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The prevalence of premature loss of primary teeth and its impact on malocclusion in the Eastern Province of Saudi Arabia

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Abstract

Objectives. The present study was designed to determine the prevalence of premature loss of primary teeth and its effect on malocclusion in Eastern Province, Saudi Arabia. ***Materials and methods.*** This is an observational, cross-sectional study that included 307 male children aged 9–11 years old. Clinical examinations were performed using a disposable sharp explorer, a UNC periodontal probe and a dental mirror. The samples were examined clinically to detect the following traits: Angle's classification of malocclusion, overjet, overbite, anterior open-bite, lateral open-bite, midline shift and cross-bite. Additionally, a dental caries examination was performed using WHO methods. Questionnaires in Arabic were coded and sent to the students' parents. ***Results.*** The mean DMFT was 5.61 (SD = 3.01). The d-component was the highest, with a mean of 4 (SD = 2.83). Of the 307 children, it was found that 204 (66.4%) had a high DMFT score, which is defined as a score above 4. It was found that 156/307 (51%) children had premature loss of deciduous teeth. ***Conclusion.*** A high prevalence of premature loss of teeth was found in this study. This finding emphasizes the importance of increasing awareness levels about this issue and focuses attention on the need for more preventive efforts to maintain healthy and normal dentitions that would improve the masticatory function and aesthetics of individuals and the whole population. In addition, the findings emphasize the importance of the early detection of premature loss of primary teeth to prevent future malocclusion.

Key Words: *premature loss, primary teeth, malocclusion, prevalence*

Introduction

The early loss of primary teeth is a public health problem that is widespread globally. Early or premature loss is defined by the loss of a deciduous tooth before the time of its natural exfoliation [1,2] (Table I). Premature loss of teeth is most commonly caused by dental caries, trauma, periodontal disease and premature root resorption [3–5]. Early loss of primary teeth leads to earlier or delayed eruption of the successor teeth [5]. Paediatric patients may experience different effects, such as dental rotation, extrusion of the antagonist tooth, dental crowding, development of deleterious habits, craniofacial growth disturbances and, particularly, impaction of the successor tooth and dental arch length reduction [5].

The relationship between the prevalence of premature tooth loss, ethnicity and the importance of environmental factors has been demonstrated by several studies [1–6].

In a study performed in Brazil, a total of 369 children (6–10 years old) were examined to evaluate the prevalence of the early loss of primary molars in school children. In that study, it was found that 24.9% of the sample experienced loss of one or more primary molars. The prevalence was highest among the 9-year-olds (27.2%) and the most commonly missing teeth were the lower primary molars (74.3%) [2].

In another study conducted in Denmark, 723 children in the 3rd grade were examined and 324 of them had experienced early loss of primary teeth due

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Table I. The exfoliation time of the primary dentition.

	Exfoliation (years)
Central Incisor	6–8
Lateral Incisor	7–9
Canine	9–12
1st Molar	10–12
2nd Molar	10–12

to caries. Unilateral distal occlusion was the most common (12.8 %) consequence of early tooth loss among these children [6].

In Saudi Arabia, a sample of 344 children aged 4–9 years was examined. It was found that the mean DMFT value was 6.6. The (d) component was very high (5.35), while the value of (m) was 0.64 (9.7%) [7].

It is generally accepted that the premature loss of the primary teeth, especially a molar, may lead to lack of space, malocclusion and mid-line discrepancies in the permanent dentition [8]. In addition, the premature loss of primary teeth reduces the arch length required for the succeeding tooth and, therefore, pre-disposes the crowding, rotation and impaction of the permanent teeth [9]. The present study was designed to determine the prevalence of the premature loss of primary teeth and its effect on malocclusion in Eastern Province, Saudi Arabia.

Materials and methods

This is an observational, cross-sectional study. The subjects of this study are 307 male Saudi children aged 9–11 years old who are regularly attending private and public schools in Dammam city. Clinical examinations were performed using a disposable sharp explorer, a UNC periodontal probe and a dental mirror (Chicago, Hu-Friedy, USA). The samples were clinically examined to detect the following traits: Angle's classification of malocclusion, overjet, overbite, anterior open bite, lateral open bite, midline shift and cross-bite. Additionally, dental caries were examined using the WHO method. Two examiners who were tested prior to the launch of the study performed all of the clinical examinations. The intra-examiner reliability test was performed with an un-weighted kappa of 0.87. The demographic background information collected included the patient's age, gender and residential information. Questionnaires in Arabic were coded and sent to the students' parents that covered nationality, gender, age, parents' level of education, socioeconomic status, area of residence, family size, frequency of tooth brushing, frequency of sugar intake, tooth brushing encouragement, frequency of dental visits, awareness of tooth eruption time and awareness of the child's missing teeth. When necessary, assistance was offered to parents to complete the questionnaire. A pilot test was conducted on 10% of the sample size to assess the feasibility of the questionnaire prior to the launch of the study.

Inclusion criteria

(1) All cases had experienced the premature loss of at least one primary tooth, specifically, a primary canine or molar.
(2) The study subjects were between the ages of 9–11 years.
(3) The study subjects provided informed consent and were present for examination on the day of screening.
(4) No space-maintenance or space-regaining appliances or other interventions were used.

Exclusion criteria

(1) Non-Saudi patients were excluded.
(2) Patients who exhibited one or more of the following pathological situations were excluded from the study: any disease or fracture of the jaw that might have affected the normal growth of permanent dentition; any hereditary diseases or syndromes such as Down's syndrome, cleidocranial dysostosis or endocrinal deficiency (hypothyroidism or hypopituitarism); any supernumerary extractions.

Written informed consent was obtained from the patient prior to the start of this study and the protocol was reviewed and approved by the Ethical Committee of the College of Dentistry, University of Dammam, Saudi Arabia.

Data management and analysis

The clinical examination data and the questionnaire data were all entered into the database by two of the researchers. Another researcher reviewed the data to ensure the quality and to ensure that no errors were made during the entry. The data were then analysed using IBM SPSS Statistics 16 (SPSS, Chicago, IL). The level of significance was set at $p \leq 0.05$.

During data entry for the questionnaires, three levels were used for parents education, three levels were used for income, three levels were used for the number of siblings, four levels were used for brushing frequency, four levels were used for sweets intake, two levels were used for brushing encouragement, two levels were used for dental visit frequency, two levels were used for regular dental visits and four levels were used for awareness of eruption time. During data entry for the clinical examination, 20 levels were used for DMFT, three levels were used for angle classification (right), three levels were used for angle classification

(left), two levels were used for mid-line, two levels were used for cross-bite, two levels were used for anterior open-bite, two levels were used for unilateral posterior open-bite, two levels were used for bilateral posterior open-bite, two levels were used for overjet and two levels were used for over-bite.

Results

Of the 307 questionnaires distributed, 128 (41.6%) were completed. The reported age of the parents ranged from 40–49 years old ($n = 48$, 47%). In terms of the parents' education level, 43% ($n = 53$) of the fathers had only a high school degree. Conversely, the majority of the mothers ($n = 57$, 46%) continued their education after high school. The median income of the families was 1300–4000 USD ($n = 71$, 58%), while, in terms of the number of siblings, we found that 68% ($n = 87$) of the families had more than three children. Sixty-five (50%) of the parents reported that their children brush their teeth once daily and 5% of the parents admitted that they do not encourage their children to brush their teeth on a daily basis. In addition, we found that three children (1.7%) attending private school and two children (1.4%) attending public schools had finger sucking habits. There were no significant differences in the finger sucking habits between children attending private and public schools. Moreover, 71% ($n = 91$) of the families took their children to the dentist at least once per year, of which 12% ($n = 15$) took their children for regular dental checkups. The results are shown in Table II.

Table II. Parent's education level and information for children aged 9–11 years old.

Participants variables		*n* (%)
Parents age	20–29	3 (2.9)
	30–39	35 (34)
	40–49	48 (46.6)
	>50	17 (16.5)
Father's education	Under high-school	24 (19.4)
	High school	53 (42.7)
	Higher education	47 (37.9)
Mother's education	Under high-school	20 (16)
	High school	48 (38.4)
	Higher education	57 (45.6)
Income	<5 000	19 (15.6)
	5 000–15 000	71 (58.2)
	>15 000	31 (25.4)
No of siblings	1	3 (0.8)
	2	8 (6.2)
	3	32 (25)
	>3	87 (68)

Table III. Mean and SD of dmft for children aged 9–11 years old.

	Mean	SD	Max	Min
Total dmft	5.61	3.01	15	0
D	4.0	2.83	15	0
M	1.01	1.36	8	0
f	0.64	1.28	7	0

In reporting the total DMFT for the cases, the numbers ranged from 0–15. The mean DMFT was 5.61 (SD = 3.01). The d component was the highest, with a mean of 4 (SD = 2.83), as shown in Table III.

Of the 307 participants, we found that 204 (66.4%) had a high DMFT score, which was defined as a score above 4, as shown in Table IV.

We found that 156/307 (51%) of the children had premature deciduous tooth loss. The proportion of children attending public school who had missing teeth was 71/134 (53%), while in the private schools we observed 85/173 (49%) with missing teeth. Among those who had had premature tooth loss, 77/307 (25%), the majority had lost only one tooth. Six participants were found to have five or more missing teeth (1.95%).

The malocclusion trait frequencies of the different groups that have missing teeth based on school type showed that 38/85 (44.7%) of the private school children and 31/71 (43.7%) of the public school children had a mid-line shift. In addition, 53/85 (62.3%) of the private school children compared to 41/71 (57.7%) of the public school children had an abnormal overjet. Moreover, 44/85 (51.7%) of the private school children compared to 39/71 (54.9%) of the public school children had an abnormal overbite (Table V).

Table VI shows the relationship between the premature loss of deciduous teeth and the prevalence of malocclusion. The relationship was not statistically significant.

Discussion

Premature loss of a primary tooth is of concern not only because of the loss of function but also because of the increased possibility that other teeth may drift [9]. Prediction of subsequent premature loss of primary teeth would be useful in determining treatment [10]. Moreover, the premature loss of deciduous teeth

Table IV. Frequency (%) of the different dmft scores.

	Frequency (%)	Frequency$_c$ (%$_c$)
Healthy (0)	20 (6.5%)	20 (6.5%)
Low score (1–4)	83 (27.1%)	103 (33.6%)
High score (4+)	204 (66.4%)	307 (100%)
Total	307 (100%)	

Table V. Malocclusion frequencies of the Private and Public schools.

		Frequency (%)	
		Private school n = 85/173 (missing)	Public school n = 71/134 (missing)
Class I	Right	53 (62.3%)	41 (57.7%)
	Left	56 (65.9%)	31 (43.6%)
Class II	Right	24 (28.2%)	25 (35.2%)
	Left	22 (25.9%)	30 (42.2%)
Class III	Right	7 (8.2%)	4 (5.6%)
	Left	5 (5.9%)	9 (12.7%)
Mid-line shift		38 (44.7%)	31 (43.7%)
Cross-bite	Unilateral	19 (22.3%)	12 (16.9%)
	Bilateral	11 (12.9%)	1 (1.4%)
Anterior open bite		11 (12.9%)	3 (4.2%)
Unilateral posterior open bite		2 (2.4%)	1 (1.4%)
Bilateral posterior open bite		1 (1.17%)	1 (1.4%)
Abnormal Overjet		53 (62.3%)	41 (57.7%)
Abnormal Over-bite		44 (51.7%)	39 (54.9%)

influences the development of normal occlusion and creates an increased need for orthodontic treatment [11].

The early loss of primary teeth has been observed in research studies throughout many areas around the world [12–16]. In this study, we examined 307 children between the ages of 9–11 years old, 173 of which were attending private schools and 134 were attending public schools. These children were selected from the Eastern Province of Saudi Arabia.

In this study, 50% of the parents reported that their children brush their teeth only once daily. This result is similar to the findings of a study performed in Tabuk, which found that 46% of the children brush their teeth only once per day. The present study showed a significant association between low brushing frequency and increased DMFT scores.

Of the 307 children, 156 (51%) had premature loss of at least one tooth that was either a deciduous canine or a molar, whereas 47.3% of children in a study performed in Denmark [6] and 24.9% in a study performed in Brazil [2] were found to have premature tooth loss. Compared to the Danish and Brazilian results, the children in our research experienced

Table VI. Relationship between malocclusion with premature loss and without premature loss of the primary teeth.

		Frequency (%)		p-value
		With no premature loss (n = 148)	With premature loss (n = 154)	
Class I	Right	92 (62.2%)	94 (61.1%)	0.759
	Left	97 (65.5%)	88 (57.1)	0.062
Class II	Right	47 (31.7%)	49 (31.8%)	0.759
	Left	44 (29.7%)	52 (33.8)	0.062
Class III	Right	9 (6.1)	11 (7.1%)	0.759
	Left	7 (4.8%)	14 (9.1)	0.062
Mid-line shift		71 (47%)	69 (44.2%)	0.624
Cross-bite	Unilateral	31 (20.5%)	31 (19.9%)	0.605
	Bilateral	7 (4.6%)	12 (7.7%)	
Anterior open bite		19 (12.6%)	14 (8.97%)	0.309
Unilateral posterior open bite		3 (1.98%)	3 (1.92%)	0.968
Bilateral posterior open bite		3 (1.98%)	2 (1.3%)	0.627
Abnormal Overjet		90 (59.6%)	94 (60.25%)	0.998
Abnormal Over-bite		89 (58.9%)	83 (53.2)	0.296

significantly higher rates of premature loss of deciduous teeth. This difference could be related to the high mean for decayed teeth, which was found to be 4.0. It might also be because parents do not care about primary teeth because they have an idea that primary teeth will be replaced. In addition, we did not find a statistically significant difference ($p = 0.505$) in the frequency of premature tooth loss cases reported between public and private schools. Moreover, despite the high percentage of premature tooth loss, upon examination, we found only five children wearing space maintainers.

It has been previously stated that the premature loss of primary teeth can affect the normal eruption time of the permanent successors by either retarding or accelerating their emergence [13].

Literature reviews have shown a relationship between the premature loss of deciduous teeth and the prevalence of malocclusion. This study was not designed to establish the statistical relationship between premature tooth loss and the development of malocclusion. Additionally, the participants were not old enough to confirm the potential outcomes of premature tooth loss. However, premature loss of primary teeth is considered to be the most common local factor leading to malocclusion because of its interference with the harmony of the adult dentition, resulting in crowding caused by migration of the adjacent teeth [17]. In addition, our study emphasizes the importance of early detection of premature primary tooth loss to prevent malocclusion in the future. Therefore, the premature loss of deciduous teeth affects the normal occlusion development and creates an increased need for orthodontic intervention.

With respect to overjet, the present study reported that 53 (62.3%) participants attending private schools had an abnormal overjet compared to 41 (57.7%) participants attending public schools. This is supported by the findings of Proffit et al. [18] that demonstrated that, between 8–11 years of age, 45.2% of children had a mildly increased overjet. Concerning over-bite, the present study found that 44 (51.7%) children attending private schools had an abnormal over-bite compared to 39 (54.9%) children attending public schools. Tauscher et al. [19] showed that an increased over-bite and overjet were the most frequent malocclusions in the early mixed dentition period. Therefore, the wide range of orthodontically relevant traits identified in the present study underlines the need for orthodontic screening at 9 years of age or earlier.

Finally, because of the deleterious effects of early loss of primary teeth, it is necessary to increase oral health awareness by conducting school dental health programmes to inform the children and their parents about the deleterious effects caused by the early loss of primary teeth. Children and their parents should be educated about the value of primary teeth so that they pay attention to preserving them. Children with an early loss of primary teeth should be instructed to have space maintainers if necessary. The parents of those children should be advised to bring their children to the dental hospital for dental procedures.

Conclusion

A high prevalence of premature tooth loss was found in this study. This finding emphasizes the importance of increasing awareness about this issue and the need to focus further efforts towards early tooth loss prevention and intervention to maintain healthy dentition, thereby improving masticatory functions and aesthetics for individuals and the whole population. In addition, our findings emphasize the importance of early detection of the premature loss of primary teeth to prevent malocclusion.

Recommendations

Children between the ages of 9–11 years old are of the appropriate age to be included in a study on the prevalence of premature loss of deciduous teeth; however, this age is too early for the determination of the effect of premature loss on malocclusion. Thus, a cohort study should be conducted.

With the prevalence rate of premature loss at 51% and a high DMFT score detected in 66.4% of the sample, public schools should take immediate action and schools should have more oral health awareness programmes. Community surveys must be conducted to assess the malocclusion problems of a larger sample.

Limitations

Due to the lack of female staff, students from female schools were not examined. This impacted the sample size and gender. Moreover, some school management staff did not allow the research team to examine their students, thus creating a problem in the randomization of schools to achieve a representative sample of the Eastern Province community.

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