

Retained primary tooth in unusual ages in southern Iran: A population-based study

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Original Article

Abstract

BACKGROUND AND AIM: The retained primary tooth (RPT) is a tooth that remains beyond its exfoliation time, which can cause some problems. This study aimed to evaluate the prevalence of RPT in unusual ages in Larestan, a city in Fars Province, southern Iran.

METHODS: In this cross-sectional population-based study (April-October 2015), clinical and radiological evaluations were done for all patients referred to Larestan dentistry clinics. The characteristics of RPT were evaluated. All data were analyzed statistically using SPSS and MedCalc software ($\alpha = 0.05$).

RESULTS: Among 2106 patients, 145 (6.88%) had at least one RPT. The most frequent RPT were primary canine in the maxilla (42.45%) and second primary molar in the mandible (33.01%). The main cause of RPT was absence of permanent successor tooth congenitally (67.45%) and impaction of it (33.54%). The most tooth mobility was class III (17.92%) and the second molar in mandible had the most mobility (6.60%). Root resorption was seen in about 45% of patients, which level 3 was the most (24.76%), mostly in second molar in mandible. Infra-occlusion was seen only in 5.18% of patients. There were significant correlations between root resorption and age ($r = 0.175$, $P = 0.0360$) and gender ($r = 0.171$, $P = 0.0400$), mobility and decay ($r = 0.470$, $P < 0.0010$), as well as infra-occlusion ($r = 0.262$, $P = 0.0010$).

CONCLUSION: The prevalence of RPT in unusual ages was not high in this study, but exact examination can detect the RPT earlier, to prevent the related problems by suitable treatments. Studies in larger population are recommended.

KEYWORDS: Primary Tooth; Panoramic Radiography; Epidemiology; Iran; Health Policy

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The retained primary tooth (RPT) is the tooth that still remains beyond the time of shedding.¹ Few studies on the RPT at the unusual age have been conducted.^{2,3} In some researches, RPT had been studied besides the malocclusion evaluation or dental anomalies,³⁻⁷ and others studied the causes,² methods of treatment,¹ and the mineralized tissue in the pulp of RPT.⁸ The frequency of the RPT is about 3.20% to 16.60% according to previous studies.³⁻⁷

Primary tooth may be maintained for

different reasons; however, the most common reason is congenitally missing permanent successor tooth,^{9,10} but it has not been fully explained. It could be due to a combination of genetic and environmental factors such as infection, trauma, drugs, radiation, and endocrine system or may be related to the syndromes such as Down syndrome.¹⁰ RPT may lead to periodontitis disease, decay, dental ankylosis, as well as cosmetic problems.^{1,11} Dentists often are the first ones that recognize the dental anomalies. Clinical and radiographic assessment for all patients

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with RPT is essential. In clinical examination, tooth shape, color, and structure, gums, teeth relationship with opposite and adjacent teeth, and teeth relationship with occlusal plane should be checked. In radiographic examination, the apical position of the tooth, root resorption, periodontal support tissues, bone height, and inter-radicular space should be examined.¹ Our literature review showed that few studies assessed the prevalence of RPT in Iran. Sheikhi et al. reported that the prevalence of congenitally missing tooth in evaluation of 2422 patients between 7 and 35 years old in 8 provinces of Iran was 10.90%.¹² Also, in the study of Vahid-Dastjerdi et al., this rate was reported as 9.10% from 1999 to 2009 in Tehran, Iran, which was conducted on 1751 patients (9-27 years old).¹³

Hence, the RPT in unusual ages leads to wide dental problems and it is important to know the prevalence in health policy and prevention programs; this study aimed to assess the prevalence of RPT in unusual ages in southern Iran.

Methods

The current prospective cross-sectional population-based study (April-October 2015) was conducted on all patients referred to dental clinic of Larestan University of Medical Sciences and Rahgozar Charity Dentistry Clinic in Larestan, a city in Fars Province, southern Iran, with about 213920 populations in 2016.¹⁴

The inclusion criteria were all patients aged upper than 10 years, with good physical condition, Persian language, no previous pulled primary tooth, no contraindication for radiological imaging, and without any systemic disease or syndrome associated with RPT, such as Down syndrome, cleidocranial dysplasia, hypothyroidism, or hypopituitarism.¹⁰ All of these patients were examined for RPT clinically by 5 dentists. Data collecting form was filled for all of them, which included demographic information such as age, gender,

occupational status, telephone number and address, their awareness about RPT and its way. Panoramic radiography (Planmeca Promax, Finland, 64 kV/10 mA) was done for patients who were diagnosed clinically as having RPT, by a specific radiology center. Image processing and fixing were done automatically (care stream).

For the second time, clinical evaluation for types of RPT, number, place, being one-sided or two-sided, being decayed or not, mobility, tooth infra-occlusion, and conducted treatment were done by one specific dentist. Also radiological evaluations involving impaction, being decayed or not, existence of permanent successor tooth, and root absorption were done for them.

In this study, tooth mobility was classified according to Miller's classification:¹⁵

- 1) Class 0: Normal (physiologic) movement
- 2) Class I: Horizontal movement less than 1 mm
- 3) Class II: Horizontal movement 1 mm and more
- 4) Class III: Horizontal and vertical movement 1 mm and more

The amount of root resorption of second primary molar tooth in mandible in radiological images was classified in 6 levels:¹⁶

- 1) Level 1: No root resorption
- 2) Level 2: 1/4 root resorption
- 3) Level 3: 2/4 root resorption
- 4) Level 4: 3/4 root resorption
- 5) Level 5: 4/4 root resorption with remained tooth
- 6) Level 6: 4/4 root resorption without any tooth

Based on Nordquist et al.³ study, the other teeth root resorption was evaluated. Tooth infra-occlusion was measured via the space between primary tooth occlusal level and the adjacent permanent tooth. If this interval was 1 mm or more, infra-occlusion was occurred.¹⁷

All findings were recorded on data collecting form. The SPSS software (version 20, IBM Corporation, Armonk, NY, USA) and MedCalc statistical software (version 13.3.3, MedCalc Software bvba, Ostend, Belgium;

<http://www.medcalc.org>; 2014) were used for the statistical analysis, through descriptive and analytical tests such as chi-square test, Fisher's exact test, one-way analysis of variance (ANOVA), and Spearman's rho correlation test. Results were summarized in number and percentage for categorical variables. Two-sided P-value less than 0.050 and confidence interval (CI) of 95% were considered to be statistically significant.

The study was reviewed and approved by Larestan University of Medical Sciences (#1393/117 on 1393.7.14). To consider ethical issue, the collected data were not revealed to anybody, except to the researchers; therefore, the patients' names were confidential. Also, all participants signed the written informed consent.

Results

Among 2106 patients referred to these centers, 145 (6.88%) patients had at least one RPT, and totally 212 RPT were diagnosed, which 51 (35.20%) were men and 94 (64.80%) were women ($P < 0.0001$) using chi-square test. RPT was more frequent in women ($P < 0.0001$) and the ages between 20 and 29. Using one-way ANOVA test, the number

of RPT was significantly associated with age ($P < 0.0001$). Total of 64 (44.10%) patients knew about their RPT existence and 39.30% of this knowledge was dependent on dentists' examination. Women were more aware about having RPT ($P = 0.0250$) using chi-square test. Only 5 (3.40%) patients had positive family history for RPT, although we cannot rely to their responses because of information bias. Total of 100 patients (68.96%) had only 1 RPT (Table 1).

The most frequent RPT was primary canine in maxilla (42.45%) and the second primary molar in mandible (33.01%). The least frequent was primary central incisor in maxilla (0.94%). The first primary molar in maxilla was not seen. The main cause of RPT was absence of permanent successor teeth, congenitally (34.81%). Although 4.71% of patients had tooth extraction, a total of 56.60% of RPT were seen in one side of the jaw (left or right), and the most common teeth were second molar in mandible (21.70%) and canine in maxilla (21.70%). The most rate of dental pathology was periodontal disease (28.77%) and dental decay (17.05%), respectively.

Table 1. Patients' characteristics

Variable		Frequency of patients [n (%)]	RPT [n (%)]	Knowledge about RPT existence [n (%)]
Gender	Female	94 (64.80)	130 (61.32)	44 (30.30)
	Male	51 (35.20)	82 (38.67)	20 (13.80)
	Total	145 (100)	212 (100)	64 (44.10)
		$P < 0.0001^*$	$P < 0.0001^*$	$P = 0.0250^*$
Age (year)	10-19	51 (35.20)	79 (37.26)	6 (4.10)
	20-29	52 (35.90)	69 (33.54)	32 (22.10)
	30-39	27 (18.60)	39 (18.39)	15 (10.30)
	40-49	12 (8.96)	22 (10.37)	9 (6.20)
	50-59	3 (2.75)	3 (1.88)	2 (1.40)
	Total	145 (100)	212 (100)	64 (44.10)
		$P < 0.0001^*$		$P < 0.0001^*$
Number of RPT	1	100 (69.00)	-	-
	2	35 (24.10)		
	3	4 (2.80)		
	4	4 (2.80)		
	5	0 (0)		
	6	1 (0.70)		
	7	0 (0)		
	8	1 (0.70)		
	Total	145 (100)		

*Statistically significant using chi-square test

RPT: Retained primary tooth

Table 2. The characteristics and the cause of retained primary tooth (RPT)

Maxilla	Central incisor [n (%)]	Lateral incisor [n (%)]	Canine [n (%)]	First molar [n (%)]	Second molar [n (%)]	Total [n (%)]
Number of RPT	2 (0.94)	4 (1.89)	90 (42.45)	0 (0)	22 (10.38)	118 (55.66)
On one side of the jaw	2 (0.94)	4 (1.89)	46 (21.70)	0 (0)	8 (3.77)	60 (28.30)
Hidden RPT	1 (0.47)	0 (0)	53 (25.00)	0 (0)	3 (1.41)	57 (26.89)
Absence of permanent successor tooth	1 (0.47)	4 (1.89)	29 (13.68)	0 (0)	8 (3.77)	42 (19.81)
Decay	0 (0)	0 (0)	7 (3.30)	0 (0)	10 (4.72)	17 (8.09)
Restoration	0 (0)	0 (0)	1 (0.47)	0 (0)	0 (0)	1 (0.47)
Root treatment	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Mandible						
Number of RPT	9 (4.26)	3 (1.41)	7 (3.30)	3 (1.41)	72 (33.01)	94 (44.34)
On one side of the jaw	2 (0.94)	3 (1.41)	7 (3.30)	2 (0.94)	46 (21.70)	60 (28.30)
Hidden RPT	0 (0)	2 (0.94)	4 (1.89)	1 (0.47)	0 (0)	7 (3.30)
Absence of permanent successor tooth	9 (4.26)	1 (0.47)	2 (0.94)	1 (0.47)	40 (18.87)	53 (25.00)
Decay	0 (0)	0 (0)	1 (0.47)	1 (0.47)	17 (8.01)	19 (8.96)
Restoration	0 (0)	0 (0)	0 (0)	0 (0)	13 (7.10)	13 (7.10)
Root treatment	0 (0)	0 (0)	0 (0)	0 (0)	2 (0.94)	2 (0.94)

RPT: Retained primary tooth

The most percentage of decay was seen in second molar in mandible (8.01%) and maxilla (4.72%). Restoration was done in 7.57% of the RPT, and only 2 roots (0.94%) were treated (Table 2).

Totally, 25 (17.20%) of patients had teeth mobility in 61 teeth. The motile RPT in maxilla and mandible were 30 and 31, respectively, which had no significant difference ($P = 0.960$). Most grade of teeth mobility was class III (17.92%), and the second molar in mandible had the most mobility (6.60%) (Table 3).

Of 212 RPT, 3 roots (1.41%) were not visible completely, due to root coverage by hidden latent permanent successor teeth, and total of 209 teeth were evaluated in root resorption. In about 45% of patients, root resorption was seen, which level 3 and 4 were

the most (24.76% vs. 13.89%). The root resorption was more in mandible compared to maxilla (36.36% vs. 18.66%, $P = 0.0520$). Second molar in mandible had the most root resorption in this study (30.62%) (Table 4). Also, only 11 (5.18%) second molars in mandible had infra-occlusion and no infra-occlusion was seen in maxilla.

Using Spearman's rho correlation test, there was association between root resorption and age ($r = 0.175$, $P = 0.0360$) in addition to gender ($r = 0.171$, $P = 0.0400$); but there were no associations between root resorption and decay ($r = -0.102$, $P = 0.2220$), mobility ($r = -0.137$, $P = 0.1010$), and infra-occlusion ($r = -0.080$, $P = 0.3430$). Moreover, there were associations between decay and mobility ($r = 0.470$, $P < 0.0001$), as well as infra-occlusion ($r = 0.262$, $P = 0.0010$) (Table 5).

Table 3. Distribution of retained primary tooth (RPT)'s mobility degree according to Miller's classification¹⁵

Maxilla	Central incisor [n (%)]	Lateral incisor [n (%)]	Canine [n (%)]	First molar [n (%)]	Second molar [n (%)]	Total [n (%)]
Class I	0 (0)	0 (0)	1 (0.47)	0 (0)	2 (0.94)	3 (1.41)
Class II	0 (0)	0 (0)	5 (2.36)	0 (0)	3 (1.41)	8 (3.77)
Class III	1 (0.47)	1 (0.47)	9 (4.25)	0 (0)	8 (3.77)	19 (8.96)
Total	1 (0.47)	1 (0.47)	15 (7.08)	0 (0)	13 (6.13)	30 (14.15)
Mandible						
Class I	0 (0)	0 (0)	0 (0)	0 (0)	2 (0.94)	2 (0.94)
Class II	1 (0.47)	0 (0)	2 (0.94)	0 (0)	7 (3.30)	10 (4.72)
Class III	1 (0.47)	0 (0)	2 (0.94)	2 (0.94)	14 (6.60)	19 (8.96)
Total	2 (0.94)	0 (0)	4 (1.89)	2 (0.94)	23 (10.85)	31 (14.62)

Table 4. Distribution of retained primary tooth (RPT) root resorption's degree according to Bjerkin and Bennett16/Nordquist et al.3 classification

Maxilla	Central incisor [n (%)]	Lateral incisor [n (%)]	Canine [n (%)]	First molar [n (%)]	Second molar [n (%)]	Total [n (%)]
Level 1	1 (0.48)	3 (1.44)	67 (32.06)	0 (0)	8 (3.83)	79 (37.80)
Level 2	0 (0)	0 (0)	2 (0.96)	0 (0)	2 (0.96)	4 (1.91)
Level 3	0 (0)	1 (0.48)	12 (5.74)	0 (0)	5 (2.39)	18 (8.49)
Level 4	0 (0)	0 (0)	4 (1.91)	0 (0)	6 (2.87)	10 (4.79)
Level 5	1 (0.48)	0 (0)	5 (2.39)	0 (0)	1 (0.48)	7 (3.35)
Level 6	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Total	2 (0.96)	4 (1.91)	90 (43.06)	0 (0)	22 (10.53)	118 (56.46)
Mandible						
Level 1	2 (0.96)	2 (0.96)	2 (0.94)	1 (0.48)	8 (3.83)	15 (7.18)
Level 2	0 (0)	0 (0)	0 (0)	0 (0)	12 (5.74)	12 (5.74)
Level 3	2 (0.96)	1 (0.48)	3 (1.44)	0 (0)	28 (13.40)	34 (16.27)
Level 4	2 (0.96)	0 (0)	2 (0.96)	1 (0.48)	14 (6.70)	19 (9.10)
Level 5	0 (0)	0 (0)	0 (0)	1 (0.48)	10 (4.79)	11 (5.26)
Level 6	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Total	6 (2.87)	3 (1.44)	7 (3.35)	3 (1.44)	72 (34.45)	91 (43.54)

Discussion

This study aimed to assess the prevalence of RPT in unusual ages, in Fars Province. Unlike the previous studies that used intraoral radiography, the panoramic radiography was used in the current study, which is consistent with the study of Aktan et al.¹¹ The prevalence of RPT was 6.88%, and the most frequent RPT was primary canine in the maxilla and second primary molar in the mandible. RPT was more frequent in women. The main cause of RPT was absence of permanent successor tooth congenitally, and then impaction of it. RPT was more frequent in women and the ages between 20 and 29 years. About 43.00% of the patients had RPT on both sides of the jaw. Most grades of teeth mobility were related to class III (17.92%), and the second molar in mandible had the

most mobility. Second molar in mandible had the most root resorption in this study, and only 5.18% of second molars in mandible had infra-occlusion.

In the present study, of 2106 subjects, 145 people (6.88%) had RPT; but a study which was conducted by Sheikhi et al.¹² in Iran on 2422 patients showed that the prevalence of congenital missing permanent tooth was 10.9%. Vahid-Dastjerdi et al. reported this rate as 9.10%, and they concluded that this rate in Iran was higher than many other countries.¹³ This prevalence was reported 7.66% in another study in Shiraz, Iran, in 2013,¹⁸ 5.90% in Germany,¹⁹ 7.50% in Turkey,²⁰ and 11.20% in Korea.²¹

Our results presented that RPT was more frequent in women significantly; but Amini et al.²² reported that although it was seen in

Table 5. Results of Spearman's rho correlation test

Variables	Gender	Decay	Root resorption	Mobility	Infra-occlusion
Age	0.077	-0.106	0.175*	-0.0620	-0.089
	0.357	0.205	0.036	0.4590	0.287
Gender		-0.200	0.171*	-0.0800	-0.147
		0.814	0.040	0.3380	0.078
Decay			-0.102	0.4700*	0.262*
			0.222	0.0001	0.001
Root resorption				-0.1370	0.080
				0.1010	0.343
Mobility					0.083
					0.323

*Correlation is significant at the 0.05 level (2-tailed). The first row of each variable is 'r' and the second row is 'P-value'.

women more, this difference was not significant, even the number of missing was more in men. A study in Shiraz showed that no statistical difference was seen in both genders, too.¹⁸ Gender ratio in this study did not match the similar researches, e.g., Nordquist et al.³ study carried out on the population of Varmland, Sweden, (50.76% men) and Jose and Joseph⁵ study conducted in a rural area in India (52.00% men). But this rate was more similar to the study of Aktan et al.,¹¹ which was done on the Turkish population (34.74% men) and Gupta et al.⁴ study in India (44.55%). Also, in the current study, unlike previous ones, the way of awareness of participants about RPT was assessed. Only 40.00% of patients were aware of their RPT, and this awareness was also made through dentist, which represents the important role of dentist in the early detection of RPT.

This study showed that the most frequent RPT was primary canine in maxilla (42.45%) and the second primary molar in mandible (33.01%), respectively, which was different from the results of studies by Nordquist et al.³ (59.55% second primary molar in mandible and 19.10% primary canine in maxilla) and Aktan et al.¹¹ (58.35% second primary molar in mandible, 23.24% primary canine in maxilla). A study in Shiraz with smaller sample size showed that the most frequent absent teeth were upper lateral incisor and lower second premolar.¹⁸ Nordquist et al. in 2005 pointed out that the primary canine had the highest frequency in some previous studies conducted in 1930, 1961, and 1972.³ This difference could be due to early diagnosis and treatment of displaced permanent canine teeth in those regions where the previous studies were conducted.

In this study, the most rates of dental pathologies were related to periodontal disease (28.77%) and dental decay (17.05%). In Aktan et al.¹¹ study, the rates of dental decay and periodontal disease were reported as 37.96% and 24.96%, respectively. This difference can be due to more awareness of

the RPT and better compliance of oral health in the city of Larestan. Also, in the current study, the mobility of teeth was assessed. The highest percentage of tooth mobility belonged to class III, and the highest percentage of mobility was seen in the second primary molar in the mandible (6.60%). To our knowledge, the mobility of teeth has not been reported in the previous studies. The mobility of RPT can influence the prognosis and treatment, because periodontal disease is known as one of the major causes of RPT.⁸

Aktan et al. reported that the most important causes for RPT were lack of permanent successor tooth (81.39%) and hidden permanent successor tooth (16.40%). Other factors were cysts, added tooth, and crowding.¹¹ Also, in the current study, these two factors were known as the causes of RPT. In a study by Nordquist et al.,³ absence of permanent successor teeth was as the most important cause, especially in the second molar in the mandible, which was mentioned by other previous studies.^{16,17} In the current study, the most important cause of remaining canine in maxilla was the hidden permanent successor teeth (25.00%), similar to study by Aktan et al.¹¹

The percentage of the restoration was 7.57% in the current study, which is higher than Aktan et al.¹¹ study (6.06%), but tooth treatment was performed in only 2 (0.94%). In Nordquist et al.³ study, the total restoration and decay was reported as 52.8%. In the previous studies, the type of treatment has not been evaluated. Moreover, in the current study, the number of RPT was assessed in each patient (67.70% had 1, 27.70% had 2, and 4.60% had 3 RPT), which was similar to Nordquist et al.³ study. The considerable point was that in about 5.00% of patients more than 3 RPT were observed, in the present study. Another study reported that if the second molar in mandible remained up to age 20, it would remain in upper age.¹⁶ Nordquist et al. have reported that if this tooth remains up to age of 20, it will remain until the age of 30-40. In the

current study, most of patients were in the age group of 20-29 years, but the age group of 10-19 years had more RPT than any other age group (35.90%).³ In this study, unlike the previous ones, the one-sided or two-sided RPT were evaluated, because viewing the RPT on one side of the jaw can guide in the diagnosis of RPT on the other side. The results showed that 43.40% of patients had RPT on both sides of the jaw (right and left).

The results of this study showed that the most frequent root resorption levels were level 3 (24.76%) and level 4 (13.89%), while the result of Aktan et al.¹¹ study showed that level 4 of root resorption was the most frequent (20.09%). But the ratio of level 2 to level 5 was similar in both studies. It is noticeable that panoramic radiography was used in both studies. In the study by Nordquist et al.,³ intraoral radiography (periapical) was used and 74.00% of second molar in mandible had root absorption level ≤ 3 . This difference could be due to difference in the type of used radiography. Intraoral radiography had more accuracy compared to extra-oral for examination of the root resorption, because extra-oral panoramic radiography had some disadvantages such as difference in the positioning the patient's head, possible movement of the patient's head during the radiography, and the angle of radiation, which can reduce the radiography resolution.

Many studies evaluated the relationship between root resorption and other factors such as age, gender, caries, and infra-occlusion. In the current study, significant relationships between root resorption and age as well as gender were seen. Also, decay had positive linear relationship with mobility. Bjerklin and Bennett noted that there was not any statistical correlation between root resorption and gender,¹⁶ which is inconsistent with the results of our study. Hvaring et al. reported that there was a statistically significant relationship between infra-occlusion, root resorption, and age, but no relationship was observed with gender.¹⁷

In Nordquist et al.³ study, no significant relationships between root resorption and gender, restoration, caries, and infra-occlusion were seen, but root resorption had a relationship with age. They reported that root resorption was more in older patients. Hvaring et al.¹⁷ showed that infra-occlusion was more important in tooth prognosis compared with root resorption. The remarkable thing in the current study is a statistically significant relationship between infra-occlusion and caries. It can be concluded that the tooth with infra-occlusion has more potential for decay, because the occlusal surfaces of teeth are lower than the adjacent teeth, and this factor could be involved in lack of access to dental hygiene. Previous studies indicated that the root resorption was not the primary cause for the loss of RPT, but also decay or gum diseases were underlying causes.⁸

This study was conducted only on patients who were referred to the clinics that were mentioned above. Although these two clinics cover a very high percentage of the Larestan population, some patients might refer to dental clinics in other cities and the center of province. Therefore, the calculated prevalence might be less than actual prevalence. Also, this study was done in one city, and the results cannot be generalized to whole Fars Province, as well as to Iran. Therefore, larger population-based studies are suggested.

Conclusion

RPT in unusual ages is an important and considerable public health issue. The prevalence of RPT in unusual ages was not high in this study, but as limited similar studies was conducted in Iran, we could not compare this rate. Careful and exact examinations by dentist and using the panoramic radiography are necessary to detect the RPT earlier and try to prevent the related problems and complications by suitable treatments. Also, conducting more detailed studies about the prevalence of RPT

and its related factors in other populations in Iran is suggested.

Conflict of Interests

Authors have no conflict of interest.

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