Bilateral Cusps of Carabelli on Maxillary first permanent Molar-Review of Literature
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Abstract:
A Carabelli cusp, a developmental anatomical anomaly is noted usually on the mesial palatal surface of the upper first permanent molars and rarely on the second or third permanent molars. The etiology of the Carabelli cusp remains vague, with both genetic and exogenous factors contributing to its genesis. This trait noted in certain fossilized specimens can present as a shallow furrow or groove, a pit, a tubercule of varying size or even as a cusp with a free apex. Additional care must be exercised in maintaining oral hygiene as this entity can serve as a potential pathway for caries initiation.

Introduction
The cusp of carabelli or the fifth cusp was first described by an Austrian dentist, George von Carabelli in 1842. He described it as a frequently occurring tubercle or cuspule on the lingual aspect of the mesiolingual cusp of the maxillary first permanent molar.

Accessory cusps are common variations of tooth morphology that are occasionally seen. Clinically three of the most commonly reported variation of accessory cusps are the Carrabelli cusps of the molars (52% - 68%), Talon cusps of the incisors (1 -7.7 %) and Leong’s tubercle of the premolar (8 %). The Carabelli cusp, a distinguishing morphological development anomaly is usually positioned on the mesiopalatal surface of the upper first permanent molars and rarely on the second or third permanent molars, or on the upper first primary molars.

It has also been variously referred to as the fifth lobe, supplemental cusp, mesiolingual elevation, accessory cusp, tuberculum anomalies, tuberculum Carabelli and tuberculum imparon. The feature that distinguishes cusp of Carabelli from dens evaginatus, which are also accessory cusps is the presence of pulp within which is in contradiction to carabelli cusp.

The etiology of the Carabelli cusp remains vague, and its origin is attributed to both genetic and exogenous factors. However, it is usually opined that the phenotypical appearance of the cusp is genetically determined, with data from studies on twins substantiating this hypothesis.

The Salazar-Ciudad and Jernvall model of tooth morphogenesis explains the development of tooth shape and manifestations of new cusps, based on a small number of developmental parameters. This theorem envisages co-variation among morphological variables, such as tooth size, intercusp distances, and cusp size.

Mutual communication between oral epithelium and neural crest-derived mesenchyme influence the folding of internal enamel epithelium, which serves as an outline for crown structure. The model believes that the pivotal point is the molecular signaling activity of enamel knots which direct the folding of the
dental epithelium at the future spots of cusp tips. These enamel knots are groups of nondividing cells, that act as signaling centers which are associated with the folding of internal enamel epithelium - which serves as an outline for crown structure.

With the distance from a preexisting enamel knot increasing there is an increased possibility of escaping the inhibition field surrounding the enamel knot, which may give rise to a new enamel knot, and thus a new cusp. One study proposed that in individuals with the genotype for Carabelli trait expression, larger molar crowns are more likely to display Carabelli cusps in comparison to smaller molar crowns which are more likely to display reduced forms of expression^5.

**Case report:**

A 12 year old male patient reported to the outpatient department of orthodontics, Modern Dental College and Research Centre, Indore. Upon clinical examination it was noted that the patient had cuspular projections resembling a Carabelli cusp on the palatal aspect of the left and right permanent maxillary first molars (figure 1)

The gingiva appeared normal and a little amount of plaque and staining were observed. The upper anterior teeth were proclined and spacing was present between the upper anterior teeth. The upper left quadrant showed lingually positioned first premolar and mesio-palatally rotated first molar. No other significant oral findings were noted.

Carabelli cusp in first molars
The lack of any symptoms due to the accessory cusp did not justify any kind of special treatment. Hence, the patient was not subjected to occlusal therapy

**DISCUSSION**

Teeth have proven to be an extremely valuable paleontology material to grasp the evolution of mankind. One of the first traits to be recorded in such an exploration was Carabelli’s trait, as early as in 1842. A Carabelli cusp in the pit form has been discovered in Australopithecus, Neanderthal man and Dryopithecus rhenanus. Carabelli's trait on the maxillary molars has also been noted intermittently on some fossils of Paleolithic man. Consequently, there exists an suggestion that Carabelli’s cusp has evolved from a simple groove to its present form of a well-developed cusp. These findings lend support to the belief that Carabelli trait is noteworthy in the evolution of man and perhaps in different racial groups.

The trait can present as a shallow furrow or groove, a pit, a tubercule of varying size or even as a cusp with a free apex which challenges the hypocone (one of the molar’s four principal cusps) in size. Carabelli's trait is expressed as either on the lingual surface of the protocone of the primary maxillary second molar, or the permanent maxillary first molar. In 1944, Dietz found that the so-called Carabelli "tubercle" or "cusp" had a variety of expressions and identified 4 main categories viz. lobular, cuspid, ridged, and pitted.

Carabelli’s trait was graded by Snyde and coworkers into:

0. no cusp and smooth – a completely smooth surface;

1. No cusp but small line – a surface
having a furrow interrupting its continuity.
2. No cusp but pit – a surface having a pit interrupting its continuity;

3. Cusp outline without apex – an eminence without a defining groove;
4. partial cusp without apex – a small cusp with a groove setting it off from the tooth surface; and
5. cusp with apex – a large cusp

Prevalence of cusp of Carabelli varies amongst different racial populations. The cusp has been reported in 17.4 - 90% of white population, 37% of the Caucasoids, but is a rare occurrence in Asians. Prevalence data for the primary dentition for all degrees of Carabelli’s trait indicate that it is more frequent in Caucasian children than in Mongoloid. For the permanent dentition, Carabelli’s trait appears commonly amongst European populations, followed by African populations, and American Indians, with the lowest prevalence occurring in the other Mongoloid races.

Yaacob opined that in the mongoloid race cusp of Carabelli is largely absent and if present, it is more often than not in a reduced form. In a study involving pediatric Saudi nationals the prevalence of the trait was 58.7% with similar prevalence in both males and females. An investigation by Falomo on 2,604 Nigerians revealed prevalence rate of 17.43%. A recent study conducted in Franca involving 402 teeth in the age group of 4 to 13 years, found a prevalence rate of 69.52% in the second primary molars and in 52.09% of the first permanent molars with a predominance of depression type and rare occurrence of prominent cuspal type.

CONCLUSION

Carabelli cusp is not known to interfere with occlusion, probably because they develop and attrite at the same rate as the other cusps.

Presence of this additional extension of tooth structure may pose various dental problems such as caries originating in the pits or deep developmental grooves between the accessory cusp and crown, as these serve as potential stagnation areas. Hence these areas should be sealed with pit and fissure sealant. These cups may also pose problems in adapting the matrix band during restorative procedures. Cusp of carabelli is a regularly noted yet often overlooked anatomical variant, with not much of a diagnostic or endodontic significance but a huge anthropological and forensic implication.

REFERENCE

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