Studies on Prevalence of Accessory Tooth Cusps in Some Ethnic Populations of Northern India and their Forensic Relevance

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ABSTRACT

A dental cusp is a prominence on the crown of the tooth and is present normally on posterior teeth. This study was carried out to determine the frequency of different accessory cusps, their sites and presence of unilateral/bilateral cusps among males and females of three distinct ethnic populations of North India – Brahmin, Rajput and Muslim with reverence to their forensic utility. The frequency analysis revealed that the male had higher presence of accessory cusps than the females, while the communities showed minor variation in the accessory cusps. The Brahmins had the most bilateral cusps (15.3%) followed by Rajputs (14.4%) and Muslims (8.6%) the least. Further, the Carabelli’s cusps were found with highest frequency than the talon cusps which are the rarest type of cusps in these communities. However, the findings suggest that the accessory dental cusps may provide the clue the identity of the individuals in the absence of any other physiognomic characteristics.

Keywords: Accessory Tooth Cusps, Prevalence, North India, Dental anomalies

INTRODUCTION

The principal basis of the dental identification lies in the fact that no two dentitions are alike and the teeth are unique to an individual. The dental characteristics such as the shoveling or scooping of the upper incisor (most common in Asiatic Mongoloids and Amerindians), taurodontism, chisel shaped incisors, Carabelli’s cusp, hypocone, and protostyloid, peg shaping of the teeth can be used to determine the ethnicity of the individual [1-3].

Developmental variations of teeth like anomalies of number, size and shape are frequently observed during a routine dental examination [4]. One such developmental variation is presence of accessory cusps on the teeth. Accessory cusps are quite common, but their incidence and prevalence do differ with respect to the types of tooth. The most common accessory cusps are cusp of Carabelli found on molars, Talons cusps of incisors and Leong’s tubercle of premolar. Their prevalence depends on their type and they differ in structure as well as size [5, 6].

Accessory tooth cusps are quite helpful in anthropological and phylogenetic analysis [7]. They help in understanding the genetic variance and relationships among different races and ethnic populations. The study of accessory tooth helps in population studies and their characterization sheds light on the interbreeding trends or history among the populations [8]. Genetic as well as external factors can play significant role in development of dentitions although studies have shown that genes play a more dominant role in their presence [9].

Forensic significance of Accessory tooth cusps

Forensic odontology is primarily concerned with the use of teeth and oral structures for identification in a legal context. Various forensic odontology techniques help in the identification of the human remains in incidents such as terrorists’ attacks, airplane, train and road accidents, fires, mass murders, and natural disasters such as tsunamis, earth quakes and floods, etc [10].

Typically, dental identification has been done by comparative analysis of ante mortem and postmortem...
data of either tooth fillings or prosthetics, and less frequently through natural dental anatomical features \(^9,^{11}\).

Depending upon the frequency of a particular type of feature within a population, it can be treated as unique and hence important, for the purpose of identification. So far, dental anatomy has been used in comparative analyses for determining the origin and the sex of individuals \(^{12, 13}\).

By determining the presence and frequency of a particular type of accessory tooth in a population, it can be as one of the identification factors of comparative analysis in forensics \(^9\).

In view of the above, this study is an endeavor to determine the frequency of different accessory cusps, their sites and presence of unilateral/bilateral cusps among males and females of three distinct ethnic populations of North India – Brahmin, Rajput and Muslim with reverence to their forensic utility.

**MATERIALS AND METHOD**

The present study is an exploratory study conducted at Amity Institute of Forensic Science, Amity University, Noida, Uttar Pradesh, India where the sample population was surveyed for the presence of different accessory cusps (talon, carabelli and protostylid) in some of the ethnic populations of North India – Brahmin, Rajput and Muslim. The study was carried out on 150 subjects (50 individuals from each population, 150 subjects in total) at the age group 15-25 years. The age range selected is expected to ensure that eruption of the full permanent dentition through the second molar and minimal effects from tooth wear and tear. The fully erupted permanent teeth, healthy state of gingiva and caries free teeth were selected from the three ethnic populations.

The informed consent was obtained from the subjects and the data was collected by clinical observations, using the simple mouth mirror and probe supplemented by examination of the dental casts, followed by the oral radiographs, wherever required.

Apart from this, cross tabulation studies were also conducted to found the incidence of accessory cusp types viz. talon cusp (figure 1), Carabelli’s cusp (figure 2) and protostylid (figure 3), sites of these cusps (left/right) and types of cusps (unilateral/bilateral) among males and females of the three communities under study.

in relation to potential forensic utility. The carabelli trait was categorized as present and absent using Goose and Lee classification (1971) while Hattab’s (1996) criteria was used for assessment of Talon’s cusp. The protostylid was studied using Grine’s (1986) criteria \(^{14-16}\).

![Figure 1: Talon Cusp](image1.png)  ![Figure 2: Carabelli’s Cusp](image2.png)  ![Figure 3: Protostylid](image3.png)

**Analysis and Interpretation**

In order to evaluate the presence of different types of accessory cusps across different sections of society in North Indian population, frequency analysis was performed on the data collected.

**Cross-Tabulation Results**

Presence of cusps in the Respondents (Community wise)

![Figure 4: Community wise distribution of cusps among the respondents](image4.png)

Figure 4 shows that all the communities have almost the same frequency of prevalence with different types of cusps. Since the frequency of prevalence is similar in the three populations, their potential to discriminate between the populations for forensic studies is not quite useful. Although community based studies of accessory cusps have not been done in North India but it’s done to study prevalence of anomalies on basis of social and/or economic background and among school children belonging to the Punjabi community of Chandigarh, India. \(^{12}\).
Presence of cusps in Respondents (Type of Cusp)

As seen in Figure 5, the presence of different type of cusps, Talon, Carabelli and Protostylid cusps, varied quite significantly among the male and female sample population, where Carabelli cusps showed the highest frequency and the incidence of protostylid cusps was lowest. The study conducted for presence of talon cusps in North Indian population found almost similar results, with 0.65% of prevalence as compared to 0.02% in the present study [13].

The talon cusp is also known by various other names dens evaginatus, supernumerary cusp/ horn, hyperplastic cingulum, evaginated odontome, cusped cingulum, accessory cusp and supernumerary lingual tubercle [13,17].

Carabelli cusps had the maximum frequency of prevalence (67.3%) and also have been studied in school children of South India, when researchers found that 89.8% of primary second molars and 63.7% permanent first molars had Carabelli cusps [18].

Last of all, protostylid cusps were found in the population at a frequency of 0.06%. Since the presence and distribution of talon and protostylid cusps among the different communities of North India is rare, they can be adopted as a forensic characteristic during identification process of individuals.

Presence of cusps in the Respondents (Site of cusp)

As seen in Figure 6, cusps were commonly bilateral. In case of unilateral cusps, more frequency was observed in the right side of the jaw for respondents of all communities as well in terms of male and female

Figure 5: Community and Gender Wise Distribution of different types of Cusps among respondents

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Figure 6: Caste and Gender wise distribution of cusps among respondents
With respect to respondents’ gender, 52.8% males and 47.1% females had accessory cusps. Khraisat et al. also concluded the prevalence, association, and sexual dimorphism of Carabelli’s molar and shovel incisor traits amongst Jordanian population[19]. In our study also males have a slightly higher prevalence of cusps than women.

The studies conducted for understanding the prevalence of dental anomalies in Indian population, where the incidence of talon cusps was shown to be higher of bilateral cusps (7.8%) than unilateral (2.9%) [20].

Considering the rarity of bilateral and unilateral cusps, this property can be used as a forensic characteristic in comparative analysis during identification.

**CONCLUSION**

The study on the presence of accessory tooth cusps among different ethnic communities of the North Indian population was undertaken to understand the trends and determine their forensic relevance. Analysis of the collected data revealed that different groups showed almost similar trends for the three cusps talon, protostylid and carabelli cusp. Therefore to determine the ethnicity based on the accessory cusps is not possible.

Among the types of cusps, carabelli cusp had the strongest presence, while talon and protostylid cusps were rare, signifying that presence of talon cusp and protostylid can be used as a forensic characteristic in personal identification. The previous studies on talon cusps in India have also shown that it is rare in the population, as evaluated for different sub-sections of the Indian population, thereby providing an opportunity for forensic identification. [12, 13, 21]

**Conflict of Interest:** None declared

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**Statement of Informed Consent:** The informed consent was obtained from the subjects before doing their oral examination.

**Statement of Human and Animal Rights:** No human rights were violated during the course of study and the procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000 (5).

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