Talon cusp in the primary dentition: literature review and report of three rare cases

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This paper reviews the nomenclature, prevalence, definition, etiology, association with other dental anomalies, diagnosis and treatment planning of talon cusp in the primary anterior teeth. Most of the reported cases have involved the primary maxillary central incisors. However, talon cusps on the primary maxillary lateral incisors are associated with high percentages of anomalies in the permanent successors. This paper reported three such rare cases and dentists should be aware of such additional anomalies.
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NOMENCLATURE AND REPORTED CASES

In 1887, two cases of supernumerary cusps on the palatal surfaces of permanent maxillary incisors and canines, which extended not more than half the distance between the cemento-enamel junction and incisal edge were reported.[1] Five years later, Mitchell described an abnormal permanent maxillary left central incisor, in a female patient, with a curved horn-like process extending from the palatal surface to the incisal edge and the pulp extended almost into the tip of the process.[2] Since then, different names, other than horn and supernumerary cusps have been used to describe the same phenomenon; for example, hyperplastic cingulum,[3] evaginated odontome,[4] cusped cingulum,[5] accessory cusp,[6] dens evaginatus,[7] and supernumerary lingual tubercle.[8] In 1970, Mellor and Ripa used the term talon cusp because of the anomaly resembled an eagle's talon.[9] They defined talon cusp as a cusp-like structure projecting from the cingulum area of a maxillary or mandibular incisor with a varied length which may extend past the incisal edge of the tooth. However, they stated that talon cusp, which was an unusual and relatively rare anomaly, had only been reported on permanent teeth.

The often quoted first report of a talon cusp in the primary dentition, which appeared in the English literature in 1976, described the anomaly on a primary left maxillary central incisor of a mummy from southern Peru, which was approximately 2200 years old.[10] However, in 1950, seven cases were noted in 63 cleft lip and palate patients, aged from three to seven years with the anomaly presented as a T-form hyperplastic primary maxillary lateral incisor.[11] These incisors were characterized by having a pronounced tuberculum dentis which was attached to the incisal edge by a crista, resulting in a T-form. In 1977, a 4-year-old Filipino girl with a talon cusp which projected from the cervico-lingual ridge to within two millimeters of the incisal edge of a discolored primary left maxillary central incisor was reported; this was probably the first case report of a talon cusp on a primary incisor of a non-cleft patient in the English literature.[12] In the same year, a report written in Japanese described nine cases of talon cusps in the primary dentition; seven involved the maxillary central incisors, one was on a maxillary lateral incisor and one case involved all four canines.[13]

The first report in the English literature involving a case of bilateral primary maxillary central incisors was in a book.[14] Since then, a number of cases involving talon cusps on primary maxillary central incisors, either unilateral or bilateral distributed, had been reported (Table 1). A talon cusp on a primary lateral incisor was not reported until 1985.[15] This case involved a 5-year-old white boy with a prominent, vertical enamel-covered ridge, diagnosed as talon cusp, on his primary maxillary right lateral incisor. Histological examination failed to reveal any pulp horn in the cusp. In 1999, the first and only case of a talon cusp on a primary mandibular incisor was reported in an Indian girl with a talon cusp on the primary mandibular left lateral incisor which extended to the middle third of the crown.[16]

A total of 55 cases of talon cusp in the primary dentition have, to date, been reported in the English literature (Table 1); this includes 11 cases in syndromic or cleft lip and/or palate patients[11,17-19] and a further seven cases were found in a survey report which did not provide details.[20] Among the 37 documented cases in normal children, 13 involved bilateral maxillary central incisors (Table 2). Of the 24

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Table 1. Report of talon cusps on primary teeth published in the English literature

Number	Authors	Year	Reference	Ethnic origin	Gender	Tooth	Permanent successor	Medical history
1	Bøhn	1950	11	Danish	M	62	normal	cleft lip patient
2				Danish	F	supernumerary 52	reduced 12	cleft lip patient
3				Danish	M	62	supernumerary 22 (distal one reduced)	cleft lip patient
4				Danish	M	62 (tuberculum dentis)	rudimentary 22	cleft lip patient
5				Danish	F	supernumerary 62	rudimentary 22	cleft lip and alveolus patient
6				Danish	M	supernumerary 52, 62	missing 12	cleft lip and alveolus patient
7				Danish	M	supernumerary 52	small atypical, malformed 12	cleft lip and alveolus patient
8	Sawyer et al	1976	10	Peru (2200 year ago)	?	61	normal	
9	Henderson	1977	12	Filipino	F	61	normal	
10	Mass et al	1978	59	?	M	61	too young to confirm	
11	Davis et al	1981	14	?	?	51,61	no mention	
12	Happle and Vakilzadeh	1982	17	German	F	52,51,61,82	upper incisors also affected	hypomelanosis of Ito
13	Natkin et al	1983	25	?	?	61	no mention	
14	Jou et al	1985	48	Chinese	F	51	no mention	
15	Mader and Kellogg	1985	15	American	M	52	no mention	
16	Davis and Brook	1986	45	Chinese	M	51,61	no mention	
17				Chinese	M	51,61	no mention	
18				Chinese	M	51	no mention	
19				Chinese	M	51,61	no mention	
20				Chinese	F	51	no mention	
21				Chinese	M	51	no mention	
22	Chen and Chen	1986	31	Chinese	M	51,61	too young to confirm	
23				Chinese	F	61	inverted mesiodens at 11*	
24				Chinese	M	61	too young to confirm	
25				Chinese	M	61	too young to confirm	
26				Chinese	M	51	no mention	
27				Chinese	M	61	no mention	
28	Morin	1987	58	Hispanic	M	51,61	too young to confirm	
29	Reddy and Mehta	1989	54	Indian	F	52	two permanent successors	
30	Meon	1990	63	Malay	M	61	normal	
31	Salama et al	1990	18	American	M	supernumerary lateral incisor	no mention	cleft lip patient
32	Hennekam and van Doorne	1990	19	Dutch	?	one incisor	no mention	Rubinstein-Taybi Syndrome
33	Acs et al	1992	55	Hispanic	M	52	supplemental 12	
34	Liu and Chen	1995	32	Chinese	twin F	51,61	too young to confirm	
35				Chinese	twin F	61	too young to confirm	
36				Chinese	twin F	51,61	normal	
37				Chinese	twin F	51,61	normal	
38-44	Ooshima et al	1996	20	Japanese	4 Male, 3 Female	maxillary lateral incisor and canine, mandibular canine	no mention	
45				Japanese	?	51	no mention	
46	Hattab and Yassin	1996	53	Jordanian-Arab	M	51,61**	too young to confirm	
47	Hattab et al	1998	41	Jordanian-Arab	F	53,63	missing 23	Ellis-van Creveld syndrome
48	Hedge and Kumar	1999	16	Indian	F	72	no mention	
49	Sarkar and Misra	2000	60	Indian	M	61	no mention	
50	Güngör et al	2000	61	Turkish	M	51,61	too young to confirm	
51	Hsu et al	2001	33	Chinese	M	51,61	normal	
52				Chinese	M	51,61	no mention	
53	Tsai and Chang	2003	62	Chinese	F	51	no mention	
54	Tiku et al	2004	56	Indian	M	62	supernumerary lateral 22	
55	Mays	2005	57	British (600 years ago)	?	62	supernumerary lateral 22	

* at adjacent central incsior

** supplemental 62

Table 2. Distribution of talon cusps on primary teeth reported in the English literature according to tooth type and gender

Tooth	Gender	Number
52	M	2
	F	1
51	M	3
	F	3
	no mention	1
61	M	6
	F	3
	no mention	2
62	M	1
	no mention	1
72	F	1
51, 61	M	9
	F	3
	no mention	1

unilateral cases, one case was found on the mandibular lateral incisor;[16] five cases were identified on the maxillary lateral incisors while 18 cases were found on the maxillary central incisors.

Prevalence

Studies on the prevalence of talon cusp were mainly on the permanent dentition and rarely on the primary dentition (Table 3). An early study of Uganda schoolchildren showed that the prevalence of cusped central incisor was 2.5%5 while the prevalence of talon cusp in a group of American children aged 2-12 years was reported to be 0.17%; however, the study did not mention whether it related to the primary or permanent dentition.[21] A later study in Mexico found the prevalence of talon cusp in the permanent dentition to be 0.06%,[22] while another study in Malaysia found a prevalence of 5.2%.[23] Using a looser definition of talon cusp, that is, a demarcated projection of a millimeter or more present on the lingual surface of anterior teeth, the prevalence in a sample of children in North India was 7.7%.[24]

Although talon cusp on permanent teeth was initially recognized as an unusual and relatively rare anomaly,[9] some authors have suggested that the incidence should be much higher.[25-27] A study of Japanese children found that the prevalence of talon cusp in the permanent dentition was 0.9% while that in the primary dentition was 0.6%, one-third of the cases being the maxillary lateral incisor and two-thirds being the maxillary and mandibular canines respectively.[20] Recent studies of Israeli patients[28] and Pakistany adults[29] showed that the prevalences of talon cusps on permanent teeth were 1% and 2.4% respectively. A review of the literature by al-Omari and co-workers revealed that permanent teeth are affected with talon cusp three times more frequently than primary teeth and it is more frequent in males than in females with a ratio of 3.5:1 in the primary and 1.8:1 in the permanent dentition.[30] However, it has been suggested that the incidence of talon cusp in the primary dentition may not be lower than that in permanent dentition.[31,32] The contributing factors for the disparity in prevalence includes variations in ethnic group, age, sampling populations and the criteria used to define talon cusp.[33]

Definition of talon cusp

The term talon cusp has been used loosely in various studies and there are no strict diagnostic criteria to define it. Madar suggested that the term should be reserved to describe only those anomalous cusps of succedaneous incisor teeth that prominently project from the lingual surface of the tooth; are morphologically well delineated; and extend at least half the distance from the cementoenamel junction to the incisal edge.[34] Lesser cusplike formation in the cingulum area of succedaneous incisor teeth should be referred to as "enlarged cingula" or "prominent cingula". Although Chawla and his co-workers defined talon cusp as a demarcated projection of a millimeter or more present on the lingual surface of anterior teeth,[24] Natkin and his co-workers stressed the need to define talon cusps more precisely and suggested the use of the more general term, hyperplastic cingulum.[25] A more detailed classification of talon cusp was proposed by Hattab and his co-workers who classified talon cusp into true talon (type 1), semi-talon (type 2) and trace talon (type 3).[35] True talon represents a morphologically well-delineated additional cusp that prominently projects from the palatal surface of a primary or permanent anterior tooth and extends at least half the dis-

Table 3. Prevalence of talon cusps on primary teeth reported in the English literature

Authors	Year	Reference	Country	Subject	Subject Number	Denition	Prevalence
Barnes	1969	5	Uganda	primary schoolchildren	1797	permanent maxillary central incisors	2.50%
Chawla et al	1983	24	North India	10-16 yrs schoolchildren	1083	permanent anterior teeth	7.66%
Buenviaje and Rapp	1984	21	USA	2-12 yrs University clinic patients	2379	No mention	0.17%
Sedano et al	1989	22	Mexico	5-14.5 yrs schoolchildren	32022	permanent incisors	0.06%
Meon	1991	23	Malaysia	7-13 yrs University clinic patients	536	permanent incisors	5.20%
Ooshima et al	1996	20	Japan	3-6 yrs kindergarten pupils	905	primary anterior teeth	0.60%
				15-18 high school students	745	permanent anterior teeth	0.90%
Dankner et al	1996	28	Israel	University patient	1350	permanent anterior teeth	1%
Sobhi et al	2004	29	Pakistan	18-30 yrs Armed Force Institute patients	450	permanent anterior teeth	2.40%

tance from the cementoenamel junction to the incisor edge. Semi-talon describes an additional cusp of a millimeter or more but extending less than half the distance from the cementoenamel junction to the incisal edge. It may blend with the palatal surface or stand away from the rest of the crown. Trace talon describes enlarged or prominent cingula and their variations, i.e. conical, bifid or tubercle-like. Based on reports of facial talon cusp,[36-38] the classification was modified to include the facial talon cusp.[33] Semi-talon (type 2) was renamed as minor talon and the height was defined more specifically as an extension of more than one fourth, but less than half the distance from the cemento-enamel junction to the incisal edge while type 3 was defined as a cingulum less than one fourth the distance.

Etiology

Talon cusps on permanent teeth have been reported in patients with Mohr syndrome,[39] Sturge-Weber syndrome[31] and Rubinstein-Taybi syndrome[19,40] while talon cusps in primary teeth have been reported in patients with cleft lip and palate,[11,18] Rubinstein-Taybi syndrome,[3,19] hypomelanosis of Ito[17] and Ellis-van Crevald syndrome.41 A 4-year-old girl affected by hypomelanosis of Ito reportedly had multiple talon cusps affecting three primary maxillary incisors and a primary mandibular right lateral incisor and also the maxillary permanent successors. However, it was mentioned that, in contrast to ordinary talon cusps, the outgrowths were of hamartomatous origin.[17]

It has been suggested that talon cusp might occur as a result of an outward folding of the inner enamel epithelial cells and a transient focal hyperplasia of the mesenchymal dental papilla.[42] Talon cusp has also been viewed as one end of a range of hyperactivity of the dental lamina with the other end being a supernumerary tooth.[43] Moreover, it has been suggested that a talon cusp may be the result of fusion of a normal and a supernumerary tooth.[10,19] The fact that talon cusp in the permanent dentition usually affects the maxillary lateral incisors while in the primary dentition the maxillary central incisors are affected suggests that the etiological factors for permanent teeth and primary teeth may be different.[33] The various reports of talon cusps on primary maxillary central incisors affecting two pairs of twins from different families[32] and talon cups in permanent incisors of cousins, siblings or parents[42,44-47] may imply that talon cusp has a genetic etiology. It is most likely that talon cusp is determined by a multifactorial etiology, involving both genetic and environmental factors.[30,45,48]

Association with other dental anomalies

Talon cusps on permanent incisors have been associated with other odontogenic anomalies such as peg-shaped lateral incisor,[9] ectopic canine,[34] complex odontome,[25] inverted mesiodens,[34,49] erupted mesiodens,[45] erupted supplemental maxillary lateral incisor,[50] a missing premolar in the same quadrant,[48] missing maxillary canine in the same quadrant,[51] a missing contralateral maxillary canine,[35] dens invaginatus of the contralateral maxillary lateral incisor,[42,45] dens evaginatus of the mandibular second premolar,[23,45] transposition of a mandibular lateral incisor and canine[45] and an inverted mandibular second premolar.[52] As dental anomalies, except double tooth, are rarer in primary than in permanent dentition, there have been very few reports of dental anomalies associated with talon cusp in the primary dentitions of non-cleft and non-syndromic patients. A rare case of supplemental primary maxillary left lateral incisor in association with bilateral talon cusps in primary maxillary central incisors has been reported.[53] A case of talon cusp on the primary maxillary left central incisor was reported to have an inverted mesiodens in the contralateral central incisor region[31] while four cases of permanent supernumerary lateral incisors were associated with a talon cusp on the primary maxillary left lateral incisor.[54-57] This association reportedly also happened in cleft lip and/or palate children[11] and in a patient suffering from hypomelanosis of Ito, the incisors of both dentitions being affected by talon cusps.[17]

Diagnosis and Treatment

Talon cusps on primary teeth may cause similar oral health problems as those on the permanent teeth.[58] However, periodontal problems resulting from excessive occlusal force and tempormandibular joint problems have not been reported in the primary dentition. The nature of problems arising from a talon cusp depends on the size of the cusp and smaller talon cusps usually present fewer problems. A large cusp may be visible and unaesthetic[48,59] and may also cause traumatic occlusion and displacement of opposing teeth.[45,53] A large talon cusp may also irritate the lower lip[60] or the tongue, adversely affecting speech[17] or disturb breast feeding.[53,61] A talon cusp in an unerupted tooth may be misdiagnosed, radiographically, as a supernumerary tooth, odontome or dens in dente. It has been suggested that radiographs of the suspected area should be made form different angles, in which the talon cusp will create two thin white lines converging from the cervical portion of an affected tooth towards the incisal margin, whereas a supernumerary tooth will present as separate images of the teeth and dental follicles.[31] An unfortunate case had been reported in which a talon cusp on a partially erupted primary maxillary central incisor in a 14-month-old boy was misdiagnosed as a supernumerary tooth, and he underwent surgical exposure of the tooth under general anesthesia, which highlights the need for accurate diagnosis.[33] The presence of developmental grooves and fissures at the junction between the talon cusp and the tooth inevitably causes plaque accumulation and the tooth is thus prone to caries.[12]

Most reported cases of talon cusps on primary teeth did not mention the treatment or no active treatment was indicated, possibly because of two reasons. Some cases were discovered as early as one to two years of age,[48,59,62] so they required follow-up only, while other cases were seen at older ages, meaning that the teeth had been in place for several years, possibly without symptoms or the teeth were near to the time of exfoliation. The treatment of talon cusp depends on the size of the talon cusp. In the case of mild occlusal interference, slight reduction of the talon cusp can be effectively carried out.[31] However, it has been suggested that large talon cusps, especially those that are separated from or stand clear of the lingual surface of the normal portion of the tooth, may contain pulp tissue.[15,61] A case of sharp and prominent bilateral talon cusps on the primary maxillary central incisors of a 17-month-old boy has been successfully treated by grinding of the tip of the cusps followed by application of fluoride varnish as a desensitizing agent.[53] Nevertheless, pulpal tissue may extend to a point where radical reduction of that cusp would result in pulp exposure.[18,45] Moreover, it has been suggested that selective grinding of the entire lingual surface, instead of cutting the tip of the cusp, produced a much larger surface area for odontoblasts to produce reparative dentine.[7] Prophylactic sealing of the deep lingual grooves has been advocated for talon cusps on primary

teeth1[2,32,33,58] and in cases in which caries has developed, restoration[32] or crowning of the tooth[63] can be performed. Root canal treatment[12,62] or extraction[32,45,61] should only be carried out if the pulp is involved. It cannot be overemphasized that, in the primary dentition, it is important to regularly monitor the occlusion during the eruption of a tooth with talon cusp as well as the opposing teeth in order to prevent a potential crossbite or malposition of a tooth.[33]

Case report

Case 1

A 6 years 11 months old Chinese boy attended for a routine dental check-up. The medical history was non-contributory. Clinical examination showed that the patient was in the early mixed dentition with all of the permanent central incisors and first molars erupted and the primary mandibular right lateral incisor and canine was a double tooth. There was a talon cusp on the palatal surface of the maxillary right primary lateral incisor extending to half the crown height which was symptomless (Fig. 1). Radiographic examination showed that the permanent successor was also affected by a talon cusp of a larger size (Figure 2) and the permanent mandibular right lateral incisor was missing. The patient was placed under regular review and at a visit one and a half years later, when the patient was 8 years 5 months old, the permanent maxillary right lateral incisor had erupted with a sharp talon cusp extending 2mm short of the incisal edge. The tooth was slightly buccally displaced due to an occlusal interference with the primary mandibular double tooth and the groove between the crown and the talon cusp caused food stagnation. The groove was sealed with fissure sealant while the primary double tooth was ground to eliminate the occlusal interference. The patient is currently under review to monitor the development of the occlusion.

Case 2

A 6 years 6 months old boy attended for a routine dental check-up. The medical history was non-contributory. Clinical examination showed that the patient was in the early mixed dentition with his permanent mandibular central incisors erupted. Caries was found on the two primary maxillary first molars, four primary maxillary incisors and all of the primary mandibular molars. On the palatal surface of

Figure 1: Case 1. An upper occlusal view showing a talon cusp on the palatal surface of the primary maxillary right lateral incisor.

Figure 2: Case 1. An upper anterior occlusal radiograph showing talon cusps affecting the maxillary right lateral incisors of both dentitions.

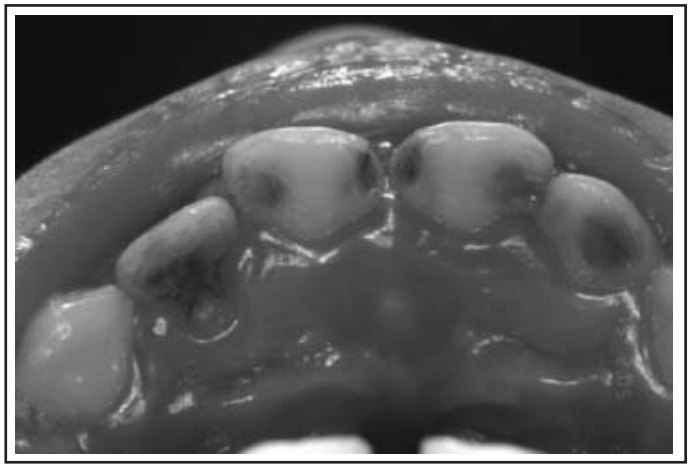

Figure 3: Case 2. An upper occlusal view showing the talon cusp on the primary right lateral incisor associated with caries.

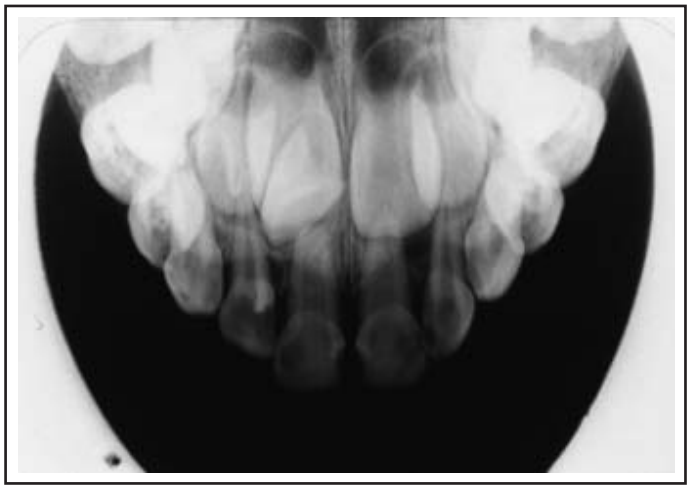

Figure 4: Case 2. An upper anterior occlusal radiograph showing talon cusps on the primary maxillary right lateral incisor and the distal supplemental permanent lateral incisor.

the primary maxillary right lateral incisor, a talon cusp was found which had been partially destroyed by caries. (Fig 3) The upper anterior occlusal radiograph showed a talon cusp on the primary maxillary right lateral incisor and a supernumerary tooth in the lateral incisor region. (Fig 4) At a subsequent visit 21 months later, the permanent central incisors had erupted and an upper anterior occlusal radiograph confirmed the presence of two permanent maxillary right lateral incisors, the distal of which had a talon cusp.

Case 3

A girl, 7 years 2 months old, attended for a routine dental check-up. The medical history was clear. The patient was in early mixed dentition stage with all permanent mandibular first molars and incisors erupted. The permanent maxillary left central incisor had erupted but the primary right central incisor was retained and firm. The primary maxillary right lateral incisor had a talon cusp on the mesio-palatal surface extending to half the crown height and a small tubercle on the disto-palatal surface. (Fig. 5) An upper anterior occlusal radiograph showed that the permanent maxillary right lateral incisor was missing and the adjacent unerupted central incisor was impacted by an odontome which was subsequently removed surgically. (Fig 6)

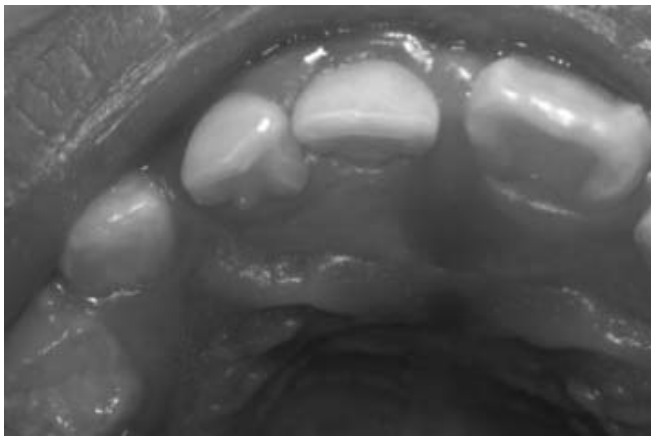

Figure 5: Case 3. An upper occlusal view showing the primary right lateral incisor with a talon cusp on the mesio-palatal surface and a small tubercle on the disto-palatal surface.

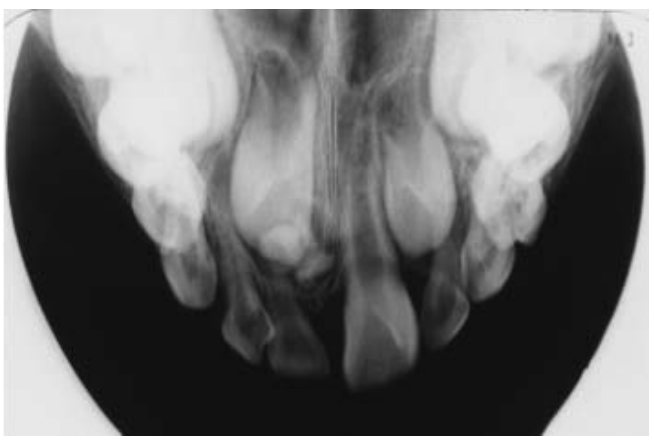

Figure 6: Case 3. An upper anterior occlusal radiograph showing a talon cusp on the primary right lateral incisor, missing permanent successor tooth and the impaction of the permanent right central incisor by an odontome.

Discussion

Among the 37 hitherto documented cases of talon cusps on primary teeth of non-cleft and non-syndromic patients, 20 were Chinese and seven were Asians including four Indians, a Malaysian, a Japanese, and a Filipino. Only seven cases of non-Asians were reported. It seems that ethnic variation plays a significant role in the etiology of talon cusp on primary teeth. Thirty-one cases involved the maxillary central incisors and only six cases involved the lateral incisors, five in maxillary arch and one in the mandibular. This paper reported three cases of a talon cusp on the maxillary lateral incisors of two Chinese boys and a Chinese girl. Case 1, besides having a talon cups in the primary maxillary right lateral incisor, had a double primary mandibular lateral incisor and canine. The authors believe that there may be an association between the two anomalies, which warrants further investigation.

It has been suggested that when a talon cusp is present in the primary dentition, the permanent dentition will be unaffected.[10,31,45] Recently a case of a talon cusp on a primary maxillary left lateral incisor was associated with a talon cusp on the contralateral permanent lateral incisor.[56] Case 1 of this report had talon cusps affecting the maxillary right lateral incisors of both dentitions while Case 2 had a talon cusp on one of the two permanent lateral incisors. An association between the supplemental permanent lateral incisor and a talon cusp on the primary predecessor has also been reported.[54-57] The anomalous primary maxillary right lateral incisor of Case 3 was unusual in that, besides the talon cusp, there was a small tubercle on the disto-palatal surface. Moreover, the permanent successor was congenitally missing and the adjacent central incisor was impacted by an odontome.

This paper presents a review the literature of talon cusps on primary teeth and reports three rare cases affecting the maxillary lateral incisor. The permanent successors of the anomalous primary teeth were affected in a completely different way with a congenital missing successor at one end of the scale and a supplemental successor at the other end. Contrary to what has been stated in the literature that when a talon cusp appears in the primary dentition, the permanent dentition will be unaffected, dentists should be cautious about the possibility of other dental anomalies being associated with the permanent successor if there is a talon cusp on a primary tooth, particularly the maxillary lateral incisor.

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