



# Effect of education on parents' awareness and attitude towards the role of space maintainers in the child's mouth

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# Abstract

**Background:** Early loss of deciduous teeth can lead to space constraints and malocclusion. One preventive intervention is using space maintainers. This study aimed to examine the effect of educational intervention on parents<sup>3</sup> awareness and attitude toward using space maintainers in children.

**Methods:** This quasi-experimental interventional study was performed on 200 parents referring to the pediatric ward of Kerman faculty of dentistry. The data collection instrument was a researcher-made questionnaire collecting demographic information with sections assessing awareness (14 items) and attitude (10 items). An educational pamphlet was used to train the participants. After three weeks, the questionnaire was re-completed by the parents. The data were analyzed using SPSS 26 through paired *t*-test, independent *t*-test, analysis of variance, Tukey's post hoc test, and linear regression.

**Results:** In terms of age, 63.5% of fathers and 81% of mothers participating in this study were between 25 and 40 years old. The mean age of the children was 6.71 years, with a standard deviation of  $\pm$  1.06. The parents' awareness score increased by 4.96 post-education compared to pre-education, and the attitude score improved by 7.09. Father's higher education level (*P*=0.01), better economic status (*P*=0.046), and better post-education awareness (*P*=0.0001) were among the significant factors affecting the improvement of attitude post-education.

**Conclusion:** The present research results indicated that educational intervention significantly improves awareness and attitude (P=0.0001). With an increase in awareness, attitude also became more positive. The results also revealed that education had a greater impact on boosting attitude than awareness.

Keywords: Space maintenance, Deciduous teeth, Parents, Awareness, Attitude, Education, Intervention

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# Introduction

Deciduous teeth play a key role in the growth and development of the child in terms of speaking, mastication, appearance, prevention of harmful oral habits, and guiding the growth of permanent teeth. Healthy deciduous teeth preserve the space for the growth of permanent teeth and the integrity of the mandibular arch. Indeed, they also function as the best space maintainers for permanent teeth.<sup>1-3</sup> The timely loss of deciduous teeth and their replacement with permanent teeth are normal physiological processes.<sup>4</sup>

One of the common problems in pediatric oral and dental health is early loss of deciduous teeth,<sup>4-6</sup> which can lead to displacement of the adjacent teeth, resulting in problems, including space constraints, impaction of permanent teeth, malocclusion, and midline misalignment.<sup>7</sup> Various

reasons, such as tooth decay, trauma, early resorption of the root, and periodontal diseases, can lead to early loss of deciduous teeth.<sup>5,8</sup>

Preventive treatment should be undertaken when the early signs of space constraints are observable in deciduous teeth or early mixed-teeth dentition.<sup>9</sup> Primary preventive interventions minimize the severity of malocclusion and the difficulty of treatment and reduce treatment time and cost. One of these preventive interventions is the use of space maintainers.<sup>10</sup>

The term "space maintenance" was first used by Brauer in 1941 and was described as maintaining the space of one tooth or several teeth in the dental arch.<sup>11</sup> A space maintainer is an instrument that can be either fixed or removable. It is the most common treatment in mixed dentition and deciduous teeth for maintaining the



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space created by the lost deciduous tooth or teeth until the emergence of successive permanent teeth and for preventing malocclusion problems.<sup>2,12</sup>

Fixed space maintainers, such as band and loop maintainers, crown and loop maintainers, trans palatal arches, lingual arches, and Nance appliances, are employed more frequently. On the other hand, different types of removable prostheses are also used as space maintainers.<sup>11</sup> The band and loop space maintainers are the most commonly used fixed space maintainers. Although its fabrication is more convenient and economical and requires shorter time in the office, it cannot recover the occlusal function of the lost teeth. Meanwhile, removable space maintainers recover the occlusion function to some extent.<sup>13</sup>

Parents are responsible for their children's oral and mental health,14 and their awareness about the importance of deciduous teeth and maintaining the space affects their children's oral and dental health.5 Ramakrishnan found that despite the parents' high awareness of the importance of deciduous teeth in India, they were unaware of the available treatment methods for space maintenance following the extraction of deciduous teeth.15 Alotaibi reported low awareness of parents about space maintainers in Taif city.<sup>16</sup> Ali et al reported that parents in Riadh had insufficient knowledge about space maintainers; the authors concluded that education was necessary.<sup>17</sup> Also, the study by AlMotawah et al in Riadh reported low awareness of parents; they reported that dentists do not promote awareness about the importance of space maintainers and the downsides of empty interdental space.18

Despite extensive research on the awareness and attitude of parents about preserving deciduous teeth and the importance of space maintainers and the emphasis of these studies on the importance of education for augmenting the awareness and attitude of parents, so far, no study has examined the effect of educational interventions in this regard. Therefore, this investigation was conducted to explore the effect of improving the level of awareness and attitude of parents about space maintainers in children.

# Methods

This quasi-experimental interventional study was conducted on 200 randomly chosen parents referred to the Kerman Faculty of Dentistry pediatric ward from September to December 2022. The data collection instrument was a Persian researcher-made questionnaire designed based on similar studies.<sup>10,16</sup>

The first section of the researcher-made questionnaire collected demographic information including the gender of the child and participating parents, the child's age, education, occupation, and age of parents, number of children, economic status self-assessment, self-assessment of the oral and dental health of the child, the child seeing a dentist over the past six months, loss of the child's deciduous teeth due to caries or trauma, and the use of different types of space maintainers by the child. The second section included 24 items in two parts, one related to parents' awareness about space maintainers (14 items) and the other on their attitude about space maintainers (10 items).

The validity of the questionnaire was calculated at 0.95 based on the opinions of five pediatric dentists and orthodontists. First, a pilot study was performed on 20 subjects to investigate the reliability; the reliability was confirmed based on a Cronbach alpha coefficient of 0.759.

Parents with children aged 5 to 9 years who were literate and willing to participate in the study were included. Parents who had children with systemic diseases or mental retardation were excluded. Simple random sampling was used.

First, a written informed consent form was acquired from the parent. Then, the questionnaire, alongside the color image of all types of space maintainers, was given to them. The volunteers responded to the written questionnaire. Next, a color educational pamphlet (Figures 1 and 2) containing general information about the importance of maintaining the space of deciduous teeth and different types of space maintainers was presented to them so that they could study it in detail. Again, after two weeks, the initial questionnaire was given to the same subjects based on previously assigned codes, and the responses to the questionnaires pre- and post-education were compared to each other.

The questionnaire scoring was evaluated based on a 5-point Likert scale ranging from absolutely agree (5 points) to absolutely disagree (1 point) up to a maximum of 70 and 50 scores for awareness and attitude, respectively. In the awareness section, higher scores indicated greater awareness, while in the attitude section, lower scores represented a more positive attitude to space maintenance.

The data were analyzed by SPSS 26. Descriptive statistics, including frequency percentage, mean, and standard deviation, were used for data description. For data analysis, a paired *t*-test was employed for comparing the pre- and post-education scores, an independent *t*-test was utilized for exploring the relationship between scores and two-state qualitative variables such as gender, analysis of variance and Tukey's post hoc test were used to examine the relationship between the questionnaire scores and multistate qualitative variables such as parental education, Pearson correlation was used for checking the relationship between awareness and attitude, and multivariate analysis was employed as a linear regression method. The significance level was  $P \le 0.05$ .

# Results

Two hundred eighty-seven questionnaires were

#### **Tooth space maintainers**

The space maintainer devices are used to maintain the permanent tooth space in children who are in the dental transition period (falling of a number of primary teeth and eruption of a number of permanent teeth). If a primary tooth is lost prematurely, a spacer is used to maintain the space of the permanent .tooth

#### Types of fixed space maintainers

Nance space maintainer consists of two bands around the molars and an acrylic button that covers part of the child's anterior palate. This device is used when the child's two molars on both sides of the upper jaw are prematurely lost. In these cases, Nance appliance maintains the required space until the eruption of permanent tooth. This space maintainer is placed only by the dentist and the child cannot remove it from her/his mouth.

# Lingual arch space maintainer

This device consists of a U-shape metal rod that is placed behind the front teeth of the lower jaw and two bands around the molars. This device is used when the child's two molars on both sides of the lower jaw are prematurely lost. In these cases, Lingual arch maintains the required space until the eruption of permanent tooth. This space maintainer is placed only by the dentist and the child cannot remove it from her/his mouth.

#### **Transpalatal space maintainer**

It consists of a metal rod that is connected to two bands around the molars of the upper jaw in the middle of the palate. It is used when the child's two molars on both sides of the upper jaw are prematurely lost .Also, the transpalatal bar helps to maintain the width of the dental arch. This space maintainer is placed only by the dentist and the child cannot remove it from her/his mouth.

Figure 1. Educational pamphlet part 1

#### Band and loop space maintainer

It consists of a metal band around a molar and a wire arm that is soldered to it. This type is used when a molar in the upper or lower jaw is missing on one side of the arch. This device prevents the movement of the teeth on both sides of the toothless area towards the empty space until the permanent tooth grows in its right place. This space maintainer is placed only by the dentist and the child cannot remove it from her/his mouth

# **Removable space maintainer**

This type consists of several metal wires and several artificial teeth placed on an acrylic base. It is used when several molars on both sides of the jaw have been lost prematurely. This device has the same function as fixed space maintainers, except that it replaces the missing teeth and the chewing function is restored. It can be .put on and taken off by the child

## How to use fixed space maintainers

During the first days of using this device, there may be some discomfort and a negative effect on speech, which will be resolved in less than a week. When using any orthodontic device, the child should avoid from eating sticky foods such as toffee, gum and very hard substances such as ice, nuts and hard candies, because these substances can cause the space maintainer to loosen and come off. The child should be constantly reminded not to move the wire of the device with her/his fingers or tongue. If food is stuck between the wire and the child's teeth, just clean the wire and teeth using a toothbrush and dental floss. Brushing the teeth while using space maintainers is very important; be sure to brush your child's teeth after meals and before going to sleep, because food particles around the device can cause tooth decay. If the child and parents take good care of them, space maintainers do not have any negative effect on the child's beauty, speech, breathing, comfort and eating

## How to use removable space maintainers

This type is usually used in older children who have the ability to take care of it. The child should be trained how to put and remove it. After each meal, the device is removed and cleaned with water and a soft toothbrush, the teeth are brushed, and it is put back .into the mouth

#### he duration of using the space maintaine

The space maintainer remains in place until the permanent tooth begins eruption and must be examined and con-.months 6 trolled by a dentist every

#### When should you see a dentist immediately?

1.If the space maintainer bands are moved or the device is completely removed

2. if the wire is broken or bent and separated from the band on one or both sides 3. If the child's tongue, gums or teeth suddenly start to be sore or sensitive.

#### Figure 2. Educational pamphlet part 2

distributed among the parents referring to the pediatric ward of Kerman Faculty of Dentistry. Of this number, 87 questionnaires were excluded from the statistical population because of incomplete responses.

Specifically, 80.5% of the participants were mothers, and 19.5% were fathers, mainly within the 25–40 age range. The mean age of the children was 6.71 years, with a standard deviation of  $\pm$  1.06. Also, 6% of the parents reported that their children were using space maintainers. The participants' demographic information is presented in Table 1 and Figures 3 and 4.

Tables 2, 3, S1 (see Supplementary file 1), and Figures 5 and 6 present the mean values of the scores of awareness and attitude items pre- and post-education with the color brochure, which included general information about the importance of deciduous teeth, the necessity of preserving deciduous teeth, as well as different types of space maintainers. The mean scores of all awareness and attitude items except for two items in the awareness section improved significantly post-intervention (P=0.0001). The total score of awareness was 53.63 pre-education and 58.59 post-education, showing an increase of 4.96. Also, the total attitude score was 28.92 pre-education and 21.83 post-education, indicating a reduction of 7.10, meaning that the attitude became more positive.

In the univariate analysis, there was no significant relationship between gender, age, education, occupation, number of children, economic status, parents' assessment of their child's oral and dental health, attitude, and awareness scores before and after the education. Although no significant relationship was found between the level of awareness preintervention and the number of dentistry visits of the child, following the education, the parents whose child had been visited by a dentist four times or more acquired a significantly higher awareness score compared to the parents whose child had not been visited at all. Considering attitude, before education, the parents whose child had seen the dentist one to three times achieved significantly higher scores than those whose child had not seen the dentist at all, indicating a greater positive attitude. However, there was no significant relationship between attitude and values following the educational intervention. Furthermore, the parents whose children had used space maintainers acquired better awareness scores pre- and post-education (Table 3).

The results revealed an inverse and significant relationship between the attitude and awareness domains pre-education (Pearson correlation (r) = -0.146, P = 0.039) and post-education (r = -0.445, P = 0.0001), signifying that with an increase in awareness, the attitude score diminishes (becomes more positive).

Multivariate analysis via linear regression indicated that physicians and freelancing mothers acquired significantly higher awareness scores than laborers and homemakers (P=0.029). Furthermore, mothers with more children

 Table 1. Demographic information of the participants as well as assessment

 of the dentistry status of the child according to the parent's view

	Categorization	NO.	%
	Girl	153	76.5
Child's gender	Воу	47	23.5
	5–6	71	35.5
Child's age	7	81	40.5
	8–9	48	24
Participating parent	Mother	161	80.5
gender	Father	39	19.5
	<25	2	1
Father's age	25-40	127	63.5
	>40	71	35.5
	<25	6	3
Mother's age	25-40	152	81
	>40	32	16
	High school diploma and below	33	16.5
Father's education	Associate and bachelor's degree	93	46.5
	Master's and PhD degree	74	37
	Diploma and below	25	12.5
Mother's education	Associate and bachelor's degree	104	52
	Master's and PhD degree	71	35.5
	1	63	31.5
No. of children	2–4	135	67.5
	>4	2	1
	Poor	8	4
Parent's self-assessment of economic status	Average	88	44
or economic status	Good	104	52
	Bad	20	10
Parent's self-assessment of child's oral health	Average	81	40.5
	Good	99	49.5
No. of child visits to	0	68	34
the dentist over the	1–3	121	60.5
past 6 months	>4	11	5.5
1 (1.1)	Yes	144	72
loss of deciduous teeth	No	56	28
(	Yes	12	6
use of space maintainer	No	188	94

showed significantly higher awareness scores (P=0.07). In confirming the results of univariate analysis, having the space maintainer (P=0.01) and the pre-education attitude score becoming more positive (P=0.0001) also led to a significant elevation of the awareness score posteducation.

Concurrent investigation of the effect of independent variables on the dependent variable via backward linear



Figure 3. Father's occupation

regression method on the total score of the questionnaire showed that pre-education, only loss of deciduous teeth (B=2.68, P=0.06), and post-training, father's education (B=-0.711, P=0.09), mother's education (B=0.821, P=0.09), and having a space maintainer (B=0.329, P=0.08) had a marginal relationship.

# Discussion

Parents have a unique position in dealing with their children's oral and dental health, including maintaining the space that results from the early loss of deciduous teeth. Meanwhile, enhancing the oral and dental health of the child directly impacts both parents' and children's quality of life.<sup>2,19</sup> Thus, undertaking educational interventions to enhance the awareness and attitude of parents is essential.<sup>20</sup> The present research results revealed that following the educational interventions, the parents' awareness of space maintainers in children increased, and their attitude became more positive.

Although numerous studies have been performed on exploring the extent of awareness and attitude of parents about space maintainers, and they have emphasized the necessity of parental education in this regard, no educational intervention was done in any of them. In the investigations by Ali et al<sup>17</sup> and Alduraihim et al<sup>2</sup> in Saudi Arabia, the parents' awareness of space maintainers was insufficient. These studies emphasize the role of dentists in educating parents and designing programs for their education. Alotaibi reported that 77% of participating parents had received no education about space maintainers and had no information on the subject.<sup>16</sup>

In the present investigation, a color educational pamphlet was used to educate the participants. It included the response to and complete explanation of the items in the questionnaire and general information about different types of space maintainers. The educational intervention led to an increase of around five in the awareness score and an improvement of about seven in the attitude score. Thus, educational intervention has been proven to be very



useful, even if it is short-term and through a pamphlet. The study by Sadat-Sajadi et al regarding parental awareness about their children's first permanent molar tooth also indicated that education is an effective method for enhancing their children's oral and dental health. Also, if the educational material includes images, it will be more effective as it is retained better.<sup>21</sup>

In the present research, in most awareness items, the scores increased significantly post-education. The largest difference in the scores was related to the item "The child cannot eat hard and sticky food with a space maintainer in their oral cavity." It was followed by "Early loss of deciduous teeth would damage the permanent teeth." In the investigation by Linjawi et al<sup>10</sup> in Saudi Arabia, Vittoba Setty and Srinivasan<sup>22</sup> in India, and Halvani et al in Iran,<sup>20</sup> parental awareness about the importance of preserving the deciduous teeth and the role of space maintainers ranged from low to average. Thus, an increase in scores acquired in the present research is essential, considering the low awareness scores in most studies. The educational intervention showed no effect regarding the two items "This space maintainer can cause halitosis if not properly cleaned" and "A fixed space maintainer attached to the base tooth is better for children than a removable space maintainer that can be removed by the child." The educational points about normal growth of teeth, maintaining space for permanent teeth, and lack of interference with the child's eating seem to have been more critical for parents than the type of space maintainer and halitosis.

Considering attitude, the educational intervention brought about improvement in all items. The largest score difference was related to the items "The space maintainer seems to interfere with the child's eating," "The child seems to feel uncomfortable with the space maintainer in their mouth," and "Daily cleaning of the space maintainer seems to be difficult for the child." The greater increase in scores in the items related to the child's eating and convenience points to the diminished concerns of parents

# Table 2. The mean and standard deviation of the scores of awareness and attitude items

		Stage	Mean	SD	P value	
	Premature loss of deciduous teeth damages permanent teeth	Pre-education	3.88	0.956	0.0001	
		Post-education	4.49	0.743		
	To preserve the space of a lost deciduous tooth, a	Pre-	3.71	0.954		
	space maintainer is placed inside the oral cavity	Post-	4.24	0.810		
	The space maintainer helps in the properly aligned	Pre-	3.97	0.870	0.0001	
	growth of permanent teeth.	Post-	4.20	0.819		
	The space maintainer can prevent orthodontic	Pre-	3.82	0.863	0.0001	
	treatment in the future.	Post-	4.15	0.742		
	With the growth of permanent teeth, the space	Pre-	4.03	0.792	0.0001	
	maintainer should be removed by the dentist.	Post-	4.32	0.762		
	The space maintainer should be cleaned daily.	Pre-	3.98	0.776	0.0001	
	. ,	Post-	4.38	0.734		
	The space maintainer should be cleaned using a brush	Pre-	3.85	0.827	0.0001	
Awareness Items	and dental floss.	Post-	4.39	0.721		
	The child cannot eat hard and sticky food with the	Pre-	3.43	0.899	0.0001	
	space maintainer inside their oral cavity.	Post-	4.09	0.807		
	If the space maintainer is not cleaned properly, it can	Pre-	3.78	0.903	0.573	
	cause nantosis.	Post-	3.82	0.855		
	If the space maintainer is not cleaned properly, it can	Pre-	3.75	0.946	0.003	
	cause tooth decay.	Post-	3.98	0.805	0.001	
	If the space maintainer is driven into the gum through	Pre-	3.68	0.885		
	excess pressure, it can cause mouth ulcers.	Post-	3.92	0.864	0.0001	
	The space maintainer should be regularly investigated	Pre-	3.94	0.802		
	by the dentist every six months.	Post-	4.38	0.774	0.0001	
	When the space maintainer is broken or lost, one should immediately refer to the dentist	Pre-	4.13	0.820		
	A fixed space maintainer attached to the base tooth is better for children than a removable space maintainer	Pro	4.55	0.841	0.951	
		Post	3.73	0.990		
	that can be removed by the child.	Pro-	2.63	0.85		
	It seems space maintainers may detach from the tooth or be lost.	Post-	2.03	0.98	0.0001	
		Pre-	3 39	0.934	0.0001	
	The child seems to feel uncomfortable with a space maintainer inside the mouth	Post-	2.51	1.06		
	The space maintainer scores to cause decreased	Pre-	2.80	0.958	0.0001	
	aesthetics for the child	Post-	2.14	0.930		
	The space maintainer seems to cause pain and a	Pre-	2.95	0.947	0.0001	
	burning sensation in the mouth and gums of the child	Post-	2.21	0.900		
Attitude items	The space maintainer seems to hurt the child's tongue.	Pre-	2.79	0.890	0.0001	
		Post-	2.12	0.828		
	The space maintainer seems to cause embarrassment for the child.	Pre-	2.76	0.887	0.0001	
		Post-	2.15	0.839		
	The space maintainer seems to interfere with the child's speaking	Pre-	2.88	0.938	0.0001	
		Post-	2.06	0.900		
	The space maintainer seems to interfere with the	Pre-	3.03	0.945	0.0001	
	child's eating	Post-	1.97	0.913	0.0001	
	The space maintainer seems to interfere with	Pre-	2.50	0.857	0.0001	
	suffocation in the child.	Post-	2.12	0.894	0.0001	
	The daily cleaning of the space maintainer seems to be	Pre-	3.22	0.956	0.0001	
	difficult for the child.	Post-	2.36	1.042		

Table 3. The mean and standard deviation of scores pre- and post-education in terms of various variables

Table 3. Continued.

Stage			Total score	P value
Child's age	Pre-	Girl	82.97	0.243
	education	Воу	81.19	
	Post-	Girl	80.72	0.227
	education	Воу	79.47	0.237
		5	79.50	
	5	6	81.98	
	Pre- education	7	83.96	0.245
		8	82.77	
Child's age		9	81.77	
einid s uge		5	81.46	
		6	79.39	
	Post- education	7	80.73	0.539
		8	81.00	
		9	79.00	
		Below high-school diploma	83.00	
		High-school diploma	83.27	
	Pre-	Associate degree	83.08	0.923
	education	Bachelor's degree	82.07	0.020
		Master's degree	81.78	
Father's		PhD	84.00	
education	Post- education	Below high-school diploma	84.00	
		High-school diploma	81.23	
		Associate degree	79.76	0.604
		Bachelor's degree	80.22	
		Master's degree	79.82	
		PhD	81.00	
	Pre- education	Below high-school diploma	79.00	
		High-school diploma	82.46	
		Associate degree	82.20	0.895
		Bachelor's degree	82.33	0.055
		Master's degree	82.24	
Mother's		PhD	84.95	
education	Post- education	Below high-school diploma	78.00	
		High-school diploma	80.50	
		Associate degree	77.73	0.646
		Bachelor's degree	80.71	
		Master's degree	80.41	
		PhD	81.25	
	Pro	1	81.94	
	Pre- education	2–4	82.82	0.798
No. of		>4	84.00	
children	Post- education	1	81.10	
		2-4	80.25	0.072
		>4	71.00	

Stage			Total score	P value
Parent's assessment of their child's oral and dental health	Pre- education	Very bad	83.93	
		Bad	83.21	
		Average	81.78	0.846
		Good	82.06	
		Very good	76.60	
	Pre- education	Very bad	79.27	
		Bad	80.62	
		Average	80.45	0.565
		Good	81.63	
		Very good	53.80	
No. of	Pre- education	0	83.06	
		1–3	81.80	0.102
		4	87.73	
dentist visits	Post- education	0	80.46	
		1–3	80.02	0.068
		4	84.64	
Loss of deciduous teeth in response to caries or trauma	Pre- education	Yes	84.48	0.062
		No	81.81	0.002
	Post- education	Yes	80.50	0.917
		No	80.40	0.517
Presence or absence of space	Pre- education	Yes	84.67	0.410
		No	82.42	
maintainer inside the	Post- education	Yes	83.42	0.001
child's mouth		No	80.23	0.051

about these issues.

As stated earlier, studies performed so far have not been interventional. Further, most studies have not dealt with evaluating parental attitudes. Only the investigation by Halvani et al<sup>20</sup> in Iran indicated that parents' attitudes about preserving deciduous teeth and the role of space maintainers were low.

The present research results revealed that awareness and attitude pre- and post-education were significantly correlated. Although good awareness and a positive attitude do not necessarily lead to better behavior and performance, changing awareness and attitude is a prerequisite to behavioral modification. As indicated by the results of this investigation, educational interventions can largely influence awareness and attitude and, thus, parents' behavior.

Another study found a relationship between parental awareness and the child having a space maintainer in their mouth. Although a small percentage of children had space maintainers, having this device had caused a significant increase in the awareness both pre- and posteducation and the positivity of attitude pre-education. This seems to be related to the dentist's explanations to the parents about the importance of having a space



 $\ensuremath{\textit{Figure 5.}}$  The mean score of awareness pre- and post-education for each item

maintainer, which has caused enhanced awareness and a better attitude. These findings were in line with the results of AlMotawah, reporting that 90% of the children did not use space maintainers, and the parents whose children had space maintainers showed a tendency for immediate visits in case it was lost or broken.<sup>18</sup>

In the present study, pre-educational awareness of physicians and freelancing mothers was significantly higher compared to laborers and homemakers, which concurs with the results of Halvani and colleagues' study.<sup>20</sup>

In the present research, the parents with more children had significantly higher scores. This did not concur with the findings of Halvani et al, who showed that parents with a single child had better attitudes and awareness about space maintenance.<sup>20</sup> The result of our research can be related to increased experience and awareness in people with more children. The increase in awareness post-education was chiefly caused by the educational intervention. Although factors such as the mother's occupation and the number of children affected awareness pre-education, they were ineffective in awareness post-education.

Investigation of the variables affecting attitude showed that having a space maintainer, younger child, loss of deciduous teeth, and more frequent visits caused significantly more improvement in attitude preeducation. This can arise from greater care for the child's oral health at younger ages, more frequent referral to the dentist because of tooth loss, and the dentists' guidance about space maintenance. Following the training, fathers' higher education, better economic status, and better awareness caused significant improvements in the



Figure 6. The mean score of attitude pre- and post-education for each item

positivity of attitude. On the other hand, investigations of Nagarajappa et al<sup>14</sup> in India and Van Den Branden et al<sup>23</sup> in Belgium showed that mothers' higher education improved attitudes and awareness about the child's oral and dental health.

Since previous studies have indicated low parental awareness and attitude and recommended conducting such educational programs, the most crucial strength of our investigation was providing educational intervention. However, because there was no similar study, comparing different educational methods and the factors affecting attitude and awareness was impossible. Geographical and cultural differences and the various techniques employed can cause differences in the results of studies.

The main limitation of this study was that the parents' performance was not evaluated. Another limitation was measuring the effect of education only through one method in the short term.

# Conclusion

The present research results indicated that following the educational intervention, the parents' awareness about space maintainers in children increased, and their attitudes became more positive. A significant relationship was found between awareness and attitude; as the awareness improved, the attitude became more positive. The effect of educational intervention on enhancing the attitude was greater than ameliorating awareness. Conducting further long-term studies with various educational methods on parents' awareness, attitude, and performance is recommended.

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# **Authors' Contribution**

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## **Competing Interests**

There are no conflicts of interest in the present research.

#### **Ethical Approval**

The Ethics Committee of the Faculty of Dentistry, Kerman University of Medical Sciences, Kerman, Iran, approved the study protocol under the code IR.KMU.REC.1401.343.

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#### **Supplementary Files**

Supplementary file 1 contains Table S1 (Questionnaire).

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