

Prevalence of ectopic eruption of first permanent molars in a Turkish population

Purpose

The aim of this study was to investigate the prevalence and characteristics of ectopically erupting first permanent molars (FPMs) in children attending the clinics of the Pediatric Dentistry Department at Istanbul University.

Materials and methods

This retrospective study was performed using panoramic radiographs of 7,649 patients (3,506 females and 4,143 males) aged from 5 to 11 years. The age and gender of the subjects, the number and location of the ectopic molars, bilateral versus unilateral occurrence, the degree of resorption of the roots of the primary molars, and other associated dental anomalies were assessed. Ectopic eruption was categorized according to a grading system based on the resorption rates of the primary molars.

Results

Of the 7,649 reviewed subjects, 203 (118 males and 85 females) were diagnosed with ectopic eruption of the FPMs, resulting in a frequency of 2.65%. The mean age of the subjects with ectopic FPMs was 6.82 ± 1.25 (range: 5–11) years. Of the 273 ectopic FPMs, 157 (57.5%) were detected in the maxilla and 116 (42.5%) in the mandible. Severe and very severe degrees of ectopic eruption were found to be more common in the maxilla than in the mandible, whereas a moderate degree of ectopic eruption was more prevalent in the mandible ($p=0.251$).

Conclusion

To our knowledge, this is the first study in a Turkish population reporting the prevalence of ectopic eruption of FPMs. Although the difference between the right and the left sides was not significant, the severity of ectopic eruption was different between the maxilla and the mandible.

Keywords: Ectopic eruption, prevalence, resorption of primary second molar, panoramic radiography, pedodontics

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Introduction

Ectopic eruption of the first permanent molar (FPM) is a local eruption disturbance characterized by the abnormal eruptive pathway of FPM causing the permanent tooth to be locked under the distal undercut of the second primary molar and failure to erupt into normal occlusal plane (Figure 1) (1-3). The prevalence of ectopic eruption of FPMs varies from 0.75% to 6% in different populations worldwide (1, 4, 5). The differences in these rates are attributed to the group size, age range of the population and caries status (6). Ectopic eruption of FPMs can be associated with other dental anomalies such as infraocclusion of primary molars (7, 8), agenesis of the second premolars (7, 9), supernumerary teeth (9) and reduced size of maxillary lateral incisors (7). Additionally, ectopic eruption of the permanent canines has been associated with the ectopic eruption of the first permanent molars (8). Although the etiology of the ectopic

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Figure 1. Intraoral view and panoramic radiograph of a 10-year-old girl with ectopically erupted maxillary first permanent molars.

FPMs is not well known, it is considered to be multifactorial, including a genetic component and local factors. The increased prevalence in siblings suggests a hereditary component (10). Possible etiologic factors of this anomaly are insufficient intercusp and anteroposterior growth of the jaws, asynchronization between eruption of the FPMs and bone growth at the tuberosity region, smaller maxilla, posterior position of the maxilla in relation to the cranial base, abnormal eruption angle or delayed calcification of the FPM, and abnormal crown morphology of the second primary molars (1, 3, 9).

Early diagnosis of this anomaly can be made during a routine radiographic examination before the eruption of FPMs, usually between five and seven years of age. The earliest radiographic sign of ectopic eruption is the superiorly and mesially directed FPMs. Clinician should also have a suspicion for ectopic eruption if there is a delay (more than 6 months) or abnormal eruption position of one or more FPM compared with the other FPMs (2, 11).

To date, there have been no studies relating to prevalence of ectopic eruption of FPM in Turkish population. Therefore, the aim of the present study was to investigate the prevalence and characteristics of ectopically erupting FPM in Turkish population.

Materials and methods

Study sample

This project has been reviewed and approved by the Ethical Committee of İstanbul University, Faculty of Dentistry (2016/54). Informed consent was waived due to the retrospective design. The present study was performed using panoramic radiographs of 7649 patients (3506 females, 4143 males) ranging in age from 5 to 11 (mean age; 8.15 ± 1.649) subjected to Pediatric Dentistry Department at İstanbul University between the years 2010 and 2013. Children were included in the study if their permanent molars were present at the time of evaluation. Children suffering from any syndrome or craniofacial malformations were excluded from the study. The age and gender of the subject, the number and location of the ectopic molars, bilateral versus unilateral occurrence, the degree of resorption on the roots of the primary molars and the other associated dental anomalies were assessed by a single investigator (pediatric dentist).

Panoramic imaging

Panoramic radiographs were taken with the Kodak 8000 Digital Panoramic Machine (Kodak Dental Systems, Carestream Health, Inc., Rochester, NY, USA) using the parameters as 65-68 kVp, 2-3.2 mA for infants and 5-6.5 mA for adolescents.

Image assessment

Ectopic eruption was categorized according to a grading system proposed by Barberia-Leache *et al.* (11), which is based on the resorption rates of the primary molars. Although the original classification has four grades of resorption (mild, moderate, severe and very severe), the present study classified the resorption rates using a three-grade system (moderate, severe and very severe) (Figure 2). Mild cases were not included in the current study in order to eliminate the errors which may result from the diagnostic difficulty in differentiating a mild form ectopic eruption from a non-ectopic teeth. The distribution and frequency of ectopic FPMs were calculated with respect to dentition type (maxilla/mandible, left/right side), ectopic eruption type and associated dental anomalies including tooth agenesis, supernumerary teeth, macrodontia/microdontia and infraocclusion.

Statistical analysis

Statistical tests were carried out using SPSS software (version 21.0; IBM, Armonk, NY, USA). Statistical analysis included descriptive statistics, frequencies, and cross-tabs with chi-square analysis. Confidence level was set to 95% and p values less than 0.05 were considered significant.

Results

Of the 7649 reviewed cases, 203 subjects (118 males and 85 females) were diagnosed with ectopic eruption of the FPMs, giving a frequency of 2.65%. Ages of the subjects with ectopic FPMs ranged between 5 and 11 years with a mean age of 6.82 ± 1.25 years. Distribution of ectopic eruption according to gender shows that there was a slightly higher prevalence in males (2.85%) than in females (2.42%) with no statistically significant differences ($\chi^2=1.320$, $p=0.251$) (Table 1). 133 children had one ectopically erupted tooth whereas 70 children had two ectopically erupted teeth. The distribution and the type



Figure 2. a-c. Representation of the grades: (a) moderate, (b) severe, (c) very severe degree of resorption of the second deciduous molar (modified from the classification of Barberia-Leache et al. (11)).

Table 1. Distribution of ectopically erupted first permanent molars according to gender (n=7649)

		Ectopically erupted n (%)	Normal n (%)	Total n (%)	p
Gender	Female	85 (2.42)	3421 (97.58)	3506 (100)	0.251 $\chi^2=1.320$
	Male	118 (2.85)	4025 (97.15)	4143 (100)	
Total		203 (2.65)	7446 (97.35)	7649 (100)	

Table 2. Distribution of the type of ectopically erupted first permanent molars (FPM) stratified by the severity of ectopic eruption

		Quadrant of the ectopic FPM					Total n (%)
		Maxillary		Mandibular			
		Right FPM n (%)	Left FPM n (%)	Left FPM n (%)	Right FPM n (%)		
The severity of ectopic eruption	Moderate	n (%)	36 (13.19%)	38 (13.92%)	40 (14.65%)	53 (19.41%)	167 (61.17%)
	Severe	n (%)	30 (10.99%)	25 (9.16%)	13 (4.76%)	6 (2.2%)	74 (27.11%)
	Very severe	n (%)	17 (6.23%)	11 (4.03%)	3 (1.1%)	1 (0.37%)	32 (11.72%)
Total		n (%)	83 (30.4%)	74 (27.11%)	56 (20.51%)	60 (21.98%)	273 (100%)

Table 3. Distribution of the associated dental anomalies according to the subjects with ectopically erupted and nonectopically erupted molars

		Ectopically erupted n (%)	Normal n (%)	Total n (%)	p
Infraocclusion	Yes	2 (0.99)	76 (1.02)	78 (1.02)	1.00
	No	201 (99.01)	7370 (98.98)	7571 (98.98)	
Tooth agenesis	Yes	10 (4.93)	398 (5.35)	408 (5.33)	0.793
	No	193 (95.07)	7048 (94.65)	7241 (94.67)	
Supernumerary teeth	Yes	4 (1.97)	178 (2.39)	182 (2.38)	1.00
	No	199 (98.03)	7268 (97.61)	7467 (97.62)	
Macrodonia	Yes	1 (0.49)	1 (0.01)	2 (0.03)	0.052
	No	202 (99.51)	7455 (99.99)	7647 (99.97)	
Total		203 (100)	7456 (100)	7649 (100)	

of ectopic eruption recorded for these 273 teeth are presented in Table 2. The most commonly affected tooth was found to be maxillary right FPM followed by maxillary left FPM, and then mandibular left FPM and mandibular right FPM.

The anomaly occurred unilaterally in 144 affected patients (70.9%) and bilaterally in 59 patients (29.1%). Right-sided unilateral ectopic eruption was more common than left sided unilateral ectopic eruption. 157 out of 273 ectopic FPMs (57.5%) were detected in the maxilla and 116 (42.5%) in the mandible. Chi-square test revealed a significant association between the severity of ectopic eruption and the affected

jaw (maxilla or mandible) ($\chi^2=32.245$, $p<0.001$). Severe and very severe degree of ectopic eruption were found to be more common in maxilla than in mandible while moderate degree of ectopic eruption was more prevalent in mandible. No significant association was found between ectopic eruption and the presence of other dental anomalies ($p>0.05$). Seventeen subjects (8.37%) with ectopic FPMs exhibited other dental anomalies including tooth agenesis (4.93%), supernumerary teeth (1.97%), infraocclusion (0.99%) and macrodonia (0.49%). The most common associated anomaly was tooth agenesis and was only seen in 10 subjects (Table 3).

Discussion

The prevalence rate of ectopic eruption of FPMs has been reported to be between 0.75–6%. Higher incidence rates have been noted in subjects with cleft lip and palate (12–15). Kuroi and Bjerklin (10) reported that the prevalence in siblings was 19.8% whereas the general population showed a prevalence of 4.3%. The increased prevalence in siblings may also suggest a hereditary component of this anomaly. The largest study, carried out by Salbach *et al.* (16), found ectopic eruption of FPM in 1.3% of a sample of 8041 kindergarten and school children aged 5–9 years. To the best of our knowledge, the present study is the second largest prevalence study in ectopic eruption after the study of Salbach *et al.* (16). This is also the first prevalence study carried out in Turkish population. Although the sample size and age of the children investigated in the present study are similar to those of Salbach *et al.* (16), their results on the prevalence was lower than that of the present study. This can be due to the fact that the current study was performed in a university hospital set up not in the general population as in the study of Salbach *et al.* No relationship was found between the presence of ectopic eruption and gender in the present investigation. This is in agreement with the most of the previous studies (1, 4, 5, 11, 16). No significant difference was found between the right and left side and this result is consistent with those of previous studies (2, 4, 11, 16, 17). Contrary to the findings of most previous studies and the present study, Barberia-Leache *et al.* (11) reported that ectopic eruption on the right side is more frequent and of a greater severity than in the left side. In the present study, the prevalence of ectopic eruption of FPMs in the maxilla was similar to that in mandible. This result is in agreement with the findings of study by Chintakanon and Boonpinon (1), whereas this is contrary to the findings of most previous studies (2, 4, 16) who found that ectopic eruptions were more frequent in the maxilla than in the mandible.

The severity of ectopic eruption of FPM and the resorption degree of the second primary molar roots were greater in the maxilla than in the mandible. Similar results were reported by Chintakanon and Boonpinon (1) and they proposed that this is related to where ectopic molar crown impacts the second primary molar. In mandible, ectopic molar crown impacts mostly at the crown which is composed of enamel and therefore resorption is slight. On the other hand, in maxilla, ectopic molar crown impacts under the cemento-enamel junction thus the chance for resorption is greater (1).

In the present study, a total of 17 (8.37%) patients with ectopic eruption were also found to have radiographic evidence of one or more dental anomalies involving mostly tooth agenesis (4.9%) and supernumerary teeth (1.97%). Contrary to our finding, Mooney *et al.* (2) reported that 60.7% of the examined patients with ectopic molar eruption had at least one other dental anomaly: primary molar infraocclusion being the most common (n=9; 32.1%) followed by hypodontia (n=8; 28.6%), cleft lip and/or palate (n=7; 25%) and supernumerary teeth (n=5; 17.9%). The conflicting results are probably related to the differences in sample size and inclusion criteria of the subjects, as the study by Mooney *et al.* (2) was performed in 28 subjects and included the subjects with a cleft lip and/or palate while the present study was conducted in 203 subjects

and patients with cleft lip and/or palate were not included. Evidence suggests that individuals with cleft lip and/or palate had a higher incidence of dental anomalies so the inclusion of cleft patients may have been resulted in greater prevalence of dental anomalies in ectopic molar patients.

Early diagnosis of ectopic eruption is essential for the delivery of appropriate treatment. If the resorption degree is slight or moderate, no treatment is required and spontaneous self-correction can be expected. However, if the resorption degree is severe or very severe, the majority of the cases do not self-correct and treatment is needed (11). If appropriate treatment cannot be provided, this may result in premature loss of the second primary molar, resultant space closure in the area and potential impaction of the second premolar (2, 5).

Conclusion

The present study, which investigated the prevalence of ectopically erupted first permanent molar in 7649 Turkish subjects, is the first to describe the prevalence of ectopic eruption in Turkish population. No statistically significant differences were observed by gender. The incidence of ectopic eruption did not differ between the right and left side or maxilla and mandible. The severity of ectopic eruption of FPM and the resorption degree of the second primary molar roots were greater in the maxilla than in the mandible.

Ethics Committee Approval: This project has been reviewed and approved by the Ethical Committee of Istanbul University, Faculty of Dentistry (2016/54).

Informed Consent: Informed consent was waived due to the retrospective design of this study.

Peer-review: Externally peer-reviewed.

Author Contributions: YG designed the study, generated and gathered the data, wrote and approved the final version of the study.

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Türkçe öz: Türk populasyonunda sürekli birinci büyük azı dişlerinin ectopik sürme prevalansı ve dağılımı. Amaç: Bu çalışmanın amacı İstanbul Üniversitesi Pedodonti Anabilim Dalı'na başvuran çocuklarda ectopik sürmüş sürekli birinci büyük azıların prevalansının ve karakteristik özelliklerinin araştırılmasıdır. Gereç ve Yöntem: Çalışmada yaşları 5-11 arasında değişen 7649 hastanın (3506 kız, 4143 erkek) panoramik röntgenleri retrospektif olarak incelenmiştir. Hastanın yaşı ve cinsiyeti, ectopik birinci büyük azıların sayısı ve lokasyonları, bilateral ya da unilateral oluşları, ikinci süt azılarının köklerindeki rezorpsiyon dereceleri ve gözlenen diğer anomaliler çalışma kapsamında değerlendirilmiştir. Ectopik sürme şiddeti süt azıların köklerindeki rezorpsiyonun derecesine göre sınıflandırılmıştır. Bulgular: İncelenen 7649 hastadan 203'ünde (118 erkek, 85 kız) ectopik birinci molar gözlenmiştir (%2,65). Yaşları 5-11 arasında değişen olguların ortalama yaşları ise $6,82 \pm 1,25$ olarak bulunmuştur. Toplam 273 ectopik olarak sürmüş birinci büyük azı dişinden 157'si (%57,5) üst çenede, 116'sı ise (%42,5) alt çenede gözlenmiştir. Şiddetli ve çok şiddetli derecelerdeki ectopik birinci büyük azılar üst çenede alt çeneye göre daha sık gözlenirken, orta derecedeki ectopik birinci büyük azılar alt çenede sıklıkla gözlenmiştir ($p=0,251$). Sonuç: Bu çalışma Türk toplumunda ectopik birinci büyük azı görülme sıklığını belirleyen ilk çalışmadır. Sağ ve sol taraflarda farklılık

olmamasına rağmen, ektojik sürme şiddeti alt ve üst çeneler arasında farklılık göstermektedir. Anahtar kelimeler: Ektojik sürme, prevalans, süt ikinci azılarının rezorpsiyonu, panoramik radyografi, pedodonti

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