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Prevalence of the cusp of carabelli among chennai population - An observational study

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Abstract

Background: The Carabelli's trait has been used as a critical ethnic indicator for several decades.Analyzing the prevalence of this simply identified anatomical feature can find its application in anthropological identification of individuals from specific human populations and different gender.
Aim To assess the prevalence of the cusp of carabelli among the chennai population. **Materials and methods** The cross-sectional study was carried out among the general public visiting as outpatients to a private dental college in chennai. Visual examination was done to evaluate the presence of a cusp of carabelli. The data collected was tabulated and analysed using IBM SPSS software (version 23). Association between the presence of Cusp of carabelli in different genders was assessed using Pearson's chi-square test.
Result : Out of 100 study participants, 13% showed presence of the cusp of carabelli whereas 87% did not even show the evidence of carabelli cusp either in the form of groove or pit or a well developed cusp. The cusp of carabelli was

predominantly seen among male population(11%) compared to that of females (2 %), which was statistically significant (chi square test,p-value is 0.013).
Conclusion The cusp of carabelli was determined to be prevalent in 13% of the chennai population. The carabelli trait was predominantly seen among males compared to females. Although a rare occurrence, the cusp of carabelli contributes to the discriminatory identification of specific human population and gender.

Key words
Cusp of carabelli, prevalence, maxillary molars, carabelli trait, innovative technique, novel method

Introduction

Teeth are beneficial in offering evidence about the nature and extent of variety between human populations(1).Dental anthropology is related to the study of morphological variation and dimensions of the dentition of human populations over time and space and their connections with the processes of adaptation and dietary changes that led to the evolution of the dental system and the human race (2,3). The principle basis is because tooth size, number and morphology have a strong genetic basis to make them useful variables for assessing biological relationships and microevolutionary trends (2).

A nonmetric feature is likely to provide the most comprehensive and discriminatory description of human dentitions(3,4). Detailed description and study of such traits could provide valuable information regarding phylogeny of humans and distinctions between races and subraces (5). The frequency of occurrence of a trait may be low in a population because that trait is becoming progressively more or less well developed in that population(2,5). Hence, it is not inconceivable that a trait could inadvertently be considered to be an anomaly, even though it may be a characteristic feature of that population(4). Although teeth have proven to be an extremely valuable fossil material for scientists to study the history of human, unusual anomalous morphological features were mistakenly regarded by some early observers as aberrations and not considered to represent normal biological variation.Thus, what may be considered to be an anomaly in one population may be a trait in another population. One of the first traits to be recorded was the Carabelli's trait.

Ever since Sir Georg Carabelli identified it in 1842, Carabelli's trait is one of the most studied nonmetric traits(1,2). It is characterized on the mesiolingual or lingual aspect of the protocol of the upper molars. The Carabelli's trait has been used as a critical ethnic indicator for several decades, most likely because it can be simply observed in both living individuals and skeletal material, and can, therefore, be used to show major ethnic differences in dentition.Analyses of different dental morphological features, particularly the Carabelli's trait, have not been utilized to their full potential by anthropologists concerned with patterns of human biological variation in the Indian population.

Our team has extensive knowledge and research experience that has translate into high quality publications (6-25). Aim of the study is to assess the prevalence of the cusp of carabelli among the chennai population.

Materials and methods

After obtaining approval from the institutional ethical review board, the study was carried out among the outpatients visiting a private dental college in chennai. Study setting was cross sectional,

observational type. Participants were explained about the study and after obtaining their consent, demographic details were collected. The oral cavity was examined for the presence of cusp of carabelli using a mouth mirror and light source. With the help of sterile wooden spatula the tongue was held down to enable clear visualisation of maxillary molars. Any evidence of cusp of carabelli in the form of either a well developed cusp, groove or pit was recorded. All the data collected were entered in Microsoft excel sheet and transformed to IBM SPSS software- version 23.The statistical analysis was performed using chi-square test to analyse the association of gender in prevalence of cusp of carabelli trait. The results with $p<0.05$ level were considered to be significant.

Result

The study included 100 participants. Of the total study participants, 50% were males and 50% were females. 13% of the participants showed presence of the cusp of carabelli whereas 87% of them did not show the evidence of carabelli cusp either in the form of groove or pit or a well developed cusp(Figure 1).After the evaluation and procedure, the results obtained were plotted into SPSS software and statistical analysis was done .Out of the 13 that shows positive for the presence of the cusp , gender difference is taken into consideration and it shows that the cusp is more dominant amongst males. The cusp of carabelli was predominantly seen among male population(11 %) compared to that of females (2 %), which was statistically significant (chi square test,p-value is 0.013 , where $p<0.05$ is significant)(Figure 2)

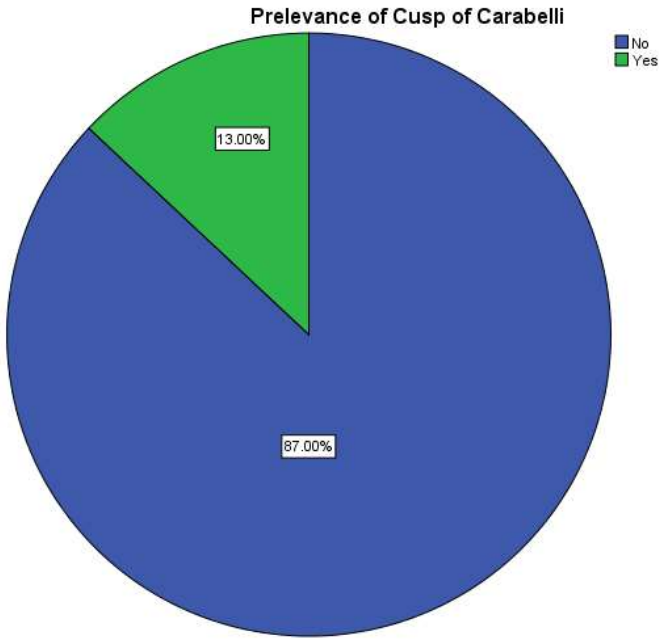

Figure1: Pie chart representing the prevalence of cusp of carabelli among the study participants. The colour green indicates the populations showing the presence of cusp of carabelli whereas the colour blue depicts the those with absence of cusp of carabelli. 13% of the participants had the presence of the cusp of carabelli while the remaining 87%of them did not show any evidence of cusp of carabelli.

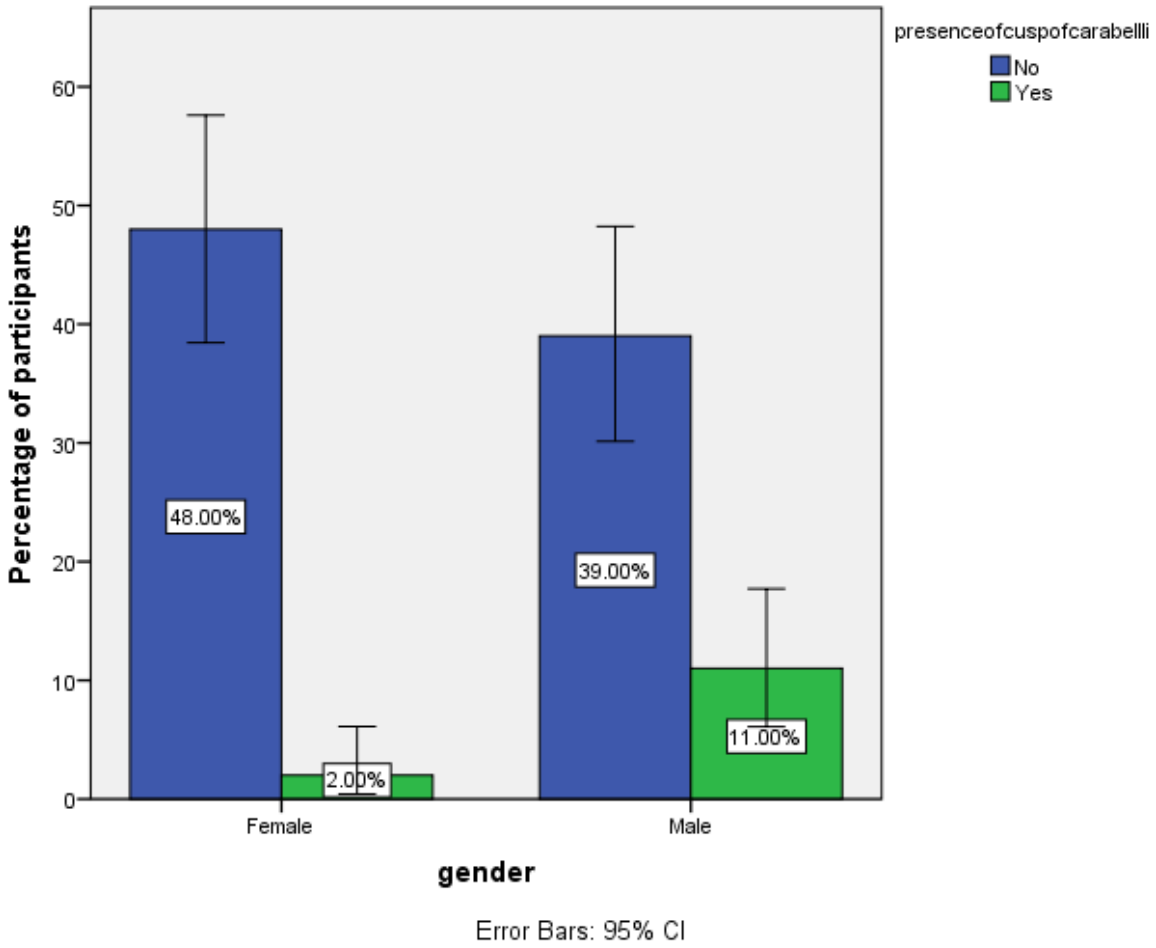

Figure 2 : Bar graph depicting the association of gender and the presence of cusp of carabelli. The green colour denotes the population showing presence of the cusp of carabelli and the blue colour denotes the population with absence of any evidence of the cusp of carabelli.11% of male population exhibits carabelli trait whereas 39% of them shows absence of carabelli. 2% of female population exhibits carabelli trait whereas 48% of them shows absence of carabelli. Male population shows significantly greater prevalence of Cusp of carabelli compared to that of female population (Chi square test, p value=0.013, hence it is statistically significant)

Discussion

Cusp of Carabelli is a type of accessory cusp, seen more often in permanent maxillary first molars, whereas its occurrence in primary teeth is rare. In this study, 13% of the participants showed

presence of the cusp of carabelli whereas 87% of them did not show the evidence of carabelli cusp either in the form of groove or pit or a well developed cusp.Out of the 13% of participants, showed positive for the presence of the cusp , gender difference is taken into consideration and it shows that the cusp is more dominant amongst males. The cusp of carabelli was predominantly seen among male population(11 %) compared to that of females (2 %), which was statistically significant (chi square test,p-value is 0.013 , where $p<0.05$ is significant).The cusp of carabelli was a rare trait present among a very small part of the population , and more prevalent among the males.

There is lack of evidence in the literature reporting the concomitant presence of supernumerary teeth and the cusp of Carabelli .Although it is referred as the Cusp of Carabelli it is actually a tubercle having genetic bases and/or developmental processes. Various theories exist to explain the occurrence of these cusps (26). However, heredity and genetics have been found to play a pivotal role in the etiology of dental anomalies of number and its increased recurrence in families. (4,5)A dominant autosomal trait has been suggested, with incomplete penetration in some generations and X chromosome linked inheritance due to the higher prevalence among males(27). Regarding the aetiology of the cusps of carabelli, it is believed that the PAX and MSX genes are responsible for the extra cusps which result in the abnormal shape of the teeth.(5)

The most generally identified dental trademark is the Carabelli cusp. This can be utilized to decide the level of intercourse between populaces with various racial attributes . Dahlberg's (1963) arrangement is the most usually applied technique for deciding the degree and articulation of Carabelli cusps(28)

Dental attributes can be separated into the alleged 'western' and eastern sorts. The recurrence of a Carabelli cusp is high in Europeans, 70–90 percent, yet low in oriental races. The discoveries of the current examination showed a commonness of 65.34 percent in the contemporary gathering, and 34 percent for the eleventh century skulls, which is, in the two cases, below the European normal. In (4)Malaysian kids, the recurrence of a Carabelli cusp on the maxillary first molars was 54.2 percent . In India, 52.77 percent of maxillary first perpetual molars showed a Carabelli tubercle . Hassanali (1982) showed that Carabelli's quality was available in 26–27 percent of Asian younger students. Caucasoid populaces vary from Mongoloids by having a high pervasiveness of Carabelli's attribute . As demonstrated in various investigations, the intercourse among European and Mongoloid populace prompts a decrease of complete recurrence of pervasiveness in the Europid populace(3,4)

These morphological abnormalities have incredible importance, both orally and regarding human sciences. The life systems of the teeth can give data on a populace and as they are not frequently affected by time, they can be concentrated on skeletons, and the turn of events and changes of a populace can be followed. The morphology and predominance of Carabelli cusps can give answers to numerous inquiries, like division of a populace into western or oriental sort dentition, the combination of races inside a populace, and the homogeneity of European and oriental populaces. A Carabelli cusp is more normal in Europeans than Mongoloids, while a claw cusp is more uncommon in Caucasians than Mongoloids

Conclusion

Hence from the Study conducted, it can be concluded that the cusp of carabelli is prevalent in 13% of the chennai population. It is more prevalent in males compared to females. A small population from South India (chennai) considered in the present study was found to possess a high degree of Carabelli trait expression and it contributes to the discriminatory identification of specific human population and gender.

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Dental Surgery Centre

Conflict of interest:

All the authors declare that there was no conflict of interest in the present study

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References:

1. Bhavyaa R, Sujitha P, Muthu MS, Kirthiga M. Prevalence of Cusp of Carabelli and its caries susceptibility – an ambidirectional cohort study [Internet]. Vol. 65, Australian Dental Journal. 2020. p. 294–301. Available from: http://dx.doi.org/10.1111/adj.12795

2. Alvesalo L, Nuutila M, Portin P. The cusp of Carabelli. Occurrence in first upper molars and evaluation of its heritability. Acta Odontol Scand. 1975;33(4):191–7.

3. Hunter JP, Guatelli-Steinberg D, Weston TC, Durner R, Betsinger TK. Model of tooth morphogenesis predicts carabelli cusp expression, size, and symmetry in humans. PLoS One. 2010 Jul 29;5(7):e11844.

4. Smitha T, Venkatesh D, Veeresh M, Hema KN, Sheethal HS, Vidya MA. The cusp of Carabelli: Frequency, distribution and type in the Bengaluru population. J Oral Maxillofac Pathol. 2018 Sep;22(3):418–22.

5. Elhag SBI, Abdulghani ASI, Elhag BI. Concomitant mesiodens with cusps of carabelli on the upper first molars: a rare case report [Internet]. Vol. 1, Dental, Oral and Craniofacial Research. 2016. Available from: http://dx.doi.org/10.15761/docr.1000142

6. Princeton B, Santhakumar P, Prathap L. Awareness on Preventive Measures taken by Health

Care Professionals Attending COVID-19 Patients among Dental Students. Eur J Dent. 2020 Dec;14(S 01):S105–9.

7. Mathew MG, Samuel SR, Soni AJ, Roopa KB. Evaluation of adhesion of Streptococcus mutans, plaque accumulation on zirconia and stainless steel crowns, and surrounding gingival inflammation in primary molars: randomized controlled trial. Clin Oral Investig. 2020 Sep;24(9):3275–80.

8. Sridharan G, Ramani P, Patankar S, Vijayaraghavan R. Evaluation of salivary metabolomics in oral leukoplakia and oral squamous cell carcinoma. J Oral Pathol Med. 2019 Apr;48(4):299–306.

9. R H, Hannah R, Ramani P, Ramanathan A, Jancy MR, Gheena S, et al. CYP2 C9 polymorphism among patients with oral squamous cell carcinoma and its role in altering the metabolism of benzo[a]pyrene [Internet]. Vol. 130, Oral Surgery, Oral Medicine, Oral Pathology and Oral Radiology. 2020. p. 306–12. Available from: http://dx.doi.org/10.1016/j.oooo.2020.06.021

10. Antony JVM, Ramani P, Ramasubramanian A, Sukumaran G. Particle size penetration rate and effects of smoke and smokeless tobacco products - An invitro analysis. Heliyon. 2021 Mar 1;7(3):e06455.

11. Sarode SC, Gondivkar S, Sarode GS, Gadbail A, Yuwanati M. Hybrid oral potentially malignant disorder: A neglected fact in oral submucous fibrosis. Oral Oncol. 2021 Jun 16;105390.

12. Hannah R, Ramani P, WM Tilakaratne, Sukumaran G, Ramasubramanian A, Krishnan RP. Author response for “Critical appraisal of different triggering pathways for the pathobiology of pemphigus vulgaris—A review” [Internet]. Wiley; 2021. Available from: https://publons.com/publon/47643844

13. Chandrasekar R, Chandrasekhar S, Sundari KKS, Ravi P. Development and validation of a formula for objective assessment of cervical vertebral bone age. Prog Orthod. 2020 Oct 12;21(1):38.

14. Subramanyam D, Gurunathan D, Gaayathri R, Vishnu Priya V. Comparative evaluation of salivary malondialdehyde levels as a marker of lipid peroxidation in early childhood caries. Eur J Dent. 2018 Jan;12(1):67–70.

15. Jeevanandan G, Thomas E. Volumetric analysis of hand, reciprocating and rotary instrumentation techniques in primary molars using spiral computed tomography: An in vitro comparative study. Eur J Dent. 2018 Jan;12(1):21–6.

16. Ponnulakshmi R, Shyamaladevi B, Vijayalakshmi P, Selvaraj J. In silico and in vivo analysis to identify the antidiabetic activity of beta sitosterol in adipose tissue of high fat diet and sucrose induced type-2 diabetic experimental rats. Toxicol Mech Methods. 2019 May;29(4):276–90.

17. Sundaram R, Nandhakumar E, Haseena Banu H. Hesperidin, a citrus flavonoid ameliorates

hyperglycemia by regulating key enzymes of carbohydrate metabolism in streptozotocin-induced diabetic rats. Toxicol Mech Methods. 2019 Nov;29(9):644–53.

18. Alsawalha M, Rao CV, Al-Subaie AM, Haque SKM, Veeraraghavan VP, Surapaneni KM. Novel mathematical modelling of Saudi Arabian natural diatomite clay. Mater Res Express. 2019 Sep 4;6(10):105531.

19. Yu J, Li M, Zhan D, Shi C, Fang L, Ban C, et al. Inhibitory effects of triterpenoid betulin on inflammatory mediators inducible nitric oxide synthase, cyclooxygenase-2, tumor necrosis factor-alpha, interleukin-6, and proliferating cell nuclear antigen in 1, 2-dimethylhydrazine-induced rat colon carcinogenesis. Pharmacogn Mag. 2020;16(72):836.

20. Shree KH, Hema Shree K, Ramani P, Herald Sherlin, Sukumaran G, Jeyaraj G, et al. Saliva as a Diagnostic Tool in Oral Squamous Cell Carcinoma – a Systematic Review with Meta Analysis [Internet]. Vol. 25, Pathology & Oncology Research. 2019. p. 447–53. Available from: http://dx.doi.org/10.1007/s12253-019-00588-2

21. Zafar A, Sherlin HJ, Jayaraj G, Ramani P, Don KR, Santhanam A. Diagnostic utility of touch imprint cytology for intraoperative assessment of surgical margins and sentinel lymph nodes in oral squamous cell carcinoma patients using four different cytological stains. Diagn Cytopathol. 2020 Feb;48(2):101–10.

22. Karunagaran M, Murali P, Palaniappan V, Sivapathasundharam B. Expression and distribution pattern of podoplanin in oral submucous fibrosis with varying degrees of dysplasia – an immunohistochemical study [Internet]. Vol. 42, Journal of Histotechnology. 2019. p. 80–6. Available from: http://dx.doi.org/10.1080/01478885.2019.1594543

23. Sarode SC, Gondivkar S, Gadbail A, Sarode GS, Yuwanati M. Oral submucous fibrosis and heterogeneity in outcome measures: a critical viewpoint. Future Oncol. 2021 Jun;17(17):2123–6.

24. Raj Preeth D, Saravanan S, Shairam M, Selvakumar N, Selestin Raja I, Dhanasekaran A, et al. Bioactive Zinc(II) complex incorporated PCL/gelatin electrospun nanofiber enhanced bone tissue regeneration. Eur J Pharm Sci. 2021 May 1;160:105768.

25. Prithiviraj N, Yang GE, Thangavelu L, Yan J. Anticancer Compounds From Starfish Regenerating Tissues and Their Antioxidant Properties on Human Oral Epidermoid Carcinoma KB Cells. In: PANCREAS. LIPPINCOTT WILLIAMS & WILKINS TWO COMMERCE SQ, 2001 MARKET ST, PHILADELPHIA …; 2020. p. 155–6.

26. Salazar-Ciudad I, Jernvall J. A gene network model accounting for development and evolution of mammalian teeth. Proc Natl Acad Sci U S A. 2002 Jun 11;99(12):8116–20.

27. Jernvall J. Linking development with generation of novelty in mammalian teeth. Proc Natl Acad Sci U S A. 2000 Mar 14;97(6):2641–5.

28. Carabelli AM. On Keynes's Method [Internet]. 1988. Available from: http://dx.doi.org/10.1007/978-1-349-19414-8

8. Alvesalo, L., Nuutila, M. and Portin, P. (1975) 'The cusp of Carabelli. Occurrence in first upper molars and evaluation of its heritability', Acta odontologica Scandinavica, 33(4), pp. 191–197.

9. Bhavyaa, R. et al. (2020) 'Prevalence of Cusp of Carabelli and its caries susceptibility – an ambidirectional cohort study', Australian Dental Journal, pp. 294–301. doi: 10.1111/adj.12795.

10. Elhag, S. B. I., Abdulghani, A. S. I. and Elhag, B. I. (2016) 'Concomitant mesiodens with cusps of carabelli on the upper first molars: a rare case report', Dental, Oral and Craniofacial Research. doi: 10.15761/docr.1000142.

11. Hunter, J. P. et al. (2010) 'Model of tooth morphogenesis predicts carabelli cusp expression, size, and symmetry in humans', PloS one, 5(7), p. e11844.

12. Smitha, T. et al. (2018) 'The cusp of Carabelli: Frequency, distribution and type in the Bengaluru population', Journal of oral and maxillofacial pathology: JOMFP, 22(3), pp. 418–422.