

The Prevalence of the Carabelli's Tubercle in a Contemporary Libyan Population Seen in Tripoli City

Ahmed Abulwefa¹ and Mohamed Fadel^{2@}

¹ Department of Orthodontic; ² Department of Biology, Faculty of Dentistry, University of Tripoli, Libya

Received 7 January 2014/Accepted 15 April 2014

ABSTRACT

The Carabelli cusp is a tubercle or the fifth cusp often seen on the palatal surface of the mesiopalatal cusp of maxillary permanent molars and maxillary second deciduous molars. The purpose of this study was to determine the prevalence and degree of expression of the Carabelli structure in the permanent first and second maxillary molars in a selected Libyan population.

Libyan patients (232) attending to the different public dental clinics in Tripoli city were randomly selected for examination. Their age ranged from 20 to 50 years old. Patients with other complaint, restored or missing upper first or second maxillary molars on any side were excluded. Both the first and the second upper molars were carefully examined for the occurrence of the Carabelli structure. The prevalence and degree of expression of a Carabelli cusp was investigated for the upper first and second permanent molars according to a seven-grade classification system. The prevalence of the Carabelli structure was 44.8% at first molar and only 13.8% at second molar, while the absence of the Carabelli structure was found to be 60% at first molar and only 8.6% at second molar, and as groove expression about 31%. It was concluded that less than half of the studied group have a degree of expression of the Carabelli trait is associated with never seen ectopic localisation of Carabelli tubercle in all the cases. Bilateral occurrence with a tendency toward concordance of expression between sides was also observed.

Keywords - Carabelli tubercle; Bilateral; Tripoli City.

INTRODUCTION

The Carabelli structure is a tubercle or a small cusp, often seen on the palatal surface of the mesiopalatal cusp of maxillary permanent molars and maxillary second deciduous molars.¹ It includes a variety of expressions that range from present to complete absence of that tubercle, or to be as a cusplet.² It represents the end product of the interaction of a complex system of ontogenetic and environmental factors.³

Alvesalo *et al.* (1975)³ examined 233 patients in a Finnish rural population for the presence of the Carabelli cusp. 79% of them had the cusp in first upper molars. The occurrence of the structure was bilateral with varying degrees of asymmetry. Their results suggested low heritability of the character. They classified the Carabelli structure as follows:

1. Smooth surface
2. Single pit or furrow
3. Double furrow or Y-shaped furrow
4. Slight protuberance or small cusp
5. Large cusp

In a study made by Rusmah (1992)⁴, 320 maxillary casts of Malaysian children were examined for the occurrence of the Carabelli trait on the maxillary first permanent molars. The total trait frequency was observed to be

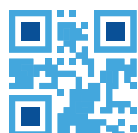
51.6%. The cusp was observed to be more bilateral.⁵ 17.43% occurrence of the Carabelli cusp in maxillary molars was reported by Falomo (2002)⁶ after examining 2604 Nigerians. There was 70.7% bilateralism in the upper first molars, with 1.9% simultaneous bilateralism in the upper first and second molars. Unilateralism in the upper first molars accounted for 25.9%.⁷ It is rarely seen in Caucasian, while Malaysian showed 52%, Hungarian showed 65.3%, and Saudi Arabia showed 57%.⁸

The purpose of this study was to determine the prevalence and degree of expression of the Carabelli structure in the permanent first and second maxillary molars in a selected Libyan population.

MATERIALS AND METHODS

Libyan patients (232) attending to the Tripoli Central Dental Clinic in Tripoli city were randomly selected for examination. Their age ranged from 20 to 50 years old. Any patient with severely carious, restored or missing upper first or second maxillary molars on any side was excluded.

Both the first and the second upper molars were carefully examined for the occurrence of the tubercle structure, from the occlusal view using a mouth mirror and dental explorer. Under efficient light condition, tubercle presence was examined by pulling the explorer tip over the groove created by the cusp looking for stickiness, and avoiding



apically directed force.⁹

The structure and its degree of expression were classified into seven categories:

- C0: no Carabelli cusp
- C1: shallow round depression at MLC
- C2: shallow longitudinal depression at MLC
- C3: pit on MLC
- C4: horizontal groove away from cusp ridge of MLC
- C5: small bulge on MLC
- C6: tubercle with round edge on MLC

C7: cusp form with mesial and distal cusp ridge on MLC

Three examiners collected the data. For inter-examiner calibration, and before starting the data collection, a teaching lesson with an expert examiner was made to unify standards of examination. At the beginning, 20 patients were examined by all examiners, in which the first examiner performed examination and recorded data followed by the second and third examiners in an orderly manner.

All statistical analysis was calculated using the Graph Pad Prism version 6, and then descriptive data analysis was used to report findings.

Table 1: Scale for the determination of degree and expression of Carabelli cusps

C0: No Carabelli cusp:				
	Right side	Left side	Both sides	Prevalence%
Maxillary first molar	71	70	141	60%
Maxillary second molar	12	8	20	8.6%
C1: Shallow round depression on ML cusp:				
	Right side	Left side	Both sides	Percentage%
Maxillary first molar	8	9	17	7.3%
Maxillary second molar	2	1	3	1.2%
C2: Shallow longitudinal depression on ML cusp line angle:				
	Right side	Left side	Both sides	Percentage%
Maxillary first molar	27	31	58	25%
Maxillary second molar	5	5	10	43%
C3: Pit on ML cusp:				
	Right side	Left side	Both sides	Percentage%
Maxillary first molar	13	25	38	16.4%
Maxillary second molar	3	3	6	2.5%
C4: Horizontal groove away from cusp ridge of ML cusp:				
	Right side	Left side	Both sides	Percentage%
Maxillary first molar	30	41	71	31%
Maxillary second molar	3	3	6	2.5%
C5: Small elevation or bulge on ML cusp:				
	Right side	Left side	Both sides	Percentage%
Maxillary first molar	55	49	104	44.8%
Maxillary second molar	19	13	32	13.8%
C6: Tubercle with round edge on ML cusp:				
	Right side	Left side	Both sides	Percentage%
Maxillary first molar	11	12	23	9.91%
Maxillary second molar	0	2	2	0.09%
C7: Carabelli's cusp form with mesial and distal cusp slope				
	Right side	Left side	Both sides	Percentage%
Maxillary first molar	7	6	13	5.6%
Maxillary second molar	1	1	2	0.09%

All of the cases are abused from extra familial source and 75% of them the family denied the history of sexual abuse.

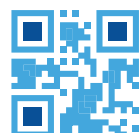


Table 2: Presence and absence of Carabelli's cusp on the first molars

Structure	Patient frequency	Prevalence (%)
Smooth Surface	141	57.5%
Carabelli trait	104	42.4%
Total	245	100

Table 3: Presence and absence of Carabelli's cusp on the first and second molars.

Criteria	Upper first molar			Upper second molar		
	Frequency (N= 262)	Percentage (%)	Total %	Frequency (N= 52)	Percentage (%)	Total %
Absence of structure	141	53.82 %	54	20	19.3%	19.3
Groove or depression	17	6.48 %	46	10	19.2 %	80.7
Prominent cusp	104	39.69 %		32	61.5 %	
Total	262	100	100	52	100	100

RESULTS

Out of the 232 patients, 141 individuals did not have any expression of the Carabelli trait 60.7% (C0) in relation to number of teeth, while the remaining showed shallow round depression at MLC is 17 individuals 7.3% (C1), while individuals showed shallow longitudinal depression at MLC is 58 with 25% (C2), and the presence of pit on MLC is 38 with 16.4% (C3), horizontal groove away from cusp ridge of MLC is 71 with 31% (C4), small bulge on MLC 104 with 44.8% (C5), tubercle with round edge on MLC 23 with 9.9% (C6), cusp form with mesial and distal cusp ridge on MLC 13 only with 5.6% (C7), as seen in the tables below respectively.

DISCUSSION

Since three examiners collected the data, it was important to unify and standardize their method of examination and data collection. The mean ANOVA test values obtained were high, which suggest that the three examiners reached an excellent inter-examiner reliability.¹⁰

The present study reveals that less than half of the Libyan population has a degree of expression of the Carabelli structure.¹¹ The results were very close to those reported by Rasmah (51.6%).⁴ Prominent pits and grooves can be foci of plaque retention and caries development, and a large tubercle can pose some problems with orthodontic bands.¹²

Bilateralism of the trait, in this study, was very high. This supports the findings of other researchers^{10, 13}; they agree that bilateralism of the trait is more frequent. Although some investigators, such as Biggerstaff (1973)¹ and (1972)⁹, suggested that bilateralism or mirroring is not a factor in the Carabelli trait, even among twins. Simultaneous Bilateralism in the upper first and second

molars was found to be low, which agrees with Falomo's findings.⁵

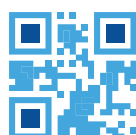
An interesting result was found, which is if the second upper molars had prominent cusps bilaterally, the upper first molars would have prominent cusps bilaterally as well. But it is not true for the grooves. This could be attributed to genetics, as some investigators^{1, 2, 12-14} reported that it may have a big influence on the Carabelli trait. Many studies^{3, 4, 11, 15} failed to show any sex dimorphism in the occurrence of the trait, although some investigators^{16, 17} observed a sex- linked pattern. Therefore, the relationship of sex to the Carabelli trait was not investigated in this study.

In the first molars, it was found that the cusp expression showed only 13 individuals (5.6 %) with mesial and distal cusp ridge of Carabelli when compared to pit expression 38(16.4%), this is true for the second molar as well. This finding can be explained by the fact that the cusp expression has a tubercle in addition to the groove; this tubercle may act as a physical barrier against the cleansing mechanisms of a tooth brush and physiological cleaning by the tongue movement and the salivary flow. In cases where the Carabelli structure was absent, caries was not detected which supports the idea that the Carabelli structure presents a foci for plaque accumulation and caries development.

Future studies should be made to assess the relationship of the Carabelli trait to genetics and its heritability, the Carabelli trait should also be studied in relation to gender and crown size.

CONCLUSION

Our findings lead us to propose that, in individuals with the genotype for Carabelli trait expression, larger molar crowns are more likely to display Carabelli cusps, whereas



molars with smaller crowns are more likely to display reduced forms of expression of the trait, we suggest that the pattern of folding of the internal enamel epithelium in developing molar crowns, particularly in the protocone region, can be modified by a developing Carabelli cusp. Bilateral occurrence with a tendency towards concordance of expression between sides was also observed.

According to the criteria of the present study, the following conclusions can be drawn:

- In this study the prevalence of the Carabelli trait in a selected Libyan population was 44.8 %.
- The Carabelli trait is bilaterally present.

Dentists are advised to perform a careful examination to the lingual surfaces of the maxillary first and second molars to roll out the presence of the Carabelli structure and caries.

REFERENCES

1. Biggerstaff RH (1973) Heritability of the Carabelli Cusp in twins, *J Dent Res.* **52**(1), 40-44.
2. Kraus BS, Jordan RE and Abrams L (1992) Kraus's dental anatomy and occlusion; 2nd edn., chapter **5**, p.75.
3. Alvesalo L, Nutila M, and Portin P (1975) The cusp of Carabelli-occurrence in the upper first molar and elevation of its variability, *Acta Odont Scand.* **33**, 191-197.
4. Rusmah M (1992) The Cusp of Carabelli in Malaysians, *Odontostomatol Trop.* **15**(1), 13-15.
5. Falomo OO (2002) The cusp of Carabelli: frequency, distribution, size and clinical significance in Nigeria, *West Afr J Med.* **21**(4), 322-324.
6. Yassin OM (1995) In Vitro Studies of the Effect of a dental explorer on the formation of an artificial carious lesion, *ASDC J Dent Child.* **62**(2), 111-117.
7. Van Dorp CS, Exterkate RA and Ten Cate JM (1988) The effect of dental probing on subsequent enamel demineralization, *ASDC J Dent Child.* **55**(5), 343-347.
8. Warren JJ, Levy SM and Wefel JS (2003) Explorer probing of root caries lesions: an in vitro study, *Spec Care Dentist.* **23**(1), 18-21.
9. Biggerstaff RH (1972) Post-canine dentition of twins, PhD thesis, University of Pennsylvania.
10. Joshi MR (1975) Carabelli trait on maxillary second deciduous and first permanent molars in Hindus, *Archs Oral Biol.* **20**, 699-700.
11. Thomas CJ, Kotze T. Jr W and Nash JM (1986) The Carabelli trait in the mixed deciduous and permanent dentition of five South African populations, *Archs Oral Biol.* **31**, 145-147.
12. Lasker G (1950) Genetical Analysis of racial traits of the teeth, *Symp Quant Biol.* **15**, 191-213.
13. Dahlberg AA (1963) The analysis of the American Indian dentition, in Brothwell, D.R. (ed). Dental Anthropology, New York, Pergamon Press.
14. Goodman HO (1965) Genitic parameters of dentofacial development, *J Dent Res.* **44**, 174-184.
15. Saunders SR and Mayhall JT (1982) Development patterns of human dental morphological traits, *Archs Oral Biol.* **27**, 45-49.
16. Kieser JA and Preston CB (1981) The dentition of the lengua Indians of Paraguay, *Am J Phys Anthropol.* **55**, 485-490.
17. Kaul V and Prakash S (1981) Morphological features of Jat dentition, *Am. J Phys Anthropol.* **54**, 123-127.

