

Ethnic variation of selected dental traits in Coorg

Chancy Uthaman,
Peter Simon Sequeira,
Jithesh Jain

Department of Public Health
Dentistry, Coorg Institute of
Dental Sciences, Kushalappa
Campus, Maggula, Virajpet,
Karnataka, India

Address for correspondence:

Dr. Chancy Uthaman,
Coorg Institute of Dental
Sciences, Kanjithanda
Kushalappa Campus,
Maggula, Virajpet - 571 218,
Karnataka, India.
E-mail: chancyu@gmail.com

Introduction

Worldwide research of anatomical pattern of tooth, palate, lip and tooth DNA strongly suggests that the oral cavity, being unique its characteristics, has a promising role in forensic disciplines. Several studies have been undertaken regarding ethnic and gender difference of tooth morphology like, metric dental trait, groove pattern, Cusp of Carabelli, shoveling and protostylid. The distribution and degree of expression of cusp of Carabelli and shoveling


Abstract

Purpose: In a country like India, in addition to the great innate diversity, there are distinct migrant populations with unique dental traits. **Aim:** To assess the distribution and degree of expression of cusp of Carabelli of maxillary first permanent molars and shoveling trait of maxillary central incisors, between three ethnic groups of Coorg, namely Kodavas, Tibetans, and Malayalees. **Materials and Methods:** A cross-sectional, indirect, anthropometric, study was carried out among 15- to 30-year-old subjects belonging to three different ethnic origins. A random sample consisting of 91 subjects were recruited for the study. The shovel trait of incisors and the Carabelli trait of molars were recorded according to the classification given by Hrdlic̃ka and Sousa *et al.*, respectively. **Statistical Analysis:** The Kruskal-Wallis test was employed to determine the difference in three populations for shoveling and Carabelli traits. Mann-Whitney Test was used for pair-wise comparisons of three populations. **Result:** Of the total 91 subjects, 31 were Kodavas, 30 Malayalees and 30 Tibetans. There was a statistically significant difference in shoveling trait among the three ethnic groups. For Carabelli traits, there was no statistically significant difference among three ethnic groups. **Conclusion:** The present study findings showed that Tibetans have a higher degree of shoveling trait than the selected South Indian ethnic groups.

Key words: Anthropometry, cusp of Carabelli, dental traits, shoveling

traits differ not only among individuals but also among ethnic groups.^[1]

Coorg/Kodagu is a district in Karnataka, South India, whose main population comprises of native Kodavas, and immigrant populations of Tibetans from Tibet and Malayalees from Kerala. These ethnic groups differ not only with respect to language but also in their dietary pattern, cultural difference and genetic variation. The literature survey suggests that no published study has been reported on the distribution of cusp of Carabelli and shoveling trait in these populations. Anthropometry of the oral hard tissues can help in the field of forensic odontology when common forensic data are unavailable. Gathering and documenting the prevalence of these dental traits and ethnic variation, if any, between the native population and the immigrants, play a major role not only in forensic dentistry but also in other fields like anatomy, cosmetology and anthropology. Thus, the aim of the study was to assess the distribution and degree of expression of the cusp of Carabelli of maxillary

Access this article online	
Website: www.jfds.org	Quick Response Code 
DOI: 10.4103/0975-1475.172422	

first permanent molars and the shoveling trait of maxillary central incisors, between the three ethnic groups of Coorg.

Materials and Methods

A cross-sectional indirect anthropometric study was carried out between February and May 2013 among 15- to 30-year-old subjects belonging to three different ethnic origins. Ethnicity was determined based on accurate history and subjects with likelihood of cross-ethnicity were excluded. The protocol of this study was reviewed and approved by the Ethics Committee of Coorg Institute of Dental Sciences.

Random samples consisted of 91 dental casts (30 Malayalees, 31 Kodavas and 30 Tibetans) that were collected from patients or their bystanders who attended the outpatient department of Coorg Institute of Dental Sciences and its nodal centers located in different parts of Coorg. The sample size was determined based on the average number of subjects who reported in the month of January 2013, to the above-mentioned centers, with 95% confidence interval and 0.05% marginal error. Prior to the study, the details of the study were explained to the study subjects and written informed consent was obtained from each participant. The inclusion criteria for the study includes subjects having complete set of fully erupted, well-aligned, non-carious, non-atrited and intact teeth with no history or clinical evidence of crown restoration, orthodontic treatment and trauma. Individuals undergoing orthodontic treatment or any other surgical procedure during the study period, those with presence of supernumerary teeth in the maxillary arch or any other condition which would hinder impression making procedure and/or the accurate measurement of teeth on the casts were excluded from the study. After obtaining the models, they were assigned codes according

to the ethnic group and sex, which were blinded to the examiner. The shovel trait of incisor and the carabelli trait of molar recorded according to the classification given by Hrdlic'ka^[2] and Sousa *et al.*,^[3] respectively. Before the start of the survey, a senior faculty member carried out training of the investigator regarding the diagnostic criteria for recording shoveling and the Carabelli trait. Calibration was done by examining 20 study casts and each cast was examined twice and the results were compared, to know the diagnostic variability and agreement.

Statistical analysis was done using SPSS 17 software. Differences in the three populations for shoveling and Carabelli trait were analyzed using the non-parametric Kruskal-Wallis test. Pair-wise comparison for three populations was done using non-parametric Mann-Whitney test.

Results

The study comprised the evaluation of 91 dental casts of study subjects, 42 males, and 49 females, with a mean age of 21 years. The intra-examiner variability was assessed using Kappa variability test and the mean Kappa co-efficient value was found to be of 0.83 which showed good agreement.

The frequency distributions of shoveling and Carabelli trait among the three ethnic groups are given in Tables 1 and 2, respectively. The Kruskal-Wallis rank test used to assess the difference in distribution of the tooth characteristic in three populations showed a statistically significant difference in shoveling trait among the three ethnic groups [Table 1]. Further, pair-wise comparison using Mann-Whitney test showed a statistically significant difference for shoveling trait of right and left central incisors among Malayalees and Tibetans and also between Kodavas and Tibetans [Table 3].

Table 1: Frequency and the mean difference in distribution of different shoveling patterns among three ethnic groups

Ethnic group	Tooth	Shovel (%)	Semishovel (%)	Trace shovel (%)	No shovel (%)	Chi-square (%)	df	P
Malayalees	Right central incisor	2 (6.7)	7 (23.3)	14 (46.7)	7 (23.3)	15.069	2	0.001*
Kodavas		4 (12.9)	12 (38.7)	8 (25.8)	7 (22.6)			
Tibetans		12 (40.0)	11 (36.7)	5 (16.7)	2 (6.7)			
Malayalees	Left centrals incisor	2 (6.7)	7 (23.3)	14 (46.7)	7 (23.3)	15.069	2	0.001*
Kodavas		4 (12.9)	12 (38.7)	8 (25.8)	7 (22.6)			
Tibetans		12 (40)	11 (36.7)	5 (16.7)	2 (6.7)			

df: Degree of freedom, P: Probability, *Statistically significant (P<0.05)

Table 2: Frequency and the mean difference in distribution of different Carabelli traits among three ethnic groups

Ethnic group	Tooth	Absent (%)	Depression (%)	Mild (%)	Prominent (%)	Chi-square	df	P
Malayalees	Right first molar	14 (46.7)	5 (16.7)	6 (20.0)	5 (16.7)	4.786	2	0.091
Kodavas		4 (12.9)	12 (38.7)	8 (25.8)	7 (22.6)			
Tibetans		10 (33.3)	5 (16.7)	8 (26.7)	7 (23.3)			
Malayalees	Left first molar	17 (56.7)	3 (10)	3 (10)	7 (23.3)	4.877	2	0.087
Kodavas		4 (12.9)	12.9 (38.7)	8 (25.8)	7 (22.6)			
Tibetans		14 (46.7)	1 (3.3)	8 (26.7)	7 (23.3)			

df: Degree of freedom, P: Probability

The Kruskal-Wallis rank test showed that there was no statistically significant difference among the three ethnic groups with respect to Carabelli trait [Table 2].

The study result showed that there was no statistically significant difference in sexual dimorphism for both shoveling and Carabelli trait within all the three ethnic groups [Table 4].

Discussion

The science of anthropometry has been used as tools in diverse fields for distinguishing characteristics within as well as between the races. In a country like India, in addition to the great innate diversity, there are distinct migrant populations settled in various parts.^[4] Each population has a distinct identity, be it in the form of physical, cultural or linguistic traits. One of the physical features which can be used to distinguish the various populations is the dentition, which shares unique characteristics in each racial group.^[1]

Enamel is the hardest tissue of the human body and has a high capacity to preserve itself even in extreme conditions of pH, moisture, salinity and high temperature. Due to its genetically unique and unrepeatable dental morphology and its resistance to change and remodel itself, except attrition and secondary dentin accumulation, tooth can provide biological and cultural information of an individual or a population.^[1]

There have been numerous scoring methods developed over the years, to assess shoveling and Carabelli trait. Scoring methods for shoveling include Hrdlicka's (1920) four-grade classification, Dahlberg's (1956) plate classification, Scott's (1970) classification and Arizona State University Dental Anthropology System's (1991) reference plate.^[1] Different scoring methods, like Shapiro's (1949) nine-grade classification, Dahlberg's plaque P12A categorical classification system, Goose and Lee's (1971) five-grade classification, Alvesalo *et al.*, (1975) five-grade classification, Arizona State University Dental Anthropology

System (1991), and Sousa *et al.*'s four-grade classification were developed to assess Carabelli trait.^[5] The fine discrimination in phenotypic dental trait expression may not be as important in population-based anthropological studies to decide whether the trait is present or not. So in the present study, we used the Hrdlicka and Sousa *et al.*'s classification system for assessing the shoveling and Carabelli trait, respectively.

Different studies on dental anthropometry have utilized shoveling and Carabelli trait as an individual parameter.^[2,3,5,6] The present study shows a statistically significant difference in shoveling trait among the three ethnic groups. Majority of the Tibetans showed shovel or semi-shovel form of shoveling trait, while trace shovel and no shovel groups were observed among Malayalees. The expressions of shoveling among Kodavas were seen mainly with respect to semi-shovel trait followed by trace shovel and no shovel traits. Further pair-wise analysis revealed a significant difference in shoveling among Tibetans as compared with the other two South Indian ethnic groups. This was in accordance with the Mongoloid dental complex developed by Hanihara, who found that five dental morphological traits, including shovel-shaped upper central incisors, had a higher frequency among Mongoloid groups.^[1] Higher prevalence of shoveling trait has been reported in Chinese, Eskimos, Pima Indians, North American Indians, and Aleuts. The reverse has been found for Europeans and Negroids.^[7] Thus, there are differences between Negroid, Caucasian-American and Mongoloid origin population groups with respect to the expression of shoveling trait.^[1]

This different degree of expression of shoveling among the ethnic groups can be attributed to the difference in genetic control of the trait. However, there is controversy in the literature with regard to the degree of genetic control in the prevalence and expression of these traits. Various theories have been put forward to explain these differences among different races. Field theory suggests that the trait is induced and is therefore subjected to environmental stress. Clonal model theory suggests that the trait is intrinsic and therefore, less responsive to environmental factors.^[6]

In the present study, there was no statistically significant difference among the three ethnic groups with respect to Carabelli trait. This could be due to the similar genetic composition for the phenotypic expression of Carabelli trait among the three ethnic groups. Also, literature supports the Carabelli trait as a Caucasoid trait.^[1]

This study showed that there was no sexual dimorphism for both shoveling and Carabelli trait within all the three ethnic groups. A similar result for Carabelli trait was reported by Salako and Bello^[6] among Saudi Arabian children and King *et al.*,^[7] among Southern Chinese in Hong Kong. However, this finding is in contrast to studies conducted among

Table 3: Pair-wise comparison of three populations for shoveling

Ethnic group	Test value	Right central	Left central
Malayalees and Kodavas	P value	0.218	0.218
Malayalees and Tibetans	P value	0.000*	0.000*
Kodavas and Tibetans	P value	0.008*	0.008*

P: Probability, *Statistically significant (P<0.05)

Table 4: The mean difference in distribution of different Carabelli traits among genders in three ethnic groups

Ethnic group	Test value	Right central	Left central	Right molar	Left molar
Malayalees	P value	0.080	0.080	0.731	0.549
Kodavas	P value	0.173	0.173	0.709	0.677
Tibetans	P value	0.120	0.120	0.583	0.340

Chinese population that reside in Southern Taiwan, by Hsu *et al.*,^[8] and in University of Franca, Franca, Brazil by Ferreira *et al.*,^[3] where Carabelli trait were more observed in males.

Conclusion

The findings of the study suggested that Tibetans have a higher degree of shoveling trait than the selected South Indian ethnic groups. The distribution of Carabelli trait among the three ethnic groups shows similar anthropometric characteristics. Hence, the use of Carabelli trait for determining ethnicity in this population is questionable. However, these interpretations are based on limited sample size. It may be necessary to assess teeth in more than one sample of a population before making conclusive statements concerning the selected dental traits findings and ethnic origin of populations.

References

1. Moreno-Gómez F. Sexual dimorphism in human teeth from dental morphology and dimensions: A dental anthropology viewpoint. Available from: <http://dx.doi.org/10.5772/55881>. [Last accessed on 2013 Jan 22].

2. Tsai PL, Hsu JW, Lin LM, Liu KM. Logistic analysis of the effects of shovel trait on Carabelli's trait in a Mongoloid population. *Am J Phys Anthropol* 1996;100:523-30.
3. Ferreira MA, Hespanhol LC, Capote TS, Gonçalves MA, Campos JA. Presence and morphology of the molar tubercle according to dentition, hemi-arch and sex. *Int J Morphol* 2010;28:121-5.
4. Kallianpur S, Desai A, Kasetty S, Sudheendra U, Joshi P. An anthropometric analysis of facial height, arch length, and palatal rugae in the Indian and Nepalese population. *J Forensic Dent Sci* 2011;3:33-7.
5. Hasegawa Y, Rogers J, Scriven G, Townsend G. Carabelli trait in Australian twins: Reliability and validity of different scoring systems. *Dent Anthropol* 2010;23:7-14.
6. Salako NO, Bello LL. Prevalence of the Carabelli trait in Saudi Arabian children. *Odontostomatol Trop* 1998;21:11-4.
7. King NM, Tsai JS, Wong HM. Morphological and numerical characteristics of the southern Chinese dentitions. Part II: Traits in the permanent dentition. *Open Anthropol J* 2010;3:71-84.
8. Hsu JW, Tsai PL, Hsiao TH, Chang HP, Lin LM, Liu KM, *et al.* Ethnic dental analysis of shovel and Carabelli's traits in a Chinese population. *Aust Dent J* 1999;44:40-5.

How to cite this article: Uthaman C, Sequeira PS, Jain J. Ethnic variation of selected dental traits in Coorg. *J Forensic Dent Sci* 2015;7:180-3.

Source of Support: Nil, **Conflict of Interest:** None declared