

## SUPERNUMERARY OCCLUSAL CUSPS

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### Abstract

Supernumerary (central) cusps which can appear on the occlusal surface of the teeth, have already been grouped by many scientists. The most comprehensive grouping of the premolar cusps is that by SCHULZE (1987). However, particular occlusal cusp forms may occur on the molar teeth, and cusp-like protrusions may develop on the incisors and the canine teeth, though these are not identical with the palatal (talon) cusp.

Occlusal cusp forms on the premolar teeth may be as follows: 1. cone-like reinforcement of the lingual cusp, 2. supernumerary occlusal cusp appearing lingually, independently from the lingual cusp, 3. dens evaginatus protruding from the buccal cusp or the occlusal groove, 4. occlusal enamel pearl, 5. lingual protrusion of the buccal cusp, 6. occlusal cusp formation in lobodontia syndrome.

The various forms of occlusal cusps can be distinguished by the following criteria: morphological characteristics, the relation of the particular forms to tooth types, and racial relationship. A distinction would allow determination of the ethnicity of the dentition.

*Key words:* occlusal cusps, premolar, molar, other teeth, morphological characteristics, racial relationship.

### Introduction

On the occlusal surface of the teeth, the contact surface of the upper and lower premolars and molars, can be found several cusps. The upper premolars and the first lower premolars have 2, the second lower premolars 2 or 3, the upper molars 3 or 4, and the lower molars 4 or 5 cusps.

The supernumerary cusps of the molars (6th and 7th cusps) can develop among the normal number of cusps situated vestibularly or orally next to each other. The Carabelli, paramolar and other cusps may be found on the vestibular and oral crown surfaces of the premolars and, more often, the molars (MORRIS, 1967; SCHULZE, 1987).

The occlusal supernumerary cusps are the central cusps among those on the occlusal surface on the buccal and lingual side. The first description was that by LEIGH (1925), who reported an enamel tubercle on the occlusal surface of the third upper right molar of an Eskimo skull. The different forms of these tubercles were grouped according to their situations and shapes by LAU (1955), MERRILL (1964), and SCHULZE

(1987), mainly for premolars. However, these cusps may also be found, though in different forms, on the molars, and they have also been described (LAU, 1955; OEHLERS, 1956; ALLWRIGHT, 1958; MERRILL, 1964), on the incisors and the canine teeth. They are not to be confused with the enlarged palatine tubercle, the talon cusp (MELLOR and RIPA, 1970).

### Forms of occlusal cusps

LAU (1955) set up two groups: cusps grown out of buccal cusps, and cusps grown out of the middle of the occlusal surface. They can be smooth, grooved, terraced or ridged.

MERRILL (1964) accepts LAU's conclusion of two groups on the premolars. In the first group, the protrusion appears on the lingual ridge of the buccal cusp; in the second, it arises from the groove. The second group involves a sub-group: the double lingual cusp (MERRILL observed one case, on a lower tooth).

SCHULZE (1987) distinguished six different shapes on the premolars, and stated that they are mainly characteristic of the Mongoloid race, and rare in other populations. The shapes are as follows:

1. A cone-like enlargement of the lingual cusp. This is a gradually strengthening serial characteristic, with the following phases:

1/a. A cone-shaped oral cusp reinforced in the vestibular direction.

1/b. A significantly enlarged lingual cusp with distinct marginal wrinkles.

1/c. A separately developed central cusp on the lingual crown side. The marginal wrinkles merge and form a cingulum.

2. Similar to the previous one, but here the original lingual cusp is clearly seen beside the central cusp. As described earlier (KOCSIS, 1984), it occurs in Europeans, too.

3. This is the best-known central cusp. JYOJIMA (1929), MATSUMURA (1934), and YUMIKURA and YOSHIDA (1936) described such occlusal cusp formation on the premolars. In the first frequency study, KATO (1937) found 1.09% on the premolars of the Japanese.

An earlier article (KOCSIS, 1984) listed 13 names for this disorder. YIP (1974) recommends the term *dens evaginatus*, used by several authors previously, and still accepted today.

The practical significance of the disorder is that, during the use of the tooth, the elevation sooner or later becomes damaged, breaks off or wears away. In a large majority of the cases, the root canal opens and the pulp chamber becomes infected. As a result of the malocclusion of the teeth, complications can develop: there will be an irregular development of the root, and the tooth will become irregularly positioned and loose.

Evagination can accompany other developmental irregularities. YIP (1974) found invagination, an extra premolar and mesiodens. SENIA and REGEZI (1974) reported the evagination of premolars and also lower three-rooted molars.

This type of occlusal cusp has been described only on premolars in the LAU (1955) and MERRILL (1964) classification. Cusps on molars and occlusal pearls are not included in the evagination referred to above. The evagination that appears on canines and incisors is also of a different character, but it has the same practical significance as a result of the vulnerability of the elevation (LAU, 1955; OEHLERS, 1956; ALLWRIGHT, 1958; MERRILL, 1964; GOTO et al., 1979; SHEY and EYTEL, 1983).

Table 1. The prevalence of dens evaginatus, and its racial relationship

Year of paper	Author(s)	Investigated population	No. of affected persons	%
1936	Yumikura and Yoshida	Japanese	17	-
1937	Kato	Japanese	-	1.09
1949	Pedersen	Eskimo (Greenland)	5	0.50
1955	Lau	Chinese	27	1.29
1955	Wu	Chinese	19	1.44
		Chinese	16	1.52
1956	Oehlers	Malays	110	-
1959	Sumiya	Japanese	-	1.88
1964	Merrill	Eskimo (Amerindian)	28	4.30
1967	Oehlers et al.	Chinese (Malays)	43	-
1970	Curzon et al.	Eskimo (Canada)	12	3.00
1974	Yip	Chinese	21	3.60
		Malay	3	1.10
		Indo-europoid	-	-
1975	Reichart and Tantiniran	Thai	51	1.01
1979	Goto et al.	Japanese	53	0.12
1980	Lin and Roan	Chinese (Taiwan)	305	3.52
1956	Villa	Filipino	1	-
1959	Villa et al.	Filipino	2	-
1965	Poyton and Vizcarra	Filipino	1	-
1974	Senia and Regezi	Filipino	1	-
1973	Palmer	Caucasian (British)	5	-
1974	Sykaras	Caucasian (Greek)	1	-
1977	Pearlman and Curzon	Negro	1	-
1981	Ciechanowski and Sonnenberg	Negroid	1	-

This type of cusp appears in ethnic groups that belong in the Mongoloid race, with a frequency of 0.5-4.3 (Table 1.); the term Mongoloid or oriental premolar reflects this (CURZON et al., 1970; REICHART and TANTINIRAN, 1975). It appears with different frequencies in the Japanese, Chinese, Malayan, Eskimo, Indian and Thai populations. A number of authors (POYTON and VIZCARRA, 1965; SENIA and REGEZI, 1974; VILLA, 1956; VILLA et al., 1959) have described evagination on premolars in Filipinos. The Filipinos are a mix of Mongoloid and European peoples, a Eurasian ethnic group, though according to LIPTÁK (1980) they are more Mongoloid.

As regards Negroids, the literature mentions only two cases so far. One case of dens evaginatus was found by PEARLMAN and CURZON (1977), on the second left lower premolar of a black boy, and the other by CIECHANOWSKI and SONNENBERG (1980), on both the lower first, and the second right premolar of a girl. In the latter case, one of the girl's great-grandmothers was part Cherokee Indian, but the teeth of her parents and sibling showed no evidence of the anomaly.

The above form of dens evaginatus is also very rare in Europeans. PALMER (1973) described it in four British boys and considered that the accentuated lingual aspect of the buccal cusp on the premolars of the sister of one of the boys was also a dens evaginatus. SYKARAS (1974) found this anomaly on the premolars of a Greek girl. A further case was reported by DOYLE (1970): a palatal elevation on the upper front teeth of a Norwegian boy. However, his description lacked precise documentation, so it is considered inconclusive. Similarly, a dens evaginatus observed on the upper first incisor (SHEY and EYTEL, 1983) should be regarded as a talon cusp.

4. An extra occlusal cusp is situated on the lingual surface of the vestibular cusp. It looks like an enamel pearl; the authors' term refers to this. NISHIJIMA et al. (1959) described it in Japanese as a "central tubercle on the lingual ridge of the buccal cusp of the upper bicuspid". Probably the same thing was described by PEDERSEN (1949) when he talks about "a peculiar enamel pearl-like 'cusp' on the occlusal surface" on the right upper molar of an Eskimo from Greenland. He believed that a case described by LEIGH (1925) in an American Eskimo was the same. He reported an occurrence (occlusal pearl) on an upper second premolar, in two cases unilaterally on lower second premolars, and bilaterally on a second and a first premolar pair. According to PEDERSEN, "in the East Greenland Eskimo dentition we meet with anatomical features the significance of which, if any, is obscure, ... the occlusal pearl-like excrescences."

5. KIRVESKARI et al. (1972) described the bulging of the lingual aspect of the buccal cusps in Lapps. It was observed on the buccal aspect of the buccal cusps of premolars, and also on the mesiobuccal cusp of molars. It has a symmetrical appearance and is more frequent on the upper teeth and also on the second premolars and first molars. The third molar is the least affected. Occasionally, it is to be found on the lingual aspect of canines. The dentin base does not show this bulge. The same was observed by KUTSCHA (1985) on the individual cusps. SCHULZE (1987) considered that it is population-specific; in spite of this, it has often been observed in both historical and recent findings, on both premolars and molars. KIRVESKARI et al. (1972) also believed that it occurs frequently in Northern populations. It seems likely that the accentuated lingual ridges of the buccal cusps on the premolars of a British girl mentioned by PALMER (1973) also belongs here.

6. A syndrome-forming characteristic that relates to the extra occlusal cusp is the occurrence of central cusps in lobodontia. A case was presented in this journal earlier (KOCSIS et al., 1994). The descriptions mention the appearance of occlusal cusps on both premolars and molars. Among others, ROBBINS and KEENE (1964), SHUFF (1972), EKMAN-WESTBORG and JULIN (1974), SCHULZE (1976), CASAMASSINO et al. (1978) and BROOK and WINDER (1979) describe the formation of an irregular cusp, with irregular patterns on the occlusal surface of premolars and molars. This group includes bulging buccal and extra lingual and occlusal cusps, as well as the atypical multitubercular chewing surface of molars, with the occasional appearance of central cusps.

### Discussion

The appearance of extra occlusal cusps has been seen to be a generic term which includes numerous, well-differentiated characteristics. One basis of differentiation is the morphological appearance, i.e. the deformation of the lingual or vestibular cusp or the appearance of an extra cusp not related to these. The other is the way the individual morphological forms are connected with the type of teeth. All central cusps described by the above authors (LAU, 1955; MERRILL, 1964; SCHULZE, 1987) appear on premolar teeth. Molar teeth exhibit a cusp system, which results in the teeth becoming rosette-shaped (ROBBINS and KEENE, 1964; SCHULZE, 1976; CASAMASSIMO et al., 1978), occasionally together with a cusp on the occlusal surface in lobodontia syndrome. An extra molar cusp on the occlusal surface can appear irrespective of this (LAU, 1955; MERRILL, 1964; OEHLERS et al., 1967). The molars also display bulging of the lingual aspect of the mesiobuccal cusp, and the occlusal enamel pearl described by LEIGH (1925), PEDERSEN (1949), NISHIJAMA et al. (1959) and ALEXANDERSEN and DAHLBERG (1967). The evagination, i.e. the elevation of the lingual ridge of incisors and canines, likewise belongs in this category (LAU, 1955; ALLWIGHT, 1958; MERRILL, 1964; KIRVESKARI et al., 1972; GOTO et al., 1979). The elevated incisor lobes that appear in lobodontia are also included here (ROBBINS and KEENE, 1964; SCHULZE, 1976; BROOK and WINDER, 1979; KOCSIS et al., 1994).

Another typical characteristic is the racial correlation, according to which types 1, 2, 5 and 6 occur in all (?) populations. In contrast, types 3 and 4 tend to appear in Mongoloid and Europomongoloid (Eurasian) populations and sporadically in other races.

The correlation between the disorder and biological sex is uncertain. According to YOSHIOKA and URANO (1963), YIP (1974) and GOTO et al. (1979) considered that there is no difference between its appearance in males and females; others (SUMIYA, 1959; OEHLERS et al., 1967) found it more frequently in men, whereas LAU (1955), MERRILL (1964), CURZON et al. (1970) and REICHART and TANTINIRAN (1975) believed it to occur more often in women. CURZON et al. (1970) described a three times higher frequency in women, and therefore suggested a correlation with the X chromosome. The racial correlation of the irregularity, and the examination of a few families (MERRILL, 1964; OKA et al., 1964) indicate that the dens evaginatus is inherited autosomatically and dominantly (STEWART et al., 1978). At the same time, PEARLMAN and CURZON (1977) considered it a developmental aberration.

On the above basis, we think that, in the event of a precise differentiation between the above cusp forms, it is possible to establish the racial identity of the examined dentition.

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