Research Article ISSN 2639-9490

Oral Health & Dental Science

Evaluation of Three Different Posts in The Restoration of Severely Decayed Primary Maxillary Anterior Teeth: A 24-Month Clinical Study

Oner R and Patir Munevveroglu A*

Department of Pedodontics, Istanbul Medipol University, Turkey.

*Correspondence:
Aslı Patır Münevveroğlu, Assistant Proffessor, Department of Pedodontics, Istanbul Medipol University, Cibali Mahallesi, Atatürk Blv. No:27, 34083 Unkapanı/Fatih/İstanbul, Turkey.

Received: 12 December 2019; **Accepted:** 03 January 2020

Citation: Oner R, Patir Munevveroglu A. Evaluation of Three Different Posts in The Restoration of Severely Decayed Primary Maxillary Anterior Teeth: A 24-Month Clinical Study. Oral Health Dental Sci. 2020; 4(1); 1-6.

ABSTRACT

Background: *The restoration of severely decayed primary maxillary anterior teeth is a big challange for pediatric dentists. For the management of such teeth, pedodontists must use intracanal posts, such as composite, polyethylene fiber, and glass fiber posts.*

Aim: *The aim of this clinical study was to evaluate and compare the marginal adaptation, retention loss, marginal discoloration, and color match and translucency of 3 different intracanal posts (composite, polyethylene fiber, and glass fiber post) in restorations of severely decayed primary maxillary anterior teeth.*

Design: *A total of 180 severely decayed primary maxillary anterior teeth from children aged 3 to 4 years were selected according to the inclusion criteria. The patients were treated under local and general anesthesia. The teeth were treated endodontically and were randomly divided into 3 groups (n=60): Group I: composite post, Group II: Ribbond polyethylene fiber post, and Group III: glass fiber post. The marginal adaptation, retention loss, marginal discoloration, and color match and translucency were clinically and radioographically evaluated during every follow-up at 6, 12, and18 months and at 24-month intervals.*

Results: *There was no significant difference between the polyethylene fiber posts and the glass fiber posts and between the polyethylene fiber posts and the composite posts after 24 months ($p>0.05$). However, there was a significant difference between the composite and the glass fiber posts after 24 months ($p<0.05$). There was no significant difference in the marginal discoloration and color match and translucency values of the specimens in the composite post, polyethylene fiber post, and glass fiber post groups after 6, 12, 18, and 24 months ($p>0.05$).*

Conclusion: *The glass fiber posts showed the maximum retention and marginal adaptation followed by the polyethylene fiber posts. The composite posts showed the least retention and marginal adaptation.*

Keywords
Composite post, Polyethylene fiber post, Glass fiber post, Marginal adaptation, Retention, Marginal discoloration.

Introduction
Early childhood caries is the most common chronic disease in childhood [1,2]. Severe destruction of the primary incisors frequently occurs due to early childhood caries [3]. The maxillary primary incisors are the most severely affected teeth, with damage usually involving the pulp. In extreme cases, early childhood caries can lead to the complete loss of the coronal structure [4]. Until very recently, the only treatment option was extraction of the affected teeth [5]. The extraction of primary maxillary anterior teeth may cause reduced masticatory efficacy, loss of vertical dimension, abnormal position of the tongue (tongue thrust), reduced bite force, and aesthetic, speech, and psychological problems. The restoration of primary teeth is important because it preserves the teeth longer without extraction [6-9].

The restoration of severely decayed primary maxillary anterior teeth is a big challenge for pediatric dentists [10]. In such teeth, in which the pulp is affected, but the root remains healthy, the pedodontists must use an intracanal post, and core restoration applications have come into consideration as a treatment alternative [3,11].

Intracanal posts enable the reconstruction of severely affected anterior primary teeth and provide a functional and aesthetic solution without interfering with root resorption. They also improve the retention of restoration following endodontic treatment. Different posts are available for use in pediatric dentistry, such as nickel-titanium and other metallic posts, orthodontic wires in "α," "γ," and "Ω" forms, cast posts with macroretentive elements, biologic posts, composite resin posts, fiber-reinforced composite (FRC) posts, such as polyethylene fiber posts, and glass fiber posts [12-14].

Prefabricated metal posts are fast, low cost, easy to perform, and involve less technique-sensitive materials. However, their unaesthetic appearance and the potential interference with physiologic root resorption limit their application [5,14]. Omega-shaped stainless steel orthodontic wire has been introduced as a simple, quick, and effective post material for the restoration of primary anterior teeth. However, the wire adaptation to the root canal walls is inadequate [5] and may cause restoration detachment and fractures of thin root canals as a result of excessive masticatory forces [15]. Biologic posts are also aesthetic materials, but the need of a tooth bank, donor and recipient acceptance, and the risk of cross infection make this treatment option impractical [16].

Since 1986, pedodontists have used composite posts, which provide aesthetic restorations for severely affected maxillary anterior primary teeth. They can be used confidently when there is normal masticatory function, a balanced diet, and oral hygiene control. However, there may be retention loss as a result of polymerization shrinkage, enhancing the microleakage and restoration fracture potential due to the high shear forces, especially in children with bruxism [7,17,18].

Polyethylene fiber, glass fiber, carbon fiber, and Kevlar fiber posts are various types of prefabricated tooth-colored FRC posts [15]. One new restoration system is a hybrid of unidirectional and braided polyethylene fibers known as Ribbond Triaxial [11]. Introduced into the market in 1992, polyethylene fiber posts are composed of ultra-high-molecular-weight polyethylene fibers [5]. Glass fiber is another type of FRC post composed of unidirectional glass fibers embedded in a resin matrix for added strength [11]. Glass FRC posts (EverStick, Turku, Finland) were introduced in the early 2000s. These posts are custom fabricated and ready to use. The fiber content of these posts provides aesthetic results, improves mechanical and chemical bonding to all restorative materials, increases the composite restoration's fracture resistance, and reduces the risk of root fracture.

The modulus of elasticity is similar to that of dentin, which helps even the distribution of stress. Moreover, it does not cause discoloration, and it presents no potential corrosion and hypersensitivity hazards. Nevertheless, the high cost, technique sensitivity, and time-consuming treatment procedure are some disadvantages [10,11,14,15,19].

The aim of this clinical study was to evaluate and compare the marginal adaptation, retention loss, marginal discoloration, and color match and translucency of 3 different types of intracanal posts (composite, polyethylene fiber, and glass fiber posts) in the restoration of severely decayed primary maxillary anterior teeth.

Materials and Methods

This study was approved by the Ethics Committee of Istanbul Medipol University Dentistry Faculty in Turkey. A total of 72 children (33 girls and 39 boys) with 180 severely decayed primary maxillary teeth were selected to participate in this randomized clinical trial. All the patients' parents were informed about the purpose of the research and gave permission. Three- to four-year-old children who had unremarkable medical histories and presented no maloclusion or deleterious oral habits were included in this study. The inclusion criteria for the maxillary incisors were: ECC involving three-fourths of the crown, no mobility, no root caries, no abscess, sound roots, and one-third external root resorption at the most, compared with the adjacent teeth in radiographs.

Uncooperative children were treated under general anesthesia while the cooperative patients received local anesthesia in a dental clinic. Teeth were randomly divided into three groups with 60 teeth in each group: Group I: composite post, Group II: Ribbond polyethylene fiber post, and Group III: glass fiber post.

The teeth were isolated with cotton rolls and a saliva ejector. Carious lesions were removed using a no. 8 carbide bur, and the pulp tissue was extirpated. The canal was prepared using endodontic files (nos. 25 to 35 K-Files, Mani Inc, Tochici, Japan) under constant irrigation with physiologic saline solution and dried with paper points. The coronal two-thirds of the canal was obturated with calcium hydroxide-iodoform paste (Metapex, Meta Biomed Co., Cheongiu City, Korea), and a layer of zinc phosphate base (Harward Cement, Harward Dental International GmbH, Honow, Germany) was placed inside the canal. Then, the obturating material was removed 2-3 mm below the cementoenamel junction (CEJ) using a straight fissure bur. The prepared canal and coronal structure were cleaned, rinsed, and air-dried.

In Group I (composite post) (n=60), the intracanal length of the root canal was measured using William's periodontal probe. The canal space and tooth were etched using 35% phosphoric acid (3M ESPE, St Paul, USA) for 20 seconds and then washed with a compressed stream of air and water for 20 seconds. Then, the surfaces were dried with a gentle air stream. A dentin bonding agent (Adper Single Bond, 3M ESPE, St. Paul, USA) was applied to the sufaces and gently air-thinned for 5 seconds to evaporate the solvents then light-cured for 20 seconds with an Elipar S10 curing light (3M ESPE, St. Paul, USA). Filtek Z350 flowable composite (3M ESPE, St Paul, USA) was injected into the canal space and on the root's cross-sectioned surface and cured for 20 seconds using an incremental technique. We used the pediatric anterior strip crown procedure for the maxillary anterior teeth restoration in all groups (3M ESPE, St. Paul, USA). The strip crowns were filled with flowable composite, put on the sectioned surfaces, and the buccal and palatal surfaces were light-cured for 40 seconds. Finally, the strip crowns were removed with an explorer, and the restoration was finished with diamond finishing burs (Teezkavan, Tehran, Iran) and composite polishing discs.

In Group II (Ribbond polyethylene fiber post) (n=60), 2 mm polyethylene fiber was used for this study. The intracanal length of the root canal was measured using William's periodontal probe. The canal space and tooth were etched using 35% phosphoric acid (3M ESPE, St. Paul, USA) for 20 seconds and then were washed with a compressed stream of air and water for 20 seconds. Then, the surfaces were dried with a gentle air stream. A dentin bonding agent (Adper Single Bond, 3M ESPE, St. Paul, USA) was applied to the sufaces and gently air-thinned for 5 seconds to evaporate the solvents then light-cured for 20 seconds with an Elipar S10 curing light (3M ESPE, St Paul, USA). The Ribbond was cut to twice the depth of the canal and immersed in a bonding agent (Adper Single Bond, 3M ESPE, St. Paul, USA) and cured for 20 seconds. Dual-cure resin cement (Rely X ARC, 3M ESPE, St. Paul, USA) was injected into the canal, and the Ribbond was inserted into the root canal with the help of plugger then cured for 40 seconds. The crown was formed with the strip crown, as in Group I.

In Group III (glass fiber post) (n=60), the intracanal length of the root canal was measured using William's periodontal probe. The canal space and tooth were etched using 35% phosphoric acid (3M ESPE, St. Paul, USA) for 20 seconds and then washed with a compressed stream of air and water for 20 seconds. Then, the surfaces were dried with a gentle air stream. A dentin bonding agent (Adper Single Bond, 3M ESPE, St. Paul, USA) was applied to the sufaces and gently air-thinned for 5 seconds to evaporate the solvents then light-cured for 20 seconds with an Elipar S10 curing light (3M ESPE, St. Paul, USA). The glass fiber post was cut with a diamond bur equal to the measured depth for each canal and immersed in a bonding agent (Adper Single Bond, 3M ESPE, St. Paul, USA) and cured for 20 seconds. Dual-cure resin cement (Rely X ARC, 3M ESPE, St. Paul, USA) was injected into the canal, and the glass fiber post was inserted into the root canal with the help of plugger then cured for 40 seconds. The crown was formed with the strip crown, as in Group I.

Two calibrated and blinded examiners evaluated all the restorations. The operators' calibration was performed by one experienced clinician. Cohen's Kappa coefficient was used to evaluate observer agreement. The restorations were evaluated at intervals of 6, 12, 18, and 24 months, according to the World Dental Federation criteria updated in 2010 for the clinical evaluation of direct and indirect restorations. The marginal adaptation, retention loss, marginal discoloration, and color match and translucency were evaluated. The data were statistically analyzed using a Chi-square test. Statistical significance was set at $\alpha=0.05$.

Results

A total of 72 children (33 girls and 39 boys) participated in the present study. There were no significant differences in age and gender among the groups. A total of 180 severely decayed primary maxillary anterior teeth were randomly treated with 60 composite post restorations, 60 polyethylene fiber post restorations, and 60 glass fiber post restorations. Then, they were evaluated in terms of marginal adaptation, retention loss, marginal discoloration, and color match and translucency during every follow-up at 6, 12, 18, and 24 month intervals.

One tooth in the composite post group and one in the fiber post group were excluded from the study at the 24-month follow-up period due to failure to attend 1 or more of the recall appointments. The composite post group showed 5 failures after 24 months, and these teeth were restored again with glass fiber posts. The polyethylene post and glass fiber post groups showed 3 failures after 24 months as complete post and restoration debonding while the post still remained in the canal. These teeth were restored again with composite restoration. No periapical lesions or root resorption were observed in the three groups, and none were extracted.

Table 1 shows the percentage and number of teeth exhibiting marginal adaptation at various time intervals. In Group I, the difference in marginal adaptation from day 0 to 12 months was found to be nonsignificant ($p>0.05$). However, when the 12- and 18-month values were compared with those at 24 months, a significant difference was observed ($p<0.05$). In Groups II and III, the difference in marginal adaptation from day 0 to 12 months was found to be nonsignificant ($p>0.05$). However, when the 12-month values were compared with those at 24 months, a significant difference was observed ($p<0.05$) (Tables 1 and 2, respectively).

	Marginal Adaptation					
	12 months		**18 months**		**24 months**	
	Number (n)	Percentage (%)	Number (n)	Percentage (%)	Number (n)	Percentage (%)
Composite post	4	7.0	10	17.5	18	32.7
Polyethylene fiber post	1	1.7	5	8.5	10	17.5
Glass fiber post	1	1.7	5	8.5	8	14.0
p value	0.193		0.210		0.038	

Table 1: Percentage and number of teeth exhibiting marginal adaptation at various time intervals.

	12 months		**18 months**		**24 months**	
	Sayı (n)	**Yüzde (%)**	**Sayı (n)**	**Yüzde (%)**	**Sayı (n)**	**Yüzde (%)**
Group 1	4	6.7	10	16.7	18	30.0
P value		0.070		0.008		
Group 2	1	1.7	5	8.3	10	16.7
P value		0.125		0.063		
Group 3	1	1.7	5	8.3	8	13.3
P value		0.125		0.250		

Table 2: Percentage and number of teeth exhibiting marginal adaptation at various time intervals.

There was no statistically significant difference in the marginal adaptation values of the specimens between the composite, polyethylene fiber, and glass fiber posts after 6, 12, and 18 months (p>0.05). Moreover, there was no significant difference between the polyethylene fiber and glass fiber posts and between the polyethylene fiber and composite posts after 24 months (p>0.05). However, there was a statistically significant difference between the composite and glass fiber posts after 24 months (p<0.05) (Table 3).

Groups	Marginal adaptation 24 months	Retention loss 24 months
Composite post - Polyethylene post (p)	0.050	0.021
Composite post - Glass fiber post (p)	0.0165	0.006
Polyethylene Post - Glass fiber post (p)	0.399	0.399

Table 3: Intergroup comparison for marginal adaptation and retention loss among Groups I, II, and III after 24 months.

Tables 4 and 5 show the percentage and number of teeth exhibiting retention loss at various time intervals. In Group I, the difference in retention loss from day 0 to 12 months was found to be nonsignificant (p>0.05). However, when the 12- and 18-month values were compared with those at 24 months, a significant alteration was observed (p<0.05). In Groups II and III, the difference in retention loss from day 0 to 12 months was found to be nonsignificant (p>0.05). However, when the 12-month values were compared with those at 24 months, a significant alteration was observed (p<0.05).

	Retention loss					
	12 months		18 months		24 months	
	Number (n)	Percentage (%)	Number (n)	Percentage (%)	Number (n)	Percentage (%)
Composite post	4	7.0	10	17.5	20	36.4
Polyethylene post	2	3.4	5	8.5	10	17.5
Glass fiber post	2	3.4	5	8.5	8	14.0
p value	0.560		0.210		0.010	

Table 4: Percentage and number of teeth exhibiting retention loss at various time intervals.

	12 months		18 months		24 months	
	Sayı (n)	Yüzde (%)	Sayı (n)	Yüzde (%)	Sayı (n)	Yüzde (%)
Group 1	4	6.7	10	16.7	20	33.3
P value		0.070		0.002		
Group 2	2	3.3	5	8.3	10	16.7
P value		0.250		0.063		
Group 3	2	3.3	5	8.3	8	13.3
P value		0.250		0.250		

Table 5: Percentage and number of teeth exhibiting retention loss at various time intervals.

There was no statistically significant difference in the specimens' marginal discoloration values between the composite, polyethylene fiber, and glass fiber posts after 6, 12, 18, and 24 months (p>0.05) (Table 6). After 24 months, 25.5% of the teeth in Group I, 24.6% in Group II, and 19.3% in Group III exhibited marginal discoloration.

	Marginal Discoloration					
	12 months		18 months		24 months	
	Number (n)	Percentage (%)	Number (n)	Percentage (%)	Number (n)	Percentage (%)
Composite post	2	3.5	6	10.5	14	25.5
Polyethylene post	3	5.1	8	13.6	14	24.6
Glass fiber post	3	5.1	7	11.9	11	19.3
p value	0.896		0.881		0.703	

Table 6: Percentage and number of teeth exhibiting marginal discoloration at various time intervals.

There was no statistically significant difference in the specimens' color match and translucency values between the composite, polyethylene fiber, and glass fiber posts after 6, 12, 18, and 24 months (p>0.05) (Table 7). After 24 months, 27.3% of the teeth in Group I, 28.1% in Group II, and 19.3% in Group III exhibited color matching and translucency.

	Color match and translucency					
	12 months		18 months		24 months	
	Number (n)	Percentage (%)	Number (n)	Percentage (%)	Number (n)	Percentage (%)
Composite post	2	3.5	7	12.3	15	27.3
Polyethylene post	3	5.1	8	13.6	16	28.1
Glass fiber post	3	5.1	7	11.9	11	19.3
p value	0.896		0.959		0.489	

Table 7: Percentage and number of teeth exhibiting color matching and translucency at various time intervals.

Discussion

Severely decayed primary maxillary anterior teeth are associated with problems such as reduced vertical dimension, masticatory insufficiency, development of parafunctional habits, and aesthetic and psychological problems. As a result, it is important to restore and preserve these teeth [19]. Restorations of severely decayed primary maxillary teeth involving more than three-fourths of the crown is a challenging task for pedodontists [18]. The use of intracanal posts after a pulpectomy procedure improves the retention of definitive restorations and offers an aesthetic and functional treatment option in severely decayed primary maxillary anterior teeth [20].

Different kinds of posts have been used in pediatric dentistry. Omega-shaped stainless steel orthodontic wire is a simple, quick, and effective post, but inserting it into the 3 mm canal space requires great dexterity and may likely lead to a radicular fracture as a result of excessive masticatory force. Biologic posts made from extracted primary teeth are another option, but the need for a tooth bank and for parental and child consent by both the donors and recipients of the tooth fragments are the disadvantages of this technique [20]. Prefabricated metal posts are indicated for primary teeth, but the unaesthetic appearance and interference with physiologic resorption limit their usage [15]. Composite resin is a common choice for restoring severely decayed anterior teeth due to its strength, resistance to wear, and aesthetic results. However, composite resin carries the risk of losing retention due to polymerization shrinkage.

FRC posts made of polyethylene and glass fiber provide the best aesthetic results and are widely used to restore severely decayed anterior teeth [21]. Polyethylene fiber posts increase the flexural characteristics of the composite resin, thus providing high fatique resistance, preserving the aesthetic shape, and maintaining fiber orientation during application [20]. Viera, et al. used polyethylene fibers for the reconstruction of severely decayed anterior primary teeth. After 1 year, they found complete retention of all posts [7]. Similar results were observed by Rocha Rde, et al. [22]. Glass FRC composite posts (Everstick) are aesthetic and easy to use, and the flexural strength of Everstick is 1,280 MPa, the highest among all FRC posts. These posts are custom fabricated and ready to use. The post's length, width, and taper can be modified according to the root canal shape. The modulus of elasticity is close to that of dentin, which helps in the even distribution of stress [19]. Glass fiber posts permit chemical and mechanical adhesion to the restorative materials and increase the fracture resistance of the composite resin restorations [20]. Glass fiber posts also reinforce weakened roots without causing root fracture. Sharaf, et al. reported that glass fiber posts applied to primary incisors remained intact after a 1-year follow-up. Laboratory studies have also reported that glass fiber posts significantly improved the fracture resistance of teeth [23]. In this study's glass fiber post group, only 3 restorations fractured after a 24-month follow-up.

Eshghi, et al. investigated the clinical success rates of 3 different intracanal posts (glass fiber, composite, and prefabricated metal posts) after 12 months. They reported that the retention of the techniques was 90%, 98%, and 100%, respectively [17]. This finding is consistent with the results of the Judd and Sharaf, et al. that reported 100% success for composite and fiber posts [18,23]. In this study, we investigated the clinical success rates of composite, polyethylene fiber, and glass fiber posts after 24 months. We found the retention of the posts was 63%, 82% and 86%, respectively.

In this clinical study, the glass fiber posts showed the maximum retention and marginal adaptation, followed by the polyethylene fiber posts, while the composite post showed the least retention and marginal adaptation. When intergroup comparisons were made for the retention loss of Groups I, II, and III, a significant difference ($p<0.05$) was observed between the glass fiber and composite posts, whereas a nonsignificant difference ($p>0.05$) was observed when the polyethylene post values were compared with either the glass fiber or composite posts. Our findings were consistent with the results of the study by Mehra, et al., in which the retention and marginal adaptation of three posts, including composite, polyethylene fiber, and glass fiber posts, were compared in severely decayed primary maxillary anterior teeth. Mehra, et al. reported that although there was a decrease in post retention after a 12-month interval for all groups, the glass fiber posts showed significantly higher retention and marginal adaptation in compliance with composite posts after 12 months [24].

Sharaf, et al. investigated the clinical success rates of different post materials and demonstrated that the application of fiber posts in severely decayed anterior primary teeth is an acceptable method. After 1 year, only two of 30 teeth were extracted, one due to luxation and the other because of pulp therapy failure. Sharaf, et al. reported that fiber posts and the use of composite posts compared to using no post significantly increased the teeth's fracture resistance [23]. In this study, we evaluated the marginal adaptation, retantion loss, marginal discoloration, and color match and translucency of composite, polyethylene fiber, and glass fiber posts. After 2 years, of 180 teeth, none were extracted, and 5 fractured composite posts were restored again with glass fiber posts. No periapical lesions or root resorption were observed in the three groups. We determined that the glass fiber post is the most successful for use in restoring severely decayed anterior primary teeth.

Gujjar and Indushekar, et al. compared the tensile strength of composite posts, orthodontic wire γ, and glass fiber posts in the primary incisors. Their study showed that the glass fiber post group had the highest, and the composite post group had the lowest tensile strength, indicating a statistically significant difference [25]. However, their study evaluated the restorations' tensile strength; this differed from our study, which compared the marginal adaptation, retention loss, marginal discoloration, and color match and translucency of the restorations.

In their study, Sawant, et al. clinically and radiographically evaluated the dislodgment, secondary caries, root fracture, and post fracture of Everstick glass FRC and ParaPost Taper Lux posts. They reported that root fracture did not occur in any of the cases during 12-month interval [19]. However, in the composite post (group 5) and the glass fiber post and polyethylene fiber post (group 3), post fracture occured during the 24-month follow-up.

Conclusion

The glass fiber posts showed the maximum retention and marginal adaptation, followed by the polyethylene fiber posts. The composite posts showed the least retention and marginal adaptation. There was a decrease in the posts' retention and marginal adaptation after 2 years for all groups, but the decrease was only significant for the composite post group. There was no statistically significant difference in the marginal discoloration and color match and translucency values of the specimens between the composite, polyethylene fiber, and glass fiber posts after 24 months.

Why this paper is important for pediatric dentists:

- There are limited studies about the management of severely decayed primary maxillary anterior teeth using intracanal post materials. No published studies exist concerning the clinical comparison of composite, polyethylene fiber, and glass fiber posts during a 24-month follow-up.
- This study gives information about which post materials are appropriate for severely decayed primary maxillary anterior teeth.
- The study illustrates that for the management of severely decayed primary maxillary anterior teeth, the use of glass fiber and polyethylene fiber posts appears to be a cost-effective alternative, in view of their ability to reinforce composite resin with adequate marginal adaptation, retention, thus improving the aesthetics and translucency.

References

1. Mouradian WE. The face of a child: children's oral health and dental education. J Dent Educ. 2001; 65: 821-831.
2. Schwartz SS, Rosivack RG, Michelotti P. A child's sleeping habit as a cause of nursing caries. ASDC J Dent Child. 1993; 60: 22-25.
3. Beldüz Kara N, Kanyilmaz T, Çankaya S, et al. Evaluation of the effect of different post materials and adhesive systems on the bonding strength of short-post technique for primary teeth. Int J Paediatr Dent. 2018; 28: 239-248.
4. Richardson BD, Cleaton-Jones PE. Nursing bottle caries. Pediatrics. 1977; 60: 748-749.
5. Maden EA, Altun C. Use of Polyethylene Fiber (Ribbond) in Pediatric Dentistry. J Clin Pediatr Dent. 2001; 26: 1-4.
6. Harris R, Nicoll AD, Adair PM, et al. Risk factors for dental caries in young children: a systematic review of the literature. Community Dent Health. 2004; 21: 71-85.
7. Viera CL, Ribeiro CC. Polyethylene fiber tape used as a post and core in decayed primary anterior teeth: a treatment option. J Clin Pediatr Dent. 2001; 26: 1-4.
8. Ngan P, Fields H. Orthodontic diagnosis and treatment planning in the primary dentition. ASDC J Dent Child. 1995; 62: 25-33.
9. Motisuki C, Santos-Pinto L, Giro EM. Restoration of severely decayed primary incisors using indirect composite resin restoration technique. Int J Paediatr Dent. 2005; 15: 282-286.
10. Chunawalla YK, Zingade SS, Ahmed BMN, et al. Glass Fibre Reinforced Composite Resin Post & Core In Decayed Primary Anterior Teeth - A Case Report. Int Journal of Clinical Dental Science. 2011; 2: 55-59.
11. Memarpour M, Shafiei F, Abbaszadeh M. Retentive strength of different intracanal posts in restorations of anterior primary teeth: an in vitro study. Restor Dent Endod. 2013 ; 38: 215-221.
12. Seraj B, Ghadimi S, Estaki Z, et al. Fracture resistance of three different posts in restoration of severely damaged primary anterior teeth: An in vitro study. Dent Res J. 2015; 12: 372-378.
13. Pollard MA, Curzon JA, Fenlon WL. Restoration of decayed primary incisors using strip crowns. Dent Update. 1991; 18: 150-152.
14. Bayrak S, Tunc ES, Tuloglu N. Polyethylene fiber-reinforced composite resin used as a short post in severely decayed primary anterior teeth: a case report. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2009; 107: 60-64.
15. Vafaei A, Ranjkesh B, Isido F. Survival of Composite Resin Restorations of severely Decayed Primary Anterior Teeth retained by Glass Fiber Posts or Reversed-orientated Metal Posts. International Journal of Clinical Pediatric Dentistry. 2016; 9: 109-113.
16. Eshghi A, Esfahan RK, Khoroushi M. A simple method for reconstruction of severely damaged primary anterior teeth. Dental Research Journal. 2011; 8: 221-225.
17. Eshghi A, Esfahan RK, Khoroushi M. Evaluation of Three Restorative Techniques for Primary Anterior Teeth with Extensive Carious Lesions: A 1-year Clinical Study. J Dent Child. 2013; 80: 80-87.
18. Judd PL, Kenny DJ, Johnston DH, et al. Composite resin short-post technique for primary anterior teeth. J Am Dent Assoc. 1990; 120: 553-555.
19. Sawant A, Chunawalla Y, Morawala A, et al. Evaluation of Novel Glass Fiber-reinforced Composite Technique for Primary Anterior Teeth with Deep Carious Lesions: A 12-month Clinical Study. Int J Clin Pediatr Dent. 2017; 10: 126-130.
20. Baghalian A, Ranjpour M, Hooshmand T, et al. Comparison of fracture resistance in post restorations in primary maxillary incisors. European Journal of Paediatric Dentistry. 2014; 15: 313-316.
21. Memarpour M, Shafiei F, Abbaszadeh M. Retentive strength of different intracanal posts in restorations of anterior primary teeth: an in vitro study. Restor Dent Endod. 2013; 38: 215-221.
22. Rocha Rde O, das Neves LT, Marotti NR, et al. Intracanal reinforcement fiber in pediatric dentistry: A case report. Quintessence Int. 2004; 35: 263-268.
23. Sharaf AA. The application of fiber core posts in restoring badly destroyed primary incisors. J Clin Pediatr Dent. 2002; 26: 217-224.
24. Mehra M, Grover R, Pandit IK, et al. Management of grossly decayed primary anteriors using various intracanal post systems: A clinical study. J Indian Soc Pedod Prev Dent. 2016; 34: 199-203.
25. Gujjar KR, Indushekar KR. Comparison of the retentive strength of 3 different posts in restoring badly broken primary maxillary incisors. J Dent Child. 2010; 77: 17-24.