

# The cusp of Carabelli: frequency, distribution, size and clinical significance in Nigeria

Olubode O. Falomo

Department of Restorative Dentistry  
College of Medicine, University of Ibadan  
Ibadan, Nigeria

## Summary

In a population of 2,604 Nigerians, 454 (17.43%) showed the presence of the cusp of Carabelli in maxillary molars. Bilateralism in the upper first molars accounted for 70.71% of the total, while bilateralism involving the upper first and second molars simultaneously accounted for only 1.98% of the total. Unilateralism in the upper first molars accounted for 25.99%.

There was no sexual dimorphism in its occurrence, but great variations were observed in the size of this structure. Its frequency of occurrence is compared with that of other population while its clinical significance is discussed.

**Keywords:** Cusp of Carabelli, Maxillary molars, Bilateralism, Caries.

## Résumé

Chez une population de 2604 nigériens, 454, (17,43%) ont montré la présence du cuspide de Carabelli dans les molaires maxillaires. Le bilatéralisme dans les premières molaires supérieures comptaient pour 70,71% de l'ensemble, alors que le bilatéralisme tenant compte des premières et secondes molaires supérieures simultanément comptaient seulement pour 1,98% du total. L'unilatéralisme dans les premières molaires supérieures comptaient pour 25,99%.

Il n'y avait aucun dimorphisme sexuel dans cet événement, mais de grandes variations ont été observées dans la taille de cette structure. La fréquence de cet événement est comparée à celle des autres populations alors que la signification clinique est discutée.

## Introduction

Carabelli in 1842 first described a tubercle on the lingual surface of the mesiolingual cusp of maxillary molars.

This protuberance has been variously described by other workers as a "fifth lobe"<sup>1</sup>, a "supplemental cusp,"<sup>2</sup> an "accessory cusp"<sup>3</sup>, a "mesiolingual elevation"<sup>4</sup>, a "fifth cusp"<sup>5</sup>, "Carabelli's tubercle"<sup>6</sup> and "Carabelli's cusp"<sup>7</sup>; while Dietz<sup>8</sup> defined four main categories – lobular, cuspid, ridged and pitted because of the variety of expressions.

This morphological variability prompted Kraus<sup>9</sup> to suggest the term "Carabelli's anomaly", for the tubercle, but Carabelli's cusp still enjoys the widest acceptance.

The protuberant and cusp-formed structures have been termed "positive cusps" while the furrow – and pit-formed structures have been termed "negative cusp".

When well developed, the "positive cusp" is demarcated occlusally from its parent molar tooth by a well accentuated curved groove<sup>3</sup>. The frequency of this structure varies from population to population.

Alvesalo et al<sup>10</sup> in their review found the frequency of occurrence of both "positive" and "negative" cusps to vary

from 51% to 90% in modern European population. They also claim that the frequency of the "positive cusp" is highest among European populations; somewhat lower in African and American Indian population and lowest among the Arctic populations.

It is found most frequently in upper first molars, although Carabelli himself pointed out that the cusp may occur on any of the maxillary molars. It is rarest on the third maxillary molar. In most cases the expression of the cusp is equivalent on the right and left side of the jaw<sup>8,9,11,12</sup> but a certain amount of asymmetry has been observed.<sup>13,14</sup> Generally it occurs bilaterally,<sup>3,5,6,7</sup> but Hirakawa<sup>15</sup> and Dietz<sup>8</sup> found "rare" unilateral cases.

Variations in the size of this cusp range from its being the largest cusp of the tooth to a barely noticeable elevation.<sup>4,6</sup>

No significant sexual dimorphism either in frequency or expression of this structure has been observed, although the frequency appears to be higher in men than in women.<sup>10</sup>

## Materials and Methods

A total of 2,604 Nigerians (1,191 men and 1,413 women) randomly selected were examined for the presence of the "positive" cusp of Carabelli. Individuals with any missing first or second maxillary molars were excluded from the study. Also not included were persons whose maxillary molars were affected by dental caries or any other defects or disturbances that made observations unreliable. The examinations were carried out in natural light using a dental mouth mirror and a dental explorer.

## Results

The results are presented in Tables 1 and 2. The incidence of individuals showing the cusp according to sex and percentage is presented in Table 1. A total of 454 persons (17.43%) exhibited the "positive" cusp of Carabelli; this varied from one to four in any one individual. This 17.43% compares with the 18.7% found in the English<sup>12</sup> and 19.7% found in Finns,<sup>10</sup> but is much lower than the 30.2% recorded for Germans,<sup>16</sup> 38.2% for American whites,<sup>17</sup> and 38.17% in Yugoslavs.<sup>18</sup> Men appear to be slightly more affected than women (18.81% to 16.28%) a ratio of ap-

**Table 1** Incidence of individuals showing cusp according to sex and percentage

Sex	Number examined	Number showing cusp	percentage
Male	1,191	224	18.81% (8.60%)
Female	1,413	230	16.28% (8.83%)
Total	2,604	454	17.43%

proximately 1.2:1.

The distribution of the cusp of Carabelli among the maxillary molars is presented in Table 2.

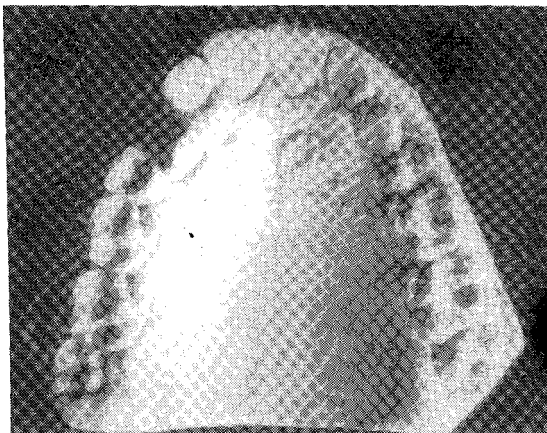
All maxillary molars are involved in this study. Bilateralism in the upper first molars accounted for 70.71% of the total, (Fig. 1); while simultaneous bilateral involvement of the first

**Table 2** Distribution of the cusp of Carabelli

Tooth/Teeth	No Involved	Percentage
/6	87	19.16%
6/	31	6.83%
6/6	321	70.71%
6/67	2	0.44%
76/67	9	1.98%
76/	1	0.22%
7/	1	0.22%
7/7	1	0.22%
8/8	1	0.22%
	454	100.00%



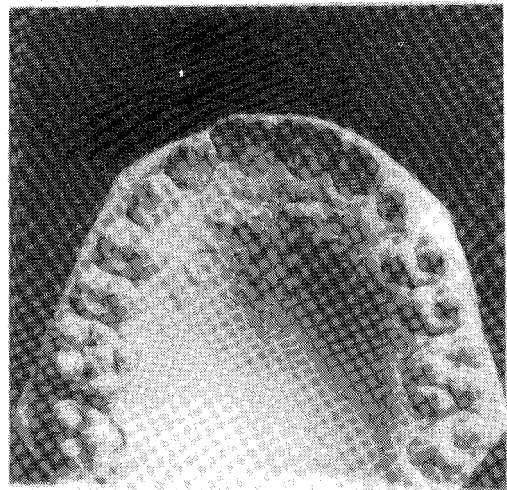
**Fig. 1** Plaster cast of upper jaw showing bilateralism in 6/6, upper first molars.



**Fig. 2** Plaster cast of upper jaw showing bilateralism in 76/67, upper first and second molars.

and second upper molars accounted for 1.98% only: (Fig. 2). Unilateralism in the right and left upper first molars accounted for over 25% of the total: (Fig. 3). The upper left molar is almost three times as affected as the right. This high degree of unilateralism is in contrast to the contention of some workers that "rare" unilateral cases do occur.<sup>8,15</sup>

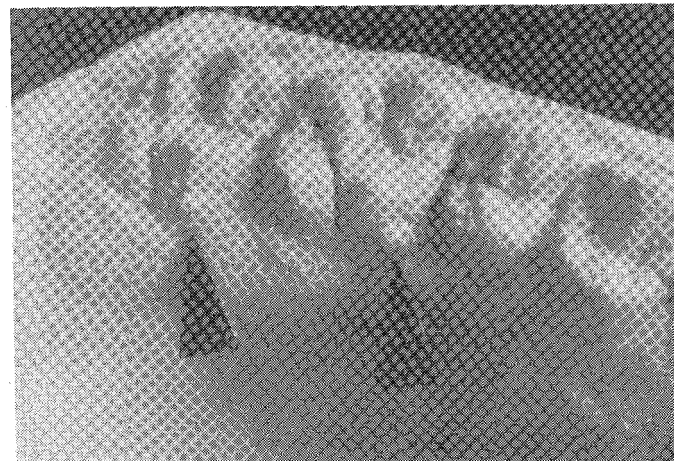
Only one case (0.22%) involving the third maxillary molars was observed. This agrees with previous findings<sup>10</sup> and is not surprising as these teeth are often congenitally missing or unerupted. No individual had more than four cusps of Carabelli



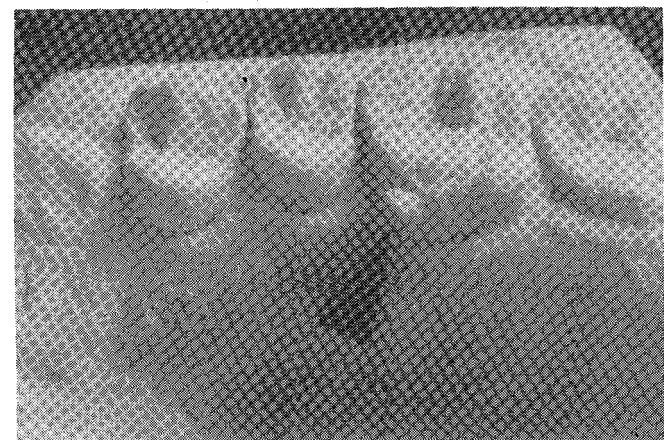
**Fig. 3** Plaster cast of upper jaw showing unilateralism in one upper first molar

in this study.

A great deal of variation in size and shape of the cusp was observed. (Figs 4a, 4b & 4c). Also some degree of asymmetry



**Fig. 4a** Plaster cast of upper jaw showing variations in size and shape of cusps.



**Fig. 4b** Plaster cast of upper jaw showing variations in size and shape of cusps.

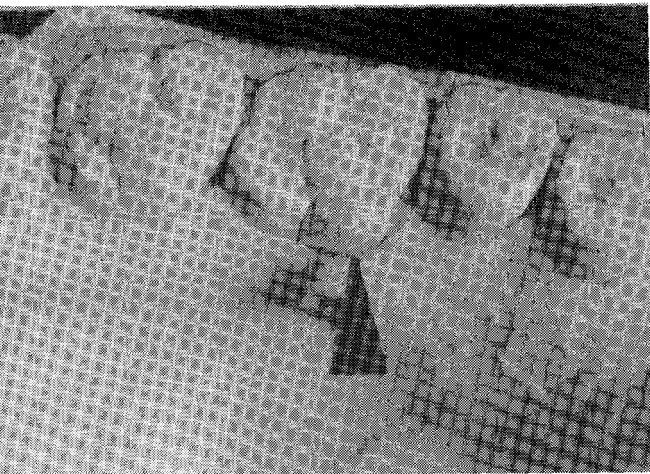


Fig. 4c Plaster cast of upper jaw showing variations in size and shape of cusps.

was noted in some of the bilateral cases. The claim that if one tooth was smooth, its contralateral never showed the cusp<sup>10</sup> or that the cusp was minimally expressed on the other molar<sup>9</sup> is at variance with the findings in this study as seen in (Fig.3).

#### Discussion

The cusp of Carabelli has never been reported to interfere with the occlusion, no matter how large it is. This is not surprising as it must have developed at the same time with the other cusps, and should wear down at the same rate as the other cusps. This is evidenced by the attrition facets observed on it. The cusp however exhibits some clinical significance. The deep groove delineating the cusp from the parent tooth is a potential stagnation area, where tooth decay could develop. A few such cases were observed which necessitated the preparation of unconventional cavities to arrest the situation.

Also in teeth where the cusp is very prominent as in (Fig.1), establishment of close adaptation of a matrix band to the tooth surface after the preparation of a Class II Mesio-occlusal cavity often proved difficult especially on the palatal embrassure wall. It invariably necessitated the use of a wedge on the palatal side in addition to the buccally placed wedge to prevent amalgam overhang and its attendant complications, of gingival irritation which could lead to chronic gingivitis which progresses to chronic periodontitis and eventual tooth loss.

The presence of the cusp of Carabelli cannot be used as the sole criterion for identifying an upper first molar as it has been found to occur solely on the second maxillary molars and to be more prominently developed than in the first molar. (Fig. 2)

It has been suggested that with more detailed knowledge of this structure it might become a new criterion for racial differentiation and may provide another genetic tool, along with blood groups for the study of race history.<sup>9</sup> More racial studies will need to be carried out however.

#### Conclusion

The incidence of the cusp of Carabelli in Nigerians compares with that of some European population,<sup>10,12</sup> but is lower than that of Germans,<sup>16</sup> American whites,<sup>17</sup> and in Yugoslavs.<sup>18</sup> This tallies with the claim that the incidence in Africans is inter-

mediate between that of Europeans and the Arctic populations.<sup>10</sup>

This study was restricted to the incidence of "positive" cusps of Carabelli as this author believes that the so called "negative" cusps – the pits and depressions should be regarded as distinct dental anomalies. A valley cannot be regarded as a "negative" mountain.

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