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Clinical Evaluation of the Occurrence of Cusp of Carabelli and it's Caries Susceptibility in Specific Population in Baghdad

Matti Qais Matti[1]; Rusul Jaffar Hadi[2]; Shahad Yousif Rashid[3]

[1,2,3]Department of Oral Diagnostic sciences, College of Dentistry, University of Baghdad, Baghdad, Iraq

[1]Email: mattialias25@gmail.com

[2]Email: russal.j@codental.uobaghdad.edu.iq

[3]Email: shahadyousif52@gmail.com

Abstract

Background: Owing to the significance of the carabelli cusp in anthropological studies, dental morphology, genetic and evolutionary insights, forensic odontology and, more specifically, clinical dentistry extensive investigation is required about its prevalence, types (small ridge, groove, prominence) and its impact on dentistry, namely the development of dental caries.

Objectives: To determine the frequency of the carabelli cusp, types (small ridge, groove, prominence), and whether it is unilateral (present on one side only) or bilateral (present on both sides). Additionally, to see if its presence makes people more susceptible to dental caries.

Methods: This study included 90 fifth-grade undergraduate dental students from College of Dentistry, University of Baghdad. Baseline data were obtained from clinical examination, students' information were arranged in case sheets which included name, gender, presence of carabelli cusp, its type on the mesiopalatal cusp (small ridge, groove, prominence), it being unilateral or bilateral and presence of caries or not. Data analyzed achieved by using Statistical Package for Social Sciences (SPSS) version 25.

Results: According to our case sheets (77%) of the participants showed presence of the Carabelli cusp and it was predominantly bilateral (68%). Furthermore, it was predominantly seen among males (61%). The groove type, with (37.68%) was the most common type and it showed the highest percentage of caries distribution with (38.46%).

Conclusions: Based on our study findings, the Carabelli cusp is frequent in the population examined within the time of this study and to have it bilaterally. Additionally, the risk of caries is raised due the challenge of keeping these areas clean.

Keywords: Cusp of carabelli, Caries, Mesiopalatal cusp, Plaque.

Introduction : Known by a number of names, including the Fifth Cusp, Molar Tubercle, Trait of Carabelli, and Tubercle [1]. Cusp of Carabelli is a non-functional cusp and is often observed on the maxillary permanent molars and maxillary second deciduous molars in the mesiopalatal cusp [2]. It includes a variety of expressions that range from complete absence to pits, grooves, tubercles, cusplet, or cusps [3]. Its sizes range from the biggest tooth cusp to a rudimentary elevation. It might be unilaterally or bilaterally [4]. Its presence adds to the complex morphology of the human dentition [5]. Its distribution shows considerable variation across totally different racial groups, countries, and geographic regions globally [1]. Dental occlusion and function may be affected by this cusp variations in size, shape, and composition, which can range from enamel-only to incorporating pulpal and dentine components [5]. In the field of dentistry, awareness of the carabelli cusp is important in forensic odontology for human identification, orthodontic treatment, occlusal adjustments and dental restorations [6],[7]**.** For example, the deep Cusp of Carabelli groove that separates the cusp from the parent tooth may operate as a plaque-retentive area, increasing the likelihood of dental decay. Additionally, during sealant placement the practitioners should be instructed to seal both the positive and negative expressions of the cusp of carabelli [8]. Although its exact etiology is unknown, excessive dental lamina activity is thought to be the cause. Environmental and genetic factors appear to influence the development of this cusp [4]. Therefore, the present study was designed to asses the prevalence of the cusp of carabelli, its patterns, assessing whether its presence is bilateral or unilateral and to investigate the association between its presence and caries susceptibility among dental students in Baghdad University.

Materials and Methods: The study was conducted during the period from November/2023 to February/2024 In the Hospital of College of Dentistry/ University of Baghdad, the study included 90 fifth-grade undergraduate dental students (45 males and 45 females). Students with badly carious or missing maxillary first permanent molar from one or both sides were excluded. Baseline data were obtained from clinical examination, their information was arranged in table including name, gender, presence of carabelli cusp, unilateral or bilateral, presence of caries or not and, type of mesiopalatal cusp (small ridge, groove, prominence) (Figure 1).

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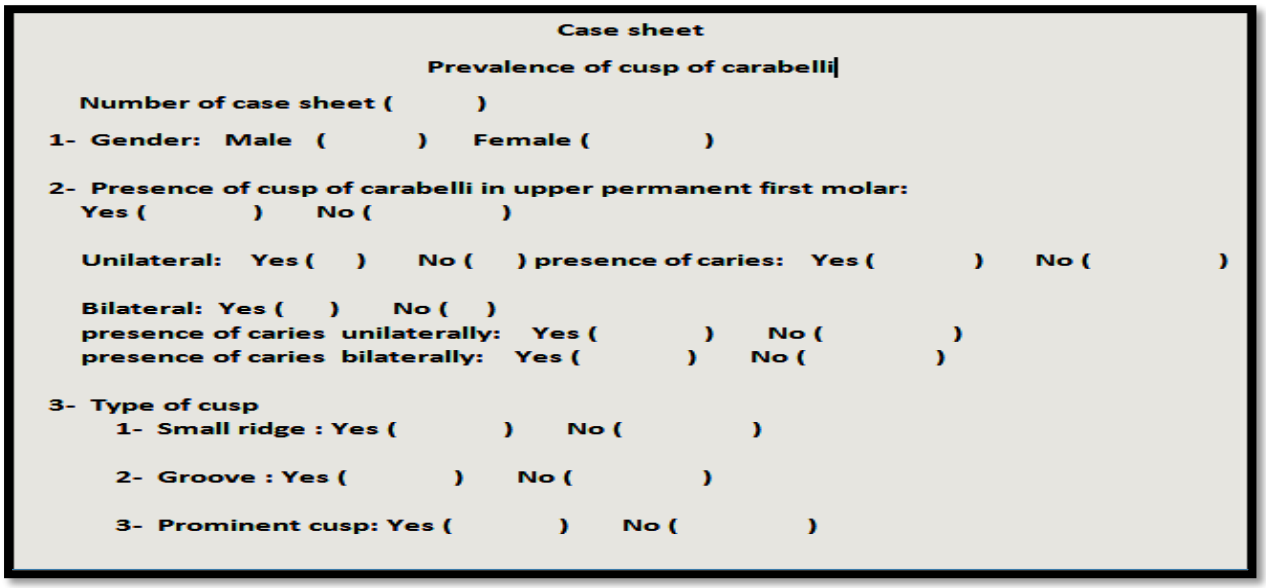
Case sheet

Prevalence of cusp of carabelli

Number of case sheet ( )

1- Gender: Male ( ) Female ( )

2- Presence of cusp of carabelli in upper permanent first molar:
Yes ( ) No ( )

Unilateral: Yes ( ) No ( ) presence of caries: Yes ( ) No ( )

Bilateral: Yes ( ) No ( )
presence of caries unilaterally: Yes ( ) No ( )
presence of caries bilaterally: Yes ( ) No ( )

3- Type of cusp
1- Small ridge : Yes ( ) No ( )

2- Groove : Yes ( ) No ( )

3- Prominent cusp: Yes ( ) No ( )

Figure (1): case sheet for data collection

After providing an explanation of the study to all participants and obtaining their consent, demographic information was gathered. In well-light conditions, using a mouth mirror and dental explorer, the probe was moved across each mesiopalatal surface of upper 1st molar on both the right and left sides without applying force in the apical direction to check for contour or cavitation of cusp and then recorded. Shape of mesiopalatal surface were divided into three categories (small ridge, pit or groove, well developed prominent cusp) and caries infection was examined in the same time. Data analyzed achieved by using Statistical Package for Social Sciences (SPSS) version 25. The data was presented by number, and percentage. The Chi-square test was used to analyze the categorical data. The results with $p \leq 0.05$ level were considered to be significant.

Results

Prevalence of the Cusp of Carabelli : The study included 90 participants. Of the total study participants, 45 (50%) were males and 45 (50%) were females. 69 (77%) of the participants showed presence of the cusp of carabelli whereas 21 (23%) of them did not. The Prevalence of the cusp of Carabelli regarding gender it showed that the cusp is more dominant among males. The cusp of carabelli was predominantly seen among male population (61%) compared to that of females (39%) (Figure 2).

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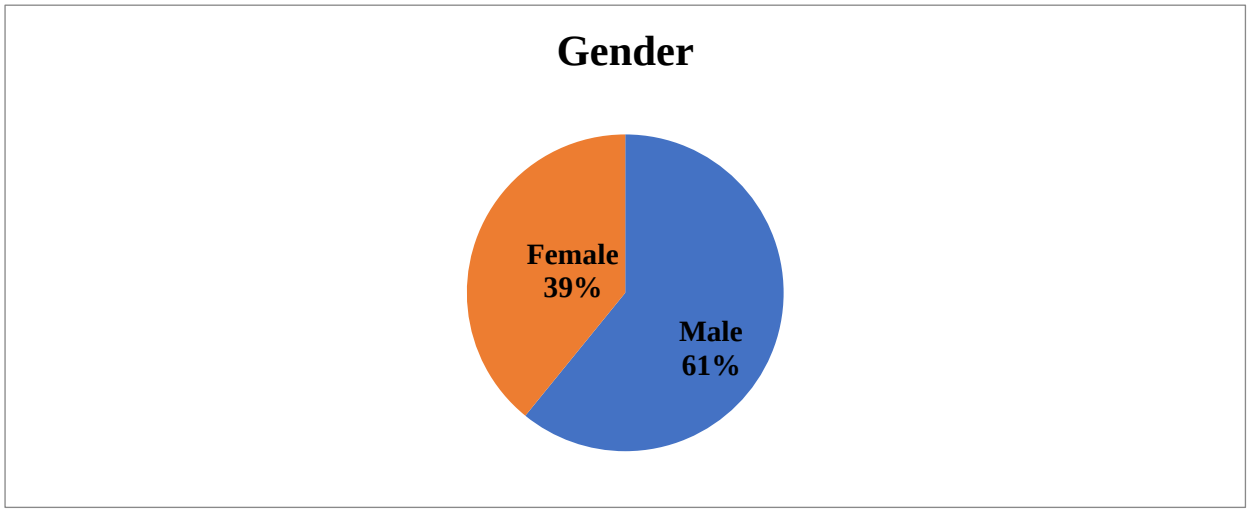

Figure (2): Pie chart representing the association of gender and the presence of cusp of carabelli

The most commonly observed type of Carabelli cusp was the groove type, with 26 cases (37.68%), followed by the prominent type with 22 cases (31.88%), and the least common was the ridge type with 21 cases (30.43%), as shown in (Figure 3).

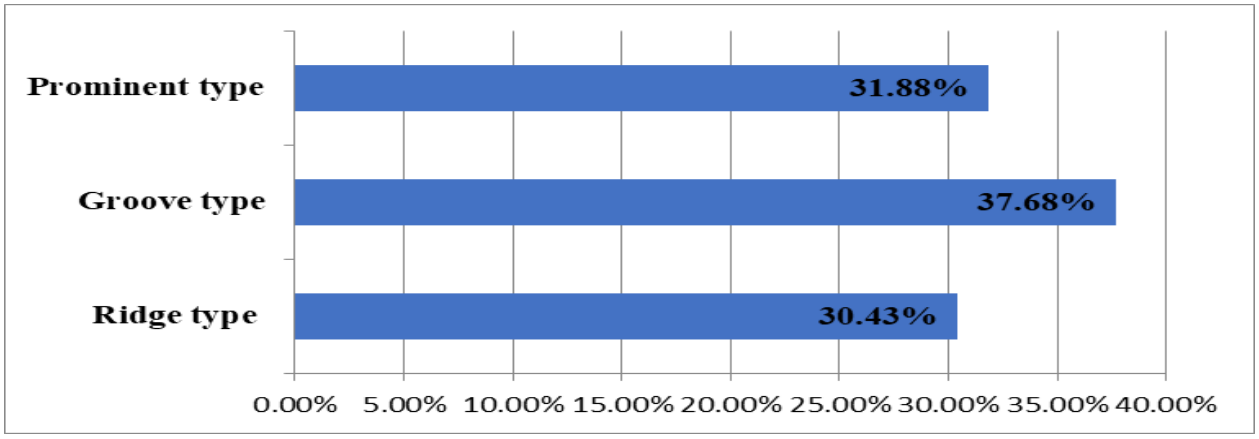

Figure (3): Percentage of the prominent, groove and smooth type of mesiopalatal surface

The Carabelli cusp was predominantly found bilaterally in 68% of cases. In contrast, only 32% of cases exhibited the Carabelli cusp in a unilateral position (Figure 4, Figure 5).

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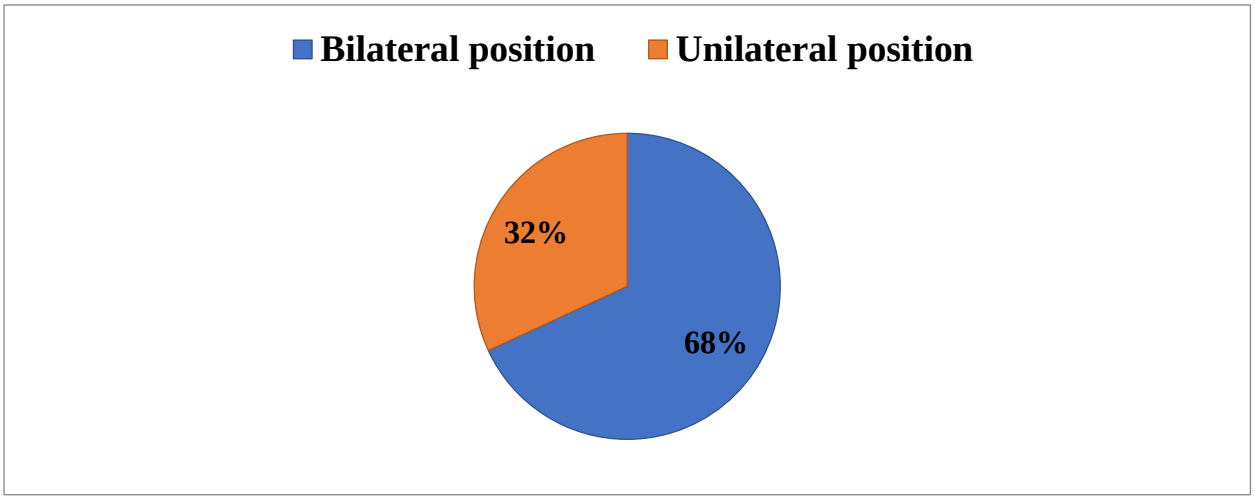

Figure (4): percentage of unilateral and bilateral distribution of cusp of carabelli in maxillary 1st molar

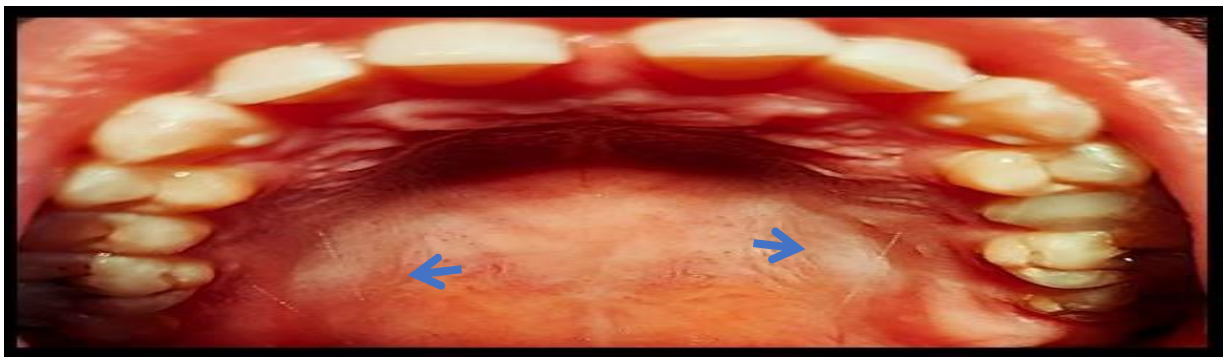

Figure (5): Bilateral distribution of cusp of carabelli in maxillary 1st molar

Table (1) showed that 22 of exanimated upper 1st molars had prominent cusp on the mesiopalatal surface (Figure 6), (77.27%) had distributed bilaterally while (22.72%) had unilateral distribution. While the groove type on the mesiopalatal surface was 26 in total of the examined teeth (Figure 7), (19.23%) distributed unilaterally while (80.76%) distributed bilaterally. Regarding the ridge type of the examined upper 1st molars was 21 (Figure 8), distributed (57.14%) unilaterally and (42.85%) bilaterally. The result was significant among all group.

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	1st Molars With Ridge N (%)	1st Molars With Groove N (%)	1st Molars With Prominent Cusp N (%)
Unilateral	**12(57.14%)**	**5 (19.23%)**	**5(22.72%)**
Bilateral	**9 (42.85%)**	**21 (80.76%)**	**17(77.27%)**
Total	**21 (100%)**	**26 (100%)**	**22(100%)**
The Chi-Square Statistic Is 8.9352. The *P*-Value Is .011475. The Result Is Significant At *P* < .05.			

Table (1): Unilateral and bilateral distribution among different types of cusp of carabelli

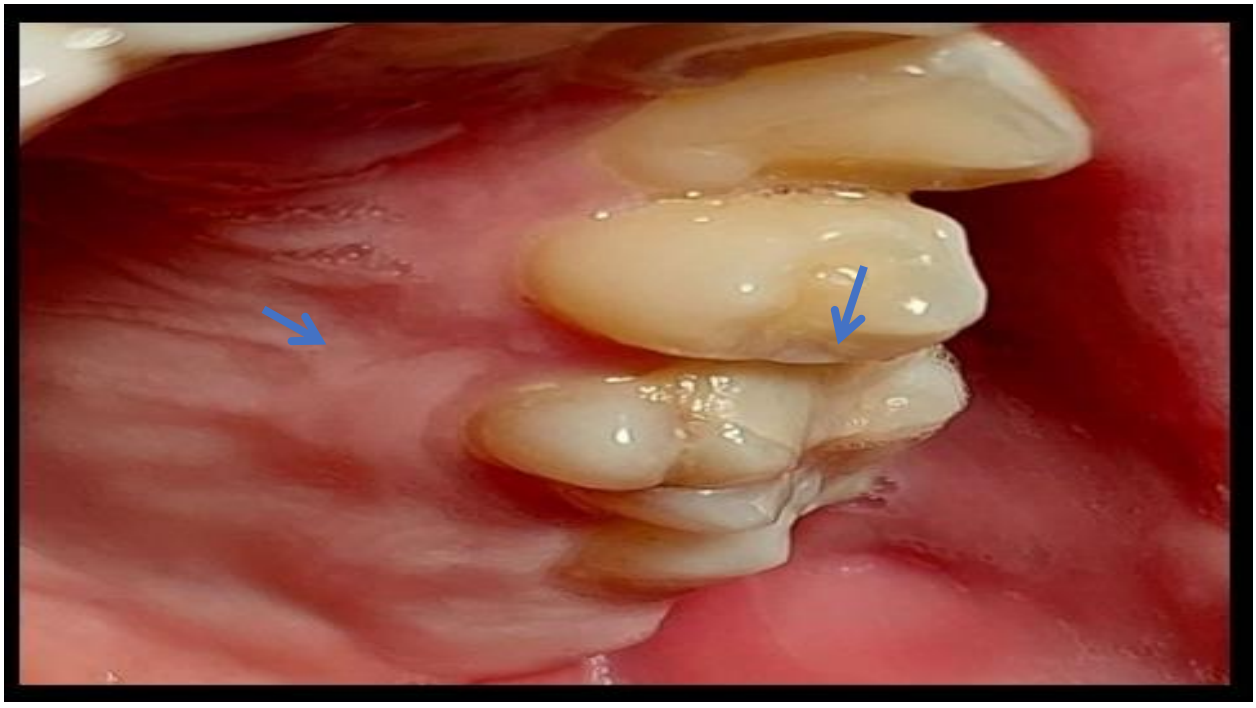

Figure (6): Maxillary 1st molar with prominent cusp

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Figure (7): Maxillary 1st molar with groove in mesiopalatal surface

Figure (8): Maxillary 1st molar with ridge on mesiopalatal surface

Caries distribution

Table 2

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Table (2): Caries distribution among different types of cusp of carabelli.

	1st Molars with Ridge N (%)	1st Molars with Groove N (%)	1st Molars with Prominent Cusp N (%)
Sound Tooth	**19 (90.47%)**	**16 (61.53%)**	**17 (77.27%)**
Carious Tooth	**2 (9.52%)**	**10 (38.46%)**	**5 (22.72%)**
Total	**21 (100%)**	**26 (100%)**	**22 (100%)**
The Chi-Square Statistic Is 5.3027. The P-Value Is .070554. The Result Is Not Significant At P < .05.			

Groove type showed the highest percentage of all by distribution of 10 (38.46%) (Figure 9). revealed that ridge type showed the least percentage of caries distribution 2 (9.52%) of total number while the prominent cusp showed an average of 5 (22.72%) of the total number and the

Figure (9): Caries distribution in prominent cusp type**.**

Discussion : The aim of the present study was to ascertain the prevalence of the cusp of Carabelli in upper first molars and investigate its susceptibility to caries among a group of students at the College of Dentistry, University of Baghdad during the period from November/2023 to February/2024. Regarding gender-based prevalence, the cusp was found to be more prevalent among males compared to females, a finding consistent with studies by Vaddi [10]and Qamar [11]. However, this contrasts with the observations of Katariya and Jagannathan who reported a greater frequency of the Carabelli cusp in females than in males, which is explained by hormonal and genetic causes [12]. Certain study propose that sex-linked

genes or genes located on the sex chromosomes affect the expression of dental features such as the Carabelli cusp. Furthermore, it has been suggested that hormonal factors like testosterone levels influence how dental features, such as cusp morphology develop [13]. The results indicated that the most commonly observed type was the groove type, followed by the prominent cusp type, with the least common type being the small ridge type. These finding was agreed with who have revealed a wide range of expressions of the groove type of the Carabelli cusp [14],[15]. Based on the location of the Carabelli, a bilateral distribution was predominantly seen among the teeth examined, with significant differences noted among the various types of Carabelli cusps. This observation aligns with a previous study conducted by Khan [16]. And its genetic foundation explains the increased prevalence. It tends to exhibit imperfect penetrance and variable expressivity, and it is inherited as a polygenic trait, indicating that numerous genes influence its expression [17]. Regarding caries susceptibility on the mesiopalatal surface, the present study found the highest percentage of caries in the groove type, followed by the prominent type, and the lowest occurrence in cases with a small ridge. These finding was consistent with previous study by Al Shethri [3]. The palatal position of prominent cusp and groove types contributes to the development of caries because toothbrushes cannot reach them easily enough to maintain proper oral hygiene. Furthermore, the cusp's existence may function as a physical barrier, preventing saliva and tongue motions from cleaning the groove. This increases the possibility of food stagnation and debris retention, which in turn raises the potential of caries [18].

Conclusion: Based on the study findings, it can be concluded that the Carabelli cusp is common in our population, particularly showing a bilateral presence and higher occurrence in males than females. Additionally, there is a substantial prevalence of both groove and prominent cusp types on the mesiopalatal surface of the upper first molar, with comparable percentages noted (the highest among the observed types). Because of the difficulty in thoroughly cleaning these areas with a toothbrush and the possibility of food collection, this raises the risk of caries. It is important to let patients know about this in order to promote further dental care. In addition, it is recommended that dentists thoroughly inspect the lingual surfaces of the maxillary first and second molars in order to detect the existence of the Carabelli structure and any probable caries.

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