Prevalence of the cusp of Carabelli in East India population

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ABSTRACT

Background: Dental morphological traits are helpful for understanding differences within and between species as well as for supplying data for genetic and phylogenetic research. Carabelli cusps can be used to compare and characterize populations because they are manifested in varying degrees and at varied frequency among humans. A tubercle or groove that is frequently observed on the palatal surface of the mesiopalatal cusp of maxillary permanent and maxillary second deciduous molars is known as the Carabelli cusp. Many studies have been conducted worldwide and different parts of India, except East India.

Aims: This study set out to ascertain the Carabelli structure's prevalence and level of expression in the East Indian population.

Subjects and Methods: The data were collected by examination of 262 patients along with their dental cast aged 7 – 40 years (118 males, 144 females) undergoing orthodontic treatment.

Results: In the first maxillary molars, the Carabelli structure was present in 50.4% of cases and expressed on both sides in 97% of cases. It was determined that the Carabelli structure expressed itself as a groove 26% of the time and as a cusp 24.4% of the time. Out of 12 mixed dentition cases those were showing carabelli structure 10 shows very similar structure both deciduous 2nd molar and permanent first molar bilaterally.

Conclusion: Half of the East Indian population has a degree of expression of the Carabelli structure. Strong bilateralism and similar expression both deciduous second molar and permanent first molar suggest genetic predisposition of this structure.

Keywords: *Cusp, Carabelli cusp, Morphology*

INTRODUCTION

In anthropological research, the examination of dental morphological traits is crucial since it can reveal details about the evolutionary relationships between species and within-population variations.[1,2] A distinctive morphological abnormality found on the mesiopalatal surface of upper first permanent molars and upper second deciduous molars is known as Carabelli's cusp. Rarely do the top first primary molars or the second or third permanent molars have it. It has most frequently been found symmetrically on the upper jaw's two sides.[3]

George Von Carabelli, an Austrian dentist, was the first to describe the cusp of Carabelli in 1842.[4] Numerous investigations of the cusp's morphology, anthropological significance, and mode of heredity have been carried out since then. Since the frequency and intensity of expression vary per species, it can be used to identify and contrast various populations. (Palomino *et al.*, 1977).[1] Carabelli's characteristic can be helpful in determining phylogenic links between closely related populations, according to Bermúdez De Castro (1989).[5] Carabelli cusp, which can be used to assess the level of sexual contact between various groups.[6] While other comparable forms include a minor ridge, pit, or furrow, the cusp may be as large as the main cusps.

Australopithecus, a Neanderthal man, was found to have a Carabelli cusp when it was merely a groove. As a result, it has been proposed that Carabelli's cusp has evolved from a basic groove to a fully formed cusp. (Dahlberg, 1963).[7] Many studies have been conducted worldwide and different parts of India except Eastern part. This study sought to ascertain the Carabelli structure's degree of expression and distribution throughout the Indian subcontinent, with a focus on the eastern population.

SUBJECTS AND METHODS

A cross-sectional study was carried out from archival dental cast records of patient in the age group between 7-40 years attending to department of orthodontics SCB Dental College& Hospital, Cuttack during the time period of June 2021–2023. Most of the patients were coming from different region of Odisha and West Bengal. This study included 262 subjects in total, split into two groups: male (n=118) patients, female (n=144). Direct light and magnifying glass were used to study the cast. Dahlberg classification system (Table-1) was used for the study. The prevalence rate of the study group was calculated by using statistical tests SPSS-29 software.

RESULTS

With a frequency of 50.4%, 132 out of the 262 dental casts had Carabelli cusps on the upper first permanent molars. Prevalence of male and female population was 43.2% and 56.6% respectively (Table 2). Carabelli cusp expressed 97 % bilaterally (Table 3). According to the Dahlberg scale degree-6 was the most common expressed Carabelli's structure which was included 10.6% of population (Table 1) .23% population expressed cuspal or tubercular form and 27.4% expressed as groove, fissure or pit form (Table 1). Ten of the twelve cases with mixed dentition displayed bilaterally extremely comparable carabelli structures in both the permanent first molar and the deciduous second molar, while the two remaining cases only

Table 1: Degree of expression of Cusp of carabelli in this study according to Dahlberg 1963

Degree	Expression	No of subject	Prevalence (%)	
0	Smooth mesiobuccal crown surface	130	49.6	49.6
1	Small vertical ridge and groove	24	9.2	
2	Small pit with minor grooves diverging from depression	24	9.2	27.4%
3	Double vertical ridges or slight and incomplete cusp outline	18	6.8	
4	Y form	6	2.2	
5	Small tubercle	18	6.8	
6	Broad cusp outline with a moderate tubercle	28	10.6	23%
7	Large tubercle with a free apex	14	5.6	
Total		262	100%	100%

Table 2: Prevalence of carabelli trait

	No of patients	Carabelli trait present	Prevalence
Male	118	51	43.2%
Female	144	81	56.25%
Total	262	132	50.4%

Table 3: Unilateral and Bilateral Distribution of Cusp of Carabelli

Carabelli's trait present	Unilateral	Bilateral	Total
No of patients	4	128	132
Prevalence (%)	3%	97%	100%

displayed carabelli structures in the permanent tooth.

DISCUSSION

More than half of East Indians exhibit some degree of Carabelli structure expression, according to the current study (Table 2). The outcomes closely matched those published by Rusmah (1992) [8] in group of Malaysian population (51.6%) and Kanappan J G *et al* (2001)[9] in a group of South Indian population (52.77%). Another study by Mavrodisz K *et al* suggested that expression of the Carabelli structure Hungarian population was 65.34% In contemporary group and 34% ancestral group which have suggested diversity and

Table 4: Degree of expression of Carabelli cusp on various studies

Author	Year	Population	Prevalence of Cusp of Carabelli (%)
Rusmah M.[9]	1992	Malaysian	51.6%
Kanappan J G *et al.*[10]	2001	South India	52.77%
	2007	Hungarian (contemporary)	65.34%
Mavrodisz *K et al.*[11]		Hungarian (skull of 11th century population)	34%
Subedi, N *et al.*[12]	2015	Nepalese	38.2%
Kirthiga M *et al.*[13]	2015	South India	40.5%
Present study	2016-2017	East India population	50.4%

Figure 1: Maxillary cast showing cusp of carabelli in mesiopalatal cusp of right 1st molar (Black arrow head)

evolution between two or more populations. Additionally, it will include information on how the carabelli characteristic varies within a community.[10] Expression of the Carabelli structure was 38.2% in Nepalese population[11] and 40.4% in a group of South Indian population.[12] (Table 4)

In this study, the trait's bilateralism was 97 percent (Table 3) and (Figure 1). This confirms the findings of other researchers who concur that bilateralism of the characteristic is more common, including Alvesalo *et al.* (1975);[3] Falomo (2002);[13] Joshi (1975);[14] Rusmah (1992);[15] and Thomas et al. (1986).[16] However, several researchers, including Biggerstaff (1973, 1972),[17,18] proposed that mirroring or bilateralism, even in twins, is not a role in the Carabelli characteristic.

Out of 12 mixed dentition cases those were showing carabelli structure 10 shows very similar structure both deciduous 2nd molar and permanent first molar bilaterally which suggested genetic predisposition of this structure and shape of deciduous 2nd molar and permanent first molar may control by same gene.

CONCLUSION

There is geographical and regional variation in distribution of the cusp of Carabelli. Increase cusp of Carabelli expression within same population over century indicate evolutionary development, migration and crossbreeding of different population. The Carabelli structure is expressed to some extent by half of the East Indian population. A hereditary propensity to this form is suggested by strong bilateralism and similar expression in both permanent first molars and deciduous second molars.

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