	Maxillary central incisor	9.17 ±0.05	7.05±0.07
2.	Maxillary Lateral incisor	7.42±0.08	6.05 ±0.07
3.	Maxillary canine	8.26±0.08	8.06±0.06
4.	Maxillary first premolar	7.44 ±0.08	9.02±0.07
5.	Maxillary second premolar	7.42±0.08	9.06±0.07
6.	Maxillary first molar	10.59±0.07	11.18±0.10
7.	Maxillary second molar	9.66±0.07	11.11±0.06

Table 2: Mesiodistal and buccolingual dimensions of maxillary permanent teeth for North-East Indian females

S. No.	Tooth	Mean±S.D.	
		Mesiodistal Diameter	Buccolingual Diameter
1.	Maxillary central incisor	8.69 ±0.09	7.11±0.06
2.	Maxillary Lateral incisor	7.09±0.28	6.10 ±0.10
3.	Maxillary canine	7.93±0.17	8.10±0.06
4.	Maxillary first premolar	7.04 ±0.08	9.12±0.09
5.	Maxillary second premolar	7.05±0.08	9.11±0.08
6.	Maxillary first molar	10.19±0.09	11.26±0.07
7.	Maxillary second molar	9.25±0.08	11.26±0.06

Table 3: Mesiodistal and buccolingual dimensions of maxillary permanent teethfor North-East Indian males

S. No.	Tooth	Mean±S.D.	
		Mesiodistal Diameter	Buccolingual Diameter
1.	Maxillary central incisor	9.29 ±0.11	7.08±0.06
2.	Maxillary Lateral incisor	7.84±0.26	6.17 ±0.05
3.	Maxillary canine	8.63±0.13	8.23±0.08
4.	Maxillary first premolar	7.85 ±0.08	9.15±0.07
5.	Maxillary second premolar	7.88±0.07	9.26±0.07
6.	Maxillary first molar	10.98±0.07	11.31±0.07
7.	Maxillary second molar	10.14±0.07	11.32±0.06

Table 4: Mesiodistal and buccolingual dimensions of maxillary permanent teeth for Nworth Indian females

S. No.	Tooth	Mean±S.D.	
		Mesiodistal Diameter	Buccolingual Diameter
1.	Maxillary central incisor	8.45 ±0.04	6.95±0.09
2.	Maxillary Lateral incisor	6.72±0.11	5.94 ±0.07
3.	Maxillary canine	7.75±0.13	7.95±0.07
4.	Maxillary first premolar	6.93 ±0.08	8.92±0.19
5.	Maxillary second premolar	6.87±0.07	8.98±0.09
6.	Maxillary first molar	10.01±0.07	11.10±0.06
7.	Maxillary second molar	8.97±0.07	11.10±0.06

DISCUSSION

The presence of sexual dimorphism in the sizes of permanent and temporary teeth is a fact well documented in humans and primates. The tooth index has been used as an inexpensive and simple to use tool for gender identification such as mandibular canine-index [9-12], but there are very few studies conducted to support the evidence of racial dimorphism.

Specific populations have variations in their odontometric features which requires to be considered. The dental measurements can be a reliable tool to identify such variations [13].

Doris et al., has reported that early dentition, particularly in young age is less affected by regressive

Table 5: Probable values of mesiodistal and buccolingual dimensions for North Indian and North-East Indian males

S. No.	Tooth	p-value	p-value
1.	Maxillary central incisor	Mesiodistal diameter 0.0000 Buccolingual diameter 0.1863	P<0.05 (significant) P>0.05(not significant)
2.	Maxillary lateral incisor	Mesiodistal diameter 0 .0000 Buccolingual diameter 0.0052	P<0.05 (significant) P<0.05 (significant)
3.	Maxillary canine	Mesiodistal diameter 0.0000 Buccolingual diameter 0.0000	P<0.05 (significant) P<0.05 (significant)
4.	Maxillary first premolar	Mesiodistal diameter 0.0000 Buccolingual diameter 0.2620	P<0.05 (significant) P>0.05(not significant)
5.	Maxillary second premolar	Mesiodistal diameter 0.0000 Buccolingual diameter 0.0000	P<0.05 (significant) P<0.05 (significant)
6.	Maxillary first molar	Mesiodistal diameter 0.0000 Buccolingual diameter 0.0423	P<0.05 (significant) P<0.05 (significant)
7.	Maxillary second molar	Mesiodistal diameter 0.0000 Buccolingual diameter 0.0111	P<0.05 (significant) P<0.05 (significant)

Table 6: Probable values of mesiodistal and buccolingual dimensions of maxillary permanent teeth for North Indian and North-East Indian females

S. No.	Tooth	p-value	p-value
1.	Maxillary central incisor	Mesiodistal diameter 0.0000 Buccolingual diameter 0.0000	P<0.05 (significant) P<0.05 (significant)
2.	Maxillary lateral incisor	Mesiodistal diameter 0 .0000 Buccolingual diameter 0.0000	P<0.05 (significant) P<0.05 (significant)
3.	Maxillary canine	Mesiodistal diameter 0.0000 Buccolingual diameter 0.0000	P<0.05 (significant) P<0.05 (significant)
4.	Maxillary first premolar	Mesiodistal diameter 0.0000 Buccolingual diameter 0.0195	P<0.05 (significant) P<0.05 (significant)
5.	Maxillary second premolar	Mesiodistal diameter 0.0000 Buccolingual diameter 0.0016	P<0.05 (significant) P<0.05 (significant)
6.	Maxillary first molar	Mesiodistal diameter 0.0000 Buccolingual diameter 0.0027	P<0.05 (significant) P<0.05 (significant)
7.	Maxillary second molar	Mesiodistal diameter 0.0000 Buccolingual diameter 0.0543	P<0.05 (significant) P>0.05 (not significant)

alterations as attrition and erosion. As a consequence, the mesiodistal dimension of teeth would be less affected [14]. Henceforth, 20-25 years' age group was selected.

According to Garn et al., teeth have behaved in many ways through the course of evolution [15]. In this study, univariate analysis of M-D dimensions and B-L dimensions of male dentition were greater than those of females which is in accordance with previous studies. Richardson et al., found that teeth of males tend to be larger than those of females for each type of tooth in both the arches [16].

Most studies indicate that the mandibular canine is the tooth that presents the greatest dimorphism, followed by first and second maxillary molars [11]. Another study had found significant difference mainly in buccolingual diameters, but they included all dental groups, the largest difference was found in teeth 44 and 47 (FDI) [12].

Another study has reported a strong population specific behavior in dimorphic dimensions of the teeth [2]. In this study, the mesiodistal and the buccolingual dimensions in North-Indians were less as compared to the North-Eastern Indians. Maxillary central incisor and maxillary first premolar in case of males and maxillary second molar in females were not reliable for determining the dimorphism in tooth size according to the present study.

A study conducted by AsteteJofré et al., [3] among the Spanish and Chilean individuals had found a greater dimorphism in teeth in Spanish individuals, both in mesiodistal and buccolingual dimensions.

These results are consistent with another study done in Chilean population [3].

Narang RS et al., in his study conducted in North Indian population has reported that mesiodistal dimensions in first molars and mandibular canine can help in sex determination [17].

In a study conducted in Udaipur population, buccolingual dimensions were found to be effective tool for gender determination [18]. Maxillary canine has shown significant results for sexual dimorphism [18–19].

A recent study evaluated the ability of standard mandibular canine index (MCI) for gender determination for forensic investigations. It has estimated it to be 80% in female subjects, while 73.33% for male individuals [20]. A small jaw size among North-East Indians may

be responsible for the variation in mesiodistal and buccolingual dimensions among North Indians and North–East Indians [21].

Further studies need to be carried out with larger samples to validate the results of this study.

CONCLUSION

The size of teeth is of great importance in establishing sexual dimorphism. The shape and dimensions of teeth does not change. Thus, they can be seen as a determining factor in providing racial dimorphism in skeletal remains, which is required for forensic identification purposes. The variety of teeth, number and morphology in each individual and belonging to a particular ethnic origin is a fact, which increases its importance as an identifying element. This difference in size and shape of teeth with the information obtained from a clinical registration document can help to distinguish the sex, age, relative size and ethnicity of the individual, resulting in a more accurate way of identifying the person sought.

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Author Contributions

Harjeet Kaur Sekhon – Substantial contributions to conception and design, Acquisition of data, Analysis and interpretation of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published

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Guarantor of Submission
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Written informed consent was obtained from the patient for publication of this study.

Conflict of Interest
Authors declare no conflict of interest.