Original Article

Prevalence, Distribution, and Condition of Persistent Primary Teeth in Children and Adolescents

Pinar Kinay Taran, Aysegül Ölmez[1]

Department of Pediatric Dentistry, Faculty of Dentistry, Bezmialem Vakif University, İstanbul, [1]Department of Pediatric Dentistry, Faculty of Dentistry, Gazi University, Ankara, Turkey

Abstract

Aim: The aim was to evaluate the prevalence, distribution, and condition of persistent primary teeth (PPT) among a group of Turkish children. **Materials and Methods:** In this retrospective study, a total of 9632 panoramic radiographies were utilized. The images belonged to patients aged 9–15 years, of which 4301 were female and 5331 were male. Recorded data within the study comprises the age and gender of each patient, total number of PPT observed and for each PPT; its location, presence/absence of a permanent successor, and its status. **Results:** The prevalence of PPT was 4.5% in the Turkish subpopulation. PPT were found more frequently in the maxilla (62.4%) and the most frequent PPT were maxillary canine (42.5%). Only 36.7% of PPT had congenital absence of their permanent successors. Root resorption was the most common condition observed at the presence of PPT (37.9%). Other conditions observed were infraocclusion (11.0%), restorations (10.9%), periapical lesion (4.3%), carious lesion (1.3%), and root canal treatment (0.5%). Besides, tipping was seen in 3.3% of the adjacent teeth of PPT. **Conclusions:** PPT were observed in a significant number of children and adolescents. The most common type of PPT seen on the dental arch was maxillary primary canines. Root resorption and infraocclusion were frequently observed in PPT.

Keywords: Persistent primary tooth, prevalence, retained tooth

Introduction

Tooth eruption is described as the axial or occlusal movement of a tooth from its intraosseous location in the jaw to its functional position within the oral cavity and is an age-specific event.[1] The eruption of deciduous teeth is followed by their exfoliation and eruption of permanent dentition. These events occur over a broad chronological age range. However, most parents become anxious by the variation in the timing of eruption, considering it an important milestone of child development. Racial, ethnic, sexual, and individual factors can influence the eruption, and they are usually taken into consideration in determining the standards of the normal eruption.[2]

In recent years, knowledge about the biology of tooth eruption has remarkably increased. It is known that tooth eruption depends on the presence of dental follicles, the osteoclasts to create an eruption pathway through the alveolar bone and the osteoblasts to form new alveolar bone.[3] If there is a disruption in any of these processes, tooth eruption cannot occur spontaneously. Disturbances in tooth eruption have a multifactorial etiology, including failure as a result of a mechanical obstruction, syndromes, pathology, or other disruptions in the eruptive mechanism. It is extremely important to diagnose and manage any eruption disturbances that may occur during the transition from the primary to the permanent dentition to be able to prevent potential clinical problems one of which is the persistence of deciduous teeth.[4]

In some cases, the deciduous teeth do not exfoliate although the eruption time of permanent tooth is past and the deciduous teeth in the dental arch are called retained or persistent primary teeth (PPT). Primary teeth may be retained for a variety of

Received: 07-Dec-2018 **Revised:** 14-Mar-2019
Accepted: 08-Apr-2019 **Published:** 29-Nov-2019

Access this article online

Quick Response Code:

Website: www.ijpedor.org

DOI: 10.4103/ijpr.ijpr_32_18

Address for correspondence: Asst. Prof. Pinar Kinay Taran, Bezmialem Vakif University, Adnan Menderes Bulvari, Fatih, Istanbul 34093, Turkey.
E-mail: pnrkinay@gmail.com

How to cite this article: Taran PK, Ölmez A. Prevalence, distribution, and condition of persistent primary teeth in children and adolescents. Int J Pedod Rehabil 2019;4:50-4.

reasons, the most common one being the congenital absence of the permanent successor, with a prevalence of 0.3%–11.3%.[5-7] Impaction or intrabony migration of the successor tooth can be named as other important factors that play a role in the persistence of primary teeth.

If the crown, roots, and supporting alveolar bone of persistent deciduous tooth are intact, it can remain problem-free in the dental arches for many years. PPT have many advantages; serving as space maintainers, preventing resorption of the supporting alveolar bone, and delaying the need for prosthetic rehabilitation. However, PPT are prone to develop continuous root resorption or infraocclusion. Furthermore, infraocclusion can cause tipping at adjacent teeth which unbalances the occlusion.[8]

There are only a few publications which mainly focus on the etiology, type, lifespan, and prognosis of PPT in the literature.[8-14] However, these studies do not clearly explain the etiologic factors and status of PPT in the dental arch. Moreover, the recent literature review reveals that there is no study about the prevalence of PPT.

The aim of this panoramic radiography-based study was to determine the prevalence of PPT as well as investigating their characteristics and related clinical conditions.

Materials and Methods

Panoramic radiographies, belonging to children and adolescents aged between 9 and 15 years, were utilized in this study. Study approval was obtained from the Institutional Review Board in full accordance with the ethical principles of the Helsinki Declaration. The radiographies were obtained from the archive of the Department of Pediatric Dentistry and Radiology, Gazi University, Ankara, Turkey, and were taken between January 2011 and July 2013 during the patients' first dental examination. The same panoramic radiography device (Morita Veraview Pacs® Kyoto, Japan) was used for radiographies of all patients. A primary tooth was recorded as persistent; if the primary tooth did not exfoliate; although, the eruption time of permanent successor tooth had been expired for >1 year.

In cases where the patient had a known diagnosis of ectodermal dysplasia or craniofacial anomaly, as well as the cases where the patient had undergone orthodontic treatment or had a tooth extraction, their radiographies were excluded from the study. In addition, poor quality (i.e., abnormal density and contrast, errors from positioning and mechanical situations) panoramic radiographs and radiographs belonging to patients with lacking information were eliminated.

All radiographic examinations were carried out by two pediatric dentists who were properly trained and calibrated. The interexaminer reliability was calculated after examining 100 radiographs and kappa value was 0.81. Information forms were prepared to record data such as patients' age, gender, total number and type of PPT observed, presence of the permanent successor, fillings, carious lesions, root canal treatment, periapical lesion, root resorption, and any infraocclusion of the persistent teeth, tipping of adjacent teeth [Table 1]. Root resorption in PPT's is hard to measure quantitatively unless all radiographic images have the same perspective. Thus, root resorption was evaluated qualitatively, only to determine its existence. Root resorption was recorded as present when observed some root shortening and/or irregular contour of roots in related PPT. In cases, persistent teeth's occlusal plane was observed to be below the adjacent teeth's occlusal plane and examined teeth were recorded as infraoccluded.

Data were analyzed using MedCalc Statistical Software version 12.7.7 (MedCalc Software BVBA, Ostend, Belgium). Descriptive analysis was made expressing the results as percentages and frequencies. The Chi-squared test (or Fisher's exact test at appropriate locations) was used to examine the relationship between categorical variables. Statistical significance was set at $P < 0.05$.

Results

In the present panoramic radiographic-based study, radiographies of 9632 children and adolescents (5331 males and 4301 females) were evaluated. Five hundred and eighty-four PPT were determined at 433 patients (170 males and 263 females) among the reviewed 9.632 radiographs. The average age of the examined patients was 12.8.

The prevalence of PPT was 4.5%. The difference in the prevalence of PPT between genders was statistically significant

Table 1: Radiographic evaluation criteria

Evaluation criteria	Status
The number of PTT	0: 1-3 teeth
	1: 3-6 teeth
	2: >6 teeth
The presence of permanent successor	0: Present
	1: Missing
Status of PPT	0: Intact
	1: Filling
	2: Carious
	3: Root canal treatment
	4: Periapical lesion
Root resorption	0: No root resorption
	1: Resorbed
Infraocclusion	0: No infraocclusion
	1: Infraoccluded
Tipping of adjacent teeth	0: No tipping
	1: Tipping

PPT: Persistent primary teeth

Table 2: Distribution of persistent primary teeth by gender

	Total	Male	Female	*P*
Total number of patient	9632	5331	4301	<0.05*
Number of patient who had PPT	433	170	263	
Percentage	4.5	3.2	5.8	

**P*<0.05; Chi-squared test. PPT: Persistent primary teeth

($P < 0.05$). In girls, the prevalence of PPT was 5.8%, whereas 3.2% in boys [Table 2].

As shown in Table 3, 401 patients had 1–3 PPT and 29 patients had 4–6 PPT, whereas only three patients had >6 PPT. The most common type of PPT was canines (49.5%) followed by second molars (27.6%), lateral incisors (11.5%), central incisors (9.1%), and first molars (2.4%). PPT were found most frequently in the maxilla (62.4%) than in the mandible (37.6%). Considering the status of the PPT, a total of 155 (21.7%) were observed to be intact and remaining 461 had at least one condition. Two hundred and seventy-one teeth (37.9%) had root resorption, 79 teeth (11%) were infraoccluded, 78 teeth (10.9%) had fillings, 74 teeth (10.3%) had dental caries, 31 teeth (4.3%) had periapical lesion, 24 teeth (3.3%) had tipping in their adjacent teeth, and only 3 teeth (0.5%) had root canal treatment.

The most common PPT on the dental arch was maxillary primary canines (42.5%), followed by mandibular primary second molars (20.6%), and maxillary primary lateral incisors (13.3%).

In 194 PPT (36.7%), developmental absence of permanent teeth was the reason as to why primary teeth were persistent, whereas permanent teeth germs were present in the remaining 390 PPT (63.3%).

The presence of permanent tooth germ was associated with the type of PPT ($P < 0.05$). A substantial amount of primary lateral and secondary molar PPT was observed without permanent teeth germs, whereas primary central incisor, canine and first molar type of persistent teeth mostly had permanent teeth germs [Table 4].

There was no statistically significant difference between the root resorption and the presence of permanent tooth germ [$P > 0.05$; Table 5]. Root resorption was seen both in the presence or absence of permanent teeth germs.

Table 3: Descriptive features of patients with persistent primary teeth

	n (%)
Gender	
Male	170 (39.2)
Female	263 (60.8)
Number of PPT	
1-3	401 (92.6)
4-6	29 (6.7)
6+	3 (0.7)
Types of PPT*	
Central	53 (9.1)
Lateral	67 (11.5)
Canine	289 (49.5)
First molar	14 (2.4)
Second molar	161 (27.6)
Permanent tooth germ*	
Presence	390 (63.3)
Absence	194 (36.7)
Location*	
Maxilla	354 (62.4)
Mandible	213 (37.6)
Condition of PPT*	
Caries	74 (10.3)
Filling	78 (10.9)
Root canal treatment	3 (0.5)
Apical lesion	31 (4.3)
Root resorption	271 (37.9)
Infraocclusion	79 (11.0)
Tipping to adjacent teeth	24 (3.3)
Intact	155 (21.7)

*More than one situation can be seen in one person. PPT: Persistent primary teeth

Table 4: The relation between the presence or absence of permanent tooth germ and the type of persistent primary teeth

Type of PPT	Permanent tooth germ		*P*
	Presence	Absence	
Central	36 (15.2)	18 (4.8)	<0.05*
Lateral	31 (8.2)	35 (14.8)	0.02*
Canine	276 (73.0)	21 (8.9)	<0.05*
First molar	10 (2.6)	5 (2.1)	0.90
Second molar	43 (11.4)	140 (59.1)	<0.05*
Total	378 (100)	237 (100)	

*P<0.05; Chi-squared test. PPT: Persistent primary teeth

Table 5: The relation between the root resorption and the presence of permanent tooth germ

Root resorption	Permanent tooth germ		*P*
	Presence	Absence	
No	168 (44.4)	116 (48.9)	0.157*
Yes	210 (55.6)	121 (51.1)	

*P>0.05; Chi-squared test. PPT: Persistent primary teeth

Discussion

The present research focuses on the prevalence of PPT and their various characteristics. In literature, there are no previous studies about the incidence of PPT and limited data are available regarding their clinical situation, distribution, and the reasons for persistence. In accordance, this is the first retrospective radiographic study of a large and young population with PPT.

The PPT prevalence was found to be 4.5% in the Turkish subpopulation, in which participant age ranged from 9 to 15. The frequency of retained primary teeth observation will decrease as the age increases because PPTs can be extracted due to various reasons. Therefore, one of the main factors in determining participant age range was not to overlook extracted PPT, and the subpopulation was chosen to be as young as possible while also keeping the data set rich. Other studies regarding PPT utilize a broader age range which makes their results incomparable to this study.[15,16]

The results of the study showed that the primary maxillary canines were the most common type of persistent deciduous teeth, followed by the primary mandibular second molars, and lateral incisors on both sides. The persistence of other primary teeth was observed rarely. These results were in agreement with Işık Aslan *et al*.[15] However, Aktan *et al*. found that the primary mandibular second molars were the most frequently PPT, followed by the primary maxillary canines.[16] The broader age range and location of their study could lead the difference in results.

In the present study, developmental absence of the permanent teeth was found in 36.7% of PPT. This finding is compatible with previous studies that focus on understanding why primary teeth have persisted and the relationship between agenesis of permanent teeth and the persistence of primary teeth.[6,9,16,17] Previous studies showed that the most common reason for the persistence of primary teeth was developmental absence of the permanent successor teeth, followed by impaction, transposition, and delayed eruption of successor teeth. However, the primary reason for persistence may differ among teeth types. Most of the primary incisors and second molars mainly persist due to developmental absence of their successors. Notwithstanding, most of the persistent primary canine teeth was present with their permanent canines. Impaction or transposition of permanent canines and congenital absence of permanent lateral incisors lead persistence of primary canine teeth. In consideration of these findings, the persistence of primary teeth may be related to developmental anomalies of the adjacent teeth or their permanent successors for the results of the present study.

In normal dentition, roots of primary teeth undergo continuous resorption during the eruption of successors. Several theories have been proposed regarding the factors influencing this process, but none have clearly explained cause and effect. The pressure of erupting permanent teeth, occlusal trauma, and inflammatory processes has all been considered to play a role in the mechanism. However, root resorption in primary teeth generally occurs in developmental absence of permanent tooth as well. The rate of root resorption varies widely among patients and decreases with age.[18-20] In the present study, it was not possible to make a confident quantitative measurement of root length due to limitations regarding surveying with panoramic radiographs. The distortion in the orthopanthograms may lead to uncertainty in determination of root resorption rate. For this reason, root resorption was evaluated quantitatively and was observed in 271 teeth (37.9%) among 508 PPT. This situation supports the hypothesis that root resorption is stimulated not only by the successor teeth germs but also potentially by other biological or environmental events. Although there are many studies about root resorption in congenital absence of the successors,[10,16,18,21] it is not known how the certain/actual/physical mechanism. Aktan *et al*. explained that if developmental absence of permanent teeth was related to persistence of primary teeth, degree of resorption was lower.[16] Conversely, if the reason for the persistence of primary teeth was impaction of the successor, a higher degree of resorption was observed. In previous studies, researchers also determined that root resorption in primary teeth slowed down as the age increases. However, related data are not conclusive for adults because a significant amount of PPTs is extracted preventing further observation.

Kjaer *et al*.[14] and Kurol and Thilander[18] reported that PPT prognosis was poor in the long-term. In this study, of 616 PPT in children and adolescents, the filling was seen in 78, dental caries was seen in 74, periapical lesion was seen in 31, and root canal treatment was seen in only 3. Besides these conditions, 155 retained primary teeth remained intact. A relatively better prognosis in these observed patients can be attributed to the younger population in this study.

Infraocclusion is detected when the rate of a tooth's crown height to its neighbor's is low. When the retained primary tooth positioned below the level of the occlusal plane, interocclusal space increases and infraocclusion occurs.[8] In the study by Bjerklin and Bennett, infraocclusion has been observed in 55% of the persistent mandibular second molars.[9] Aktan *et al*. reported that infraocclusion ratio was 79% for retained primary teeth in their study.[16] In this study, 79 of 616 PPT (11%) were infraoccluded. The age range (6–18) is the main cause for the lower infraocclusion ratio in comparison to other studies. Infraocclusion is frequently caused by tipping of the adjacent permanent teeth. In the present study, tipping of the adjacent permanent teeth was observed in 24 (30.4%) teeth among the infraoccluded 79.

Panoramic radiography has integral limitations due to its technical nature. Images produced with this technique are usually distorted and flawed. The radiographic projections are not completely consistent among all patients due to different teeth morphologies causing variance in beam directions. Moreover, the patient's head posture plays a similar role as the tooth morphology and variation among postures result in specific rendition and enlargement. In particular, children might make movements during observation, resulting in "shaking" and a lack of clarity. These distorted and inconsistent images may lead to uncertainty in determination of clinical conditions.

Conclusions

Based on this study's findings, the following conclusions can be made:

1. PPT were observed in a significant number of children and adolescents
2. The most common type of PPT seen on the dental arch was maxillary primary canines, followed by mandibular primary second molars
3. Root resorption and infraocclusion were frequently observed conditions for PPT.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Matsuzaki H, Yanagi Y, Katase N, Nagatsuka H, Hara M, Ashida M, *et al.* Case series: Conditions inhibiting eruption of permanent first molars. Pediatr Dent 2013;35:67-70.
2. Suri L, Gagari E, Vastardis H. Delayed tooth eruption: Pathogenesis, diagnosis, and treatment. A literature review. Am J Orthod Dentofacial Orthop 2004;126:432-45.
3. Wise GE, Frazier-Bowers S, D'Souza RN. Cellular, molecular, and genetic determinants of tooth eruption. Crit Rev Oral Biol Med 2002;13:323-34.
4. Noda T, Takagi M, Hayashi-Sakai S, Taguchi Y. Eruption disturbances in Japanese children and adolescents. Pediatr Dent J 2006;16:50-6.
5. Vastardis H. The genetics of human tooth agenesis: New discoveries for understanding dental anomalies. Am J Orthod Dentofacial Orthop 2000;117:650-6.
6. Polder BJ, Van't Hof MA, Van der Linden FP, Kuijpers-Jagtman AM. A meta-analysis of the prevalence of dental agenesis of permanent teeth. Community Dent Oral Epidemiol 2004;32:217-26.
7. Buyuk SK, Ozkan S, Benkli YA, Arslan A, Celik E. Evaluation of the skeletal and dental effects in orthodontic patients with maxillary lateral incisor agenesis. J Esthet Restor Dent 2017;29:284-90.
8. Robinson S, Chan MF. New teeth from old: Treatment options for retained primary teeth. Br Dent J 2009;207:315-20.
9. Bjerklin K, Bennett J. The long-term survival of lower second primary molars in subjects with agenesis of the premolars. Eur J Orthod 2000;22:245-55.
10. Ith-Hansen K, Kjaer I. Persistence of deciduous molars in subjects with agenesis of the second premolars. Eur J Orthod 2000;22:239-43.
11. Haselden K, Hobkirk JA, Goodman JR, Jones SP, Hemmings KW. Root resorption in retained deciduous canine and molar teeth without permanent successors in patients with severe hypodontia. Int J Paediatr Dent 2001;11:171-8.
12. Sletten DW, Smith BM, Southard KA, Casko JS, Southard TE. Retained deciduous mandibular molars in adults: A radiographic study of long-term changes. Am J Orthod Dentofacial Orthop 2003;124:625-30.
13. Bjerklin K, Al-Najjar M, Kårestedt H, Andrén A. Agenesis of mandibular second premolars with retained primary molars: A longitudinal radiographic study of 99 subjects from 12 years of age to adulthood. Eur J Orthod 2008;30:254-61.
14. Kjaer I, Nielsen MH, Skovgaard LT. Can persistence of primary molars be predicted in subjects with multiple tooth agenesis? Eur J Orthod 2008;30:249-53.
15. Işık Aslan B, Zafersoy Akarslan Z, Uzuner FD. Radiographic evaluation of the distribution and condition of persistent primary teeth. Acta Odontol Turc 2013;30:77-84.
16. Aktan AM, Kara I, Sener I, Bereket C, Celik S, Kirtay M, *et al.* An evaluation of factors associated with persistent primary teeth. Eur J Orthod 2012;34:208-12.
17. Altug-Atac AT, Erdem D. Prevalence and distribution of dental anomalies in orthodontic patients. Am J Orthod Dentofacial Orthop 2007;131:510-4.
18. Kurol J, Thilander B. Infraocclusion of primary molars and the effect on occlusal development, a longitudinal study. Eur J Orthod 1984;6:277-93.
19. Hvaring CL, Øgaard B, Stenvik A, Birkeland K. The prognosis of retained primary molars without successors: Infraocclusion, root resorption and restorations in 111 patients. Eur J Orthod 2014;36:26-30.
20. Harokopakis-Hajishengallis E. Physiologic root resorption in primary teeth: Molecular and histological events. J Oral Sci 2007;49:1-2.
21. Rune B, Sarnäs KV. Root resorption and submergence in retained deciduous second molars. A mixed-longitudinal study of 77 children with developmental absence of second premolars. Eur J Orthod 1984;6:123-31.