

## The Prevalence of Fifth Cusp (Cusp of Carabelli) in the Upper Molars in Saudi Arabian School Students

Prevalencia de la Cúspide Mesiopalatina de los Molares Superiores  
(Tubérculo de Carabelli) en Estudiantes Secundarios de Arabia Saudita

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**SUMMARY:** The cusp of Carabelli trait was first described by Carabelli in 1842. If present, it is seen on the mesial aspect of the mesiopalatal cusp of the deciduous maxillary second molar or permanent maxillary first, second and third molar. The level of expression varies from a mere pit or groove to a well developed cusp. The objective of this study was to assess the prevalence of this trait in Abha Secondary School boys in the age range of 15-20 years. 917 subjects without caries or fillings (or missing) in permanent upper first (16/26) and second molars (17/27) were selected out of the 3408 students examined. The trait was recorded as present or absent in 16/26 and 17/27 only as most of the students had erupted premolars and unerupted third molars. The trait was present in 41.7% of the population out of which 82.2% were seen on 16/26 bilaterally. It showed more predilection to permanent maxillary right first molar – 39.4% than permanent maxillary left first molar – 35.8%. Only 3.1% of the population had the trait on 17/27. These results are in contrast with the prevalence studies carried out in Riyadh - 57.6% and Jeddah - 58.7%. Nevertheless, it places the Saudi population in moderate CT prevalence group.

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**KEY WORDS:** Carabelli Trait; Dental cusp; Accessory cusp; Prevalence; Secondary school boys.

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### INTRODUCTION

The fifth cusp in the upper molars or Carabelli trait (CT) is the most commonly occurring dental morphological characteristic (Mavrodisz *et al.*, 2007) that is useful in forensic, anthropological and ethnic studies. It has no established etiology, nor known function or clinical importance. However, since its first description in 1842 (Mitchell, 1892), there have been a plethora of studies done on different populations, living and archaeological. The studies involved its prevalence, expression, size, shape, symmetry, dentition predilection, inheritability, morphogenesis and its association with fluoride and nutrients intake. If present, the level of expression of CT varies from a mere pit or groove to a well developed cusp. As minute as it is, CT has been classified into a maximum of eight categories (Cox *et al.*, 1961) and has been given innumerable names; trait of Carabelli, tubercle of Carabelli, molar tubercle, enamel elevation, fifth cusp, accessory cusp, mesiopalatal prominence and tuberculum anomalum.

The phenotypical appearance of the trait is attributed to a dominant Mendelian gene (Dietz, 1944) and also to the intake of fluorides (Cox *et al.*), vitamins, nutrients (Paynter & Grainger, 1956) and the size of the jaws. Therefore, it is a result of interaction between genetic and environmental factors (Biggerstaff, 1973). If one were to put forward the single most significant aspect of CT it would be its ethnic variation. For example, a distinct contrast in prevalence is accepted in Caucasian and mongoloid races (Dahlberg, 1951). It is a predominant odonto-ethnic marker as was described by Lee & Goose (1972). This vindicates the genetic probability of its etiology and inheritability.

Prior to this study there have been two separate studies reported on prevalence of CT in different Saudi populations. The objective of this study therefore, was to assess the prevalence of the CT in Secondary School boys in Abha region and compare it with the aforementioned studies.

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## MATERIAL AND METHOD

This study was part of an 'Oral Health Screening program' carried out in all the Secondary Schools in the Southern city of Abha. Twenty Boys Schools were visited over a period of 3 months. 917 Saudi students between the age of 15 and 17 years were selected out of the 3408 examined based upon the following three criteria.

1. All four permanent maxillary first (16/26) and second molars (17/27) were present.
2. The 16/26 and 17/27 did not have dental caries or restorations.
3. All of them were Saudi nationals.

The data was collected from oral examination by seven experienced examiners from King Khalid University, College of Dentistry. All examinations were done in the schools in sufficient lighting conditions. Examination gloves, mouth mask, sterile wooden spatula and a torch light were used for examination. Smooth palatal aspect of mesiopalatal cusp of the above mentioned molars, was recorded as 'trait absent'. The presence of a groove or elevation in the form of a tubercle or cusp was recorded as 'trait present'. Prevalence of CT was calculated as percentage values. Sexual dimorphism was not assessed as the study involved visits to Boys schools only. The maxillary third molars were not used as the school children were less than 17 years of age and primary molars had exfoliated.

## RESULTS

Table I. Prevalence of Carabelli Trait Saudi Population in Abha region.

	Present	Absent	Total	Percentage
<b>16/26</b>	383	534	917	41.7%
<b>17/27</b>	29	888	917	3.1%

Table II. Prevalence of Carabelli Trait in 16/26 and 17/27.

	CT Present	CT Absent	Total	Percentage
<b>16</b>	362	555	917	39.4%
<b>26</b>	329	588	917	35.8%
<b>17</b>	24	893	917	2.6%
<b>27</b>	24	893	917	2.6%

Table III. Bilateralism observed in 16/26 and 17/27.

	Bilateralism	Total CT	Percentage
<b>16/26</b>	315	383	82.2%
<b>17/27</b>	17	29	58.6%

To avoid intra observer variance in a huge sample size of 917 subjects this study excluded the assessment of level of expression of the trait. The prevalence of CT was 41.7% of the study population (Table I). Amongst the subjects that had the trait, 16/26 bilateralism was observed in 82.24% (Table III). It occurred more on the permanent maxillary right first molar (39.4%) than permanent maxillary left first molar (35.8%) (Table II). Only 3.1% of the study population had the trait on 17/27 (Table I). Interestingly the occurrence on permanent maxillary right second molar and permanent maxillary left second molar was same - 2.6% respectively (Table II). 17/27 bilateralism was observed in only 58.6% of the subjects (Table 3). Only one subject had the trait on 17/27 (bilaterally) while it was missing on 16/26.

## DISCUSSION

Kraus (1951) and Alvesalo *et al.* (1975) described dental characteristics as western (which includes CT) and eastern characteristics. A general perception in this regard is that Caucasians show high frequency than the oriental races (Hsu *et al.*, 1997). To correlate the frequency of CT with different populations the author of this study categorized groups into high CT prevalence (2/3's frequency), moderate CT prevalence (between 1/3 and 2/3 frequency), and low CT prevalence (1/3's frequency) populations. High prevalence was recorded in North West Europe origin Americans (Meredith & Hixon, 1954) while Eastern Greenland Eskimos had no CT at all (Pederson, 1949). Russians (Carbonell, 1960), Brazilians (Ferreira *et al.*, 2010; Sousa *et al.*, 2000), Malaysians (Rusmah, 1992), Saudis (Shethri, 2011; Solako & Bello, 1998) and mixed Europeans (Diamond, 1952) exhibit moderate CT prevalence. Similar to previous Saudi studies (Shethri; Solako & Bello) the prevalence of CT in the current study (41.7%) lies in moderate CT prevalence group. Table IV shows comparison of CT-prevalence on some of the population groups.

Results in this study are in mild contrast with studies carried out on smaller samples in Riyadh - 57.6% in 276 subjects (Shethri), and Jeddah - 58.7% in 250 subjects (Solako & Bello). Both the later and the former studies included subjects that were patients reporting to dental clinics and most likely representing a conglomeration of different ethnic Saudis. The current study screened all the secondary school Boys in Abha region most likely representing a big cross section of the community. It may be fair to say that the difference may have risen because of mixed ethnicity in cities of Riyadh

Table IV. Bilateralism observed in 16/26 and 17/27.

High CT prevalence - <75%	Moderate CT prevalence – 25%~75%	Low CT prevalence - >25%
North West European origin Americans – 83.5% (Meredith & Hixon, 1954)	Saudi Arabians – 57.6% (Shethri, 2011), 58.7% (Salako & Bello, 1998), 41.7% (current study)	Eastern Greenland Eskimos – 0% (Pederson, 1949)
Finish population – 79% (Alvesalo <i>et al.</i> , 1975)	Brazilians – 51.6% (Ferreira <i>et al.</i> , 2010), 57.8% (Sousa <i>et al.</i> , 2000)	Modern Chinese – 21% (Oshima, 1949)
Aboriginal Australians – 80% (Townsend & Brown, 1981)	Russians – 50% (Batujeff, 1986)	Japanese – 10.7% (Carbonell, 1960)
South Africans – 79.2% (Keiser, 1984)	Mixed Europeans – 50% (Carbonell, 1960)	Asian school children – 26% (Hassanali, 1982)
Nigerians - 78.4% (Salako <i>et al.</i> , 1993)	Malaysians – 51.6% (Rusmah, 1992)	
Indian Hindus – 88.2% (Joshi, 1975)	Indians – 52.7% (Kanappan & Swaminathan, 2001)	

and Jeddah. A unanimous agreement of higher association of CT with 16/26 than 17/27 and bilateralism is evident in the literature including this study.

In conclusion, CT seems to be more common in the city dwellers of Saudi Arabia than in the tourist town of Abha. Modern Saudi society comprises of people of different ethnicity ranging from the Arab world, North Africa, Cen-

tral, South and South East Asia. Riyadh and Jeddah are modern cosmopolitan cities where a wide spectrum of ethnically diverse Saudi population coexists. Abha on the other hand has uniformity and identicalness in its ethnography. Drawing conclusions from this study it would be interesting to examine the prevalence of CT in the different indigenous tribes, namely: the Qahtani's and the Adnanis of Kingdom of Saudi Arabia.

SADATULLAH, S.; ODUSANYA, S. A.; MUSTAFA, A.; ABDUL RAZAK, P.; ABDUL WAHAB, M. & MEER, Z. Prevalencia de la quinta cúspide (Tubérculo de Carabelli) en los molares superiores en estudiantes escolares de Arabia Saudita. *Int. J. Morphol.*, 30(2):757-760, 2012.

**RESUMEN:** La cúspide o tubérculo de Carabelli, fue descrita por primera vez por Carabelli en 1842. Si está presente, se observa en la cara mesial de la cúspide mesio-palatina del segundo molar superior permanente o temporal, segundo y tercer molar permanentes. El nivel de expresión varía desde una simple fosa a una cúspide bien desarrollada. El objetivo de este estudio fue evaluar la prevalencia de este tubérculo en los alumnos de escuelas secundarias de Abha en el rango de edad entre 15-20 años. 917 sujetos sin caries ni obturaciones (o extracción) en los primeros (16/26) y segundos (17/27) molares maxilares permanentes fueron seleccionados entre 3408 alumnos examinados. El tubérculo se registró como presente o ausente en 16/26 y 17/27 de los molares, la mayoría de los estudiantes tenían erupcionados los premolares y no erupcionados los terceros molares. El tubérculo estuvo presente en el 41,7% de la población estudiada, fuera de la cual se observó en el 82,2% sobre 16/26 bilateralmente. Hubo mayor predilección por el primer molar permanente del lado derecho, un 39,4%, en comparación al lado izquierdo, 35,8%. Sólo el 3,1% de la población tuvo el tubérculo sobre 17/27. Estos resultados contrastan con los estudios de prevalencia realizados en Riyadh con 57,6% y Jeddah con 58,7%. Sin embargo, coloca a la población de Arabia Saudita en el grupo de moderada prevalencia del tubérculo de Carabelli.

**PALABRAS CLAVE:** Tubérculo de Carabelli; Cúspide dental; Cúspide accesoria; Prevalencia; Alumnos de escuela secundaria.

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