Original Article

Treatment of Severely Decayed Anterior Primary Teeth with Short-Post Technique (Mushroom Restorations) Under General Anesthesia

S Dogan, G Ozturk, H Gumus

Department of Pedodontics, Faculty of Dentistry, Erciyes University, Turkey

Abstract

Aims: The aim of this study was to evaluation the treatment success of the short post technique (mushroom restoration) using a composite resin in severely decayed primary anterior teeth after 6, 12, and 18 months after treatment. **Methods:** Eighteen children aged 3-5 years with severely decayed primary maxillary anterior teeth (60 anterior maxillary primary teeth in total) were included. Patients were treated under general anesthesia (GA). After pulpectomy, a "mushroom shape" was formed in the root canals for the purpose of retention, and the root canals were filled with zinc oxide-eugenol (ZOE), and the teeth were restored with composite resin. The status of treatment was evaluated clinically and radiographically for periapical radiolucency, pathological root resorption, marginal fracture, and loss of restoration for each treated tooth. All findings were recorded. **Results:** As a result of the evaluation criteria, the success rates at 6, 12 and 18 months were 86%, 80%, and 71%, respectively. None of the teeth showed apical radiolucency or pathological root resorption at the end of the 18th month period. **Conclusion:** The short-post (mushroom restorations) technique is a clinically acceptable alternative method for restoration of severely decayed primary teeth. This study supports the feasibility of treatment with this technique for pediatric patients treated under GA.

Keywords: *Composite resin restoration, mushroom restoration, severely decayed primary anterior teeth, short post technique*

Received: 30-Oct-2019;
Revision: 02-Dec-2019;
Accepted: 05-Feb-2020;
Published: 11-Jun-2020

Introduction

In young children, dental caries that occur in anterior primary teeth as a result of night-time feeding habits, poor oral hygiene, cariogenic diet, or traumatic dental injuries of anterior primary teeth may need restorative treatment.[1] Otherwise, early loss of anterior primary teeth may follow resulting in impairment of mastication, loss of vertical dimension, emergence of parafunctional habits, and malocclusion. In addition, it may also result in psychological problems that can affect the speech, aesthetics, and behavioral development of the child.[2,3]

Despite the recent developments in restorative techniques in dentistry, there have been some important challenges associated with restorative treatment of anterior primary teeth, including the short and narrow shape of the crown, difficulties in acidification of the thin and aprismatic enamel tissue, and insufficient surface area for bonding.[4,5] Because of the reduced size of healthy coronal structure, direct restorative procedures may not always yield satisfactory results. In order to achieve better durability and functionality in severely decayed anterior primary teeth, the use of intracanal posts and endodontic treatment are required prior to restoration.[6,7] However, since the patients are preadolescents, cooperation may be difficult. Therefore, these complicated treatments often require general anesthesia or sedation.[8,9]

Routinely used intracanal retention techniques reported in the literature for severely decayed anterior primary

Access this article online

Quick Response Code:

Website: www.njcponline.com

DOI: 10.4103/njcp.njcp_592_19

Address for correspondence: Dr. G Ozturk, Erciyes Universitesi, Dis Hekimligi Fakultesi B Blok Kat: 4 Pedodonti Anabilim Dalı 38039 Kayseri, Turkey.
E-mail: gulcecosar@hotmail.com

How to cite this article: Dogan S, Ozturk G, Gumus H. Treatment of severely decayed anterior primary teeth with short-post technique (Mushroom Restorations) under general anesthesia. Niger J Clin Pract 2020;23:798-804.

teeth include resin composite posts shaped as inverse mushrooms (mushroom restorations), as well as metal or biological posts, stainless steel orthodontic wires, polyethylene fiber and glass fiber posts inserted into the root canal.[7,10,11] Although the prefabricated metal posts are rapid and convenient to use, their aesthetic disadvantages and incompatibility with physiological resorption restrict their use in primary teeth.[12,13] Therefore, biological posts and primary teeth extracted from another patient may be a better alternative. Major disadvantages associated with biological posts are the necessity to create a tooth bank as well as obtaining consent from parents and child-donors. In addition, this technique requires strict measures to prevent cross-infection.[14,15]

Omega-shaped orthodontic wires have been presented as a rapid and simple technique to adapt to the root canal walls. However, this technique may cause fractures in thin root canal walls and contribute to early restoration loss.[4,16] Although composite resin posts provide satisfactory aesthetic results, a requirement of technical precision and potential retention loss resulting from polymer shrinkage are major disadvantages.[17,18]

Recently, there has been a growing interest in the use of fiber-supported posts. Their advantages include reduced risk of root fracture, enhanced aesthetic translucency and proper adaptability to canal walls with adequate retention and stability via mechanical and chemical bonding to the restorative material. Despite these advantages, their use is limited due to the long treatment period, high cost, and the need for technical precision, especially in uncooperative child-patients requiring general anesthesia or sedation.[19,20]

In conclusion, for restorative treatment of severely decayed anterior primary teeth in preadolescent children, cooperation or need for general anesthesia are reasons to choose rapid, convenient, durable, aesthetic and low-cost restoration treatment options. The aim of this study was to evaluate the success of resin composite mushroom restorations under general anesthesia in severely decayed primary anterior teeth at 6, 12 and 18 months post treatment.

Methods

The study protocol was approved by the local ethics committee of Erciyes University (Approval no: 2019/171). Treatment details were explained fully to the parents of all the children, and written informed consent was obtained. This controlled clinical study was conducted with the participation of 18 (6 females, 12 male), healthy child-patients aged 3–5 years (mean age: 3.80 ± 0.74 years) who presented to the Pedodontics Department of Dentistry Faculty of Erciyes University for treatment of severely decayed anterior primary teeth. Those who had malocclusion (deep bite, cross bite), parafunctional habits and history of dental trauma were not included in the study.

Restorative treatments were performed by a single experienced pediatric dentist in a single session under general anesthesia. Prior to treatment, severely decayed primary maxillary incisor teeth were evaluated clinically and radiographically. The study included a total of 60 anterior maxillary primary teeth (31 central incisors, 29 lateral incisors) showing severe decay due to dental caries, which had completed at least two-thirds of its root development and did not show any of the following: root resorption greater than one third, excessive mobility, subgingival caries, abscess, or fistula.

After isolation using a rubber dam, decayed dental tissue in all dental surface was cleaned with a diamond bur (BR-31C, Mani Inc., Tokyo, Japan) and a stainless steel drill (Size 2, Mani Inc., Tokyo, Japan), and entry cavities were formed for access to root canals [Figure 1]. Pulpectomy was then performed using a 35# H-type file (H-file, Mani, Tokyo, Japan) and canals were irrigated with 1.0% NaOCl solution. After drying with paper points (Dentsply Maillefer), the canals were filled with zinc oxide-eugenol (ZOE; Dentsply, Caulk, Milford, DE, USA) up to 1 mm beyond the apex and 4 mm under the enamel-cement border. Above the ZOE canal filling material, an approximately 1-mm thick base was formed with zinc phosphate cement (Hoffmann, KG, GmbH, Rosenheim, Germany).

Due to severe crown damage, an intracanal post-recess was formed inside the root dentin (over the zinc phosphate cement) using a stainless-steel drill (Size 1, Mani Inc., Tokyo, Japan) to give a “mushroom shape” [Figure 2]. Since the primary teeth have thin root dentin walls, the mushroom shape was aligned parallel to the long axis of the root to avoid root perforation. The walls of the post area and the remaining crown were acidified with 37% phosphoric acid (3M ESPE, Saint Paul, MN, USA) for 20 seconds, rinsed, and dried. Then, using disposable applicators, a bond (Optibond, Kerr, Orange, CA, USA) was applied to all acidified areas and irradiated (Elipar™ S10, 3M ESPE, USA) for 20 seconds. A matrix band (Tofflemire, Hahnenkratt, Königsbach-Stein, Germany) was placed using a matrix holder to the crown parts of teeth with minimal gingival bleeding. The composite resin (Filtek Z250, 3M ESPE, USA) was applied incrementally, and each layer was irradiated for 40 seconds. After removing the excess composite material at the gingival borders with finishing burs (FO-30F, Mani Inc., Tokyo, Japan), final polishing

done performed using polishing discs (Soflex, 3M ESPE, USA).

After completion of the treatment, parents were advised to maintain good oral health of the child and to attend control examinations. Patients were re-examined at 6-, 12- and 18-month intervals following the treatment [Figure 3]. A pediatric dentist other than the one who performed the treatment evaluated patients clinically and radiographically, and each tooth was assessed in terms of periapical radiolucency, pathological root resorption, marginal fracture, and loss of restoration. All findings were recorded.

Results

18 children who met the inclusion criteria were enrolled in this randomized controlled clinical trial. Three children were excluded from the study since they did not attend the control examinations. Therefore, the study was continued with 15 children (12 male and 3 female), totaling 52 teeth. 6 children were 3 years old, six were 4 years old, and three were 5 years old (mean age 3.80 ± 0.74 years) [Table 1].

52 primary maxillary incisors of the 15 children were treated using mushroom restorations. Patients were followed up for 18 months after completion of the treatment and the results were evaluated. Of the 52 primary maxillary incisors, 27 (52%) were central incisors, and 25 (48%) were lateral incisors. Of the 27 central incisors, 14 (52%) were right central, and 13 (48%) were left central incisors. Of the 25 (48%) were lateral incisors, 14 (56%) were right lateral and 11 (44%) were left lateral incisors. Table 2 shows distribution of the teeth according to age and sex.

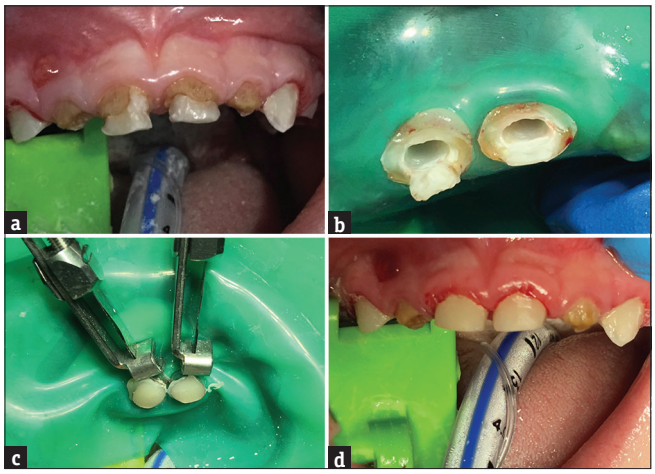

Figure 1: (a) Appearance of teeth before treatment. (b) Root canal treatment and the formation of the mushroom-shaped retentive structure in the canal. (c) Application of matrix band and completion of restoration with a composite material. (d) Completion of polishing of the restoration and the final appearance

At the 6th month mark, 4 (14.81%) of the 27 maxillary central primary incisors and 3 (12.0%) of the 25 maxillary lateral primary incisors showed restoration loss, whereas none of the central or lateral incisors had a marginal fracture. The success rate at the end of 6 months was 86.53% [Table 3].

At the end of 12 months post treatment, 7 (25.9%) of 27 maxillary central primary incisors were found to be unsuccessful. It was found that 5 of these failures were due to loss of restoration and 2 of them were due to marginal fracture. Twenty-five lateral primary incisors had stable findings compared to the 6 month evaluation with no change at the end of 12 months. The success rate at the end of the 12th month was 80.76% [Table 3].

At the end of the 18th month, 10 (37.0%) of 27 maxillary central primary incisors were found to undergo treatment failure. It was found that 6 failures were due to loss of restoration and 4 were due to marginal fracture, whereas 21 (63.0%) of the 27 central incisors did not have restoration loss or marginal fracture. Treatment failure occurred in 6 (24.0%) of the 25 maxillary lateral primary incisors. It was found that 4 of these failures were due to loss of restoration, and 2 of them were due to marginal fracture, whereas 19 (76.0%) of the 27 central incisors did not have restoration loss or marginal

Table 1: Distribution of patients by age group

Categories	Sex		Overall
	Boy	Girl	N
	N	N	
Age 3	6	0	6
Age 4	5	1	6
Age 5	1	2	3
Overall	12	3	15

N: Number of Patients

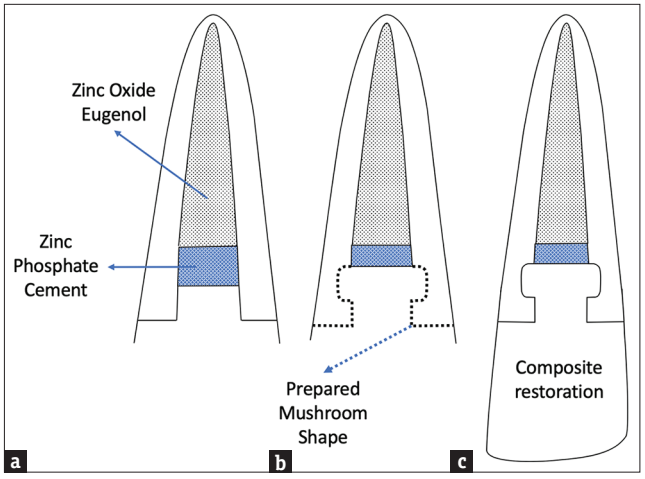

Figure 2: (a) Root canal filling (zinc oxide-eugenol) and the cement base (zinc phosphate cement). (b) Preparation of the mushroom shape. (c) Completion of restoration with the composite material

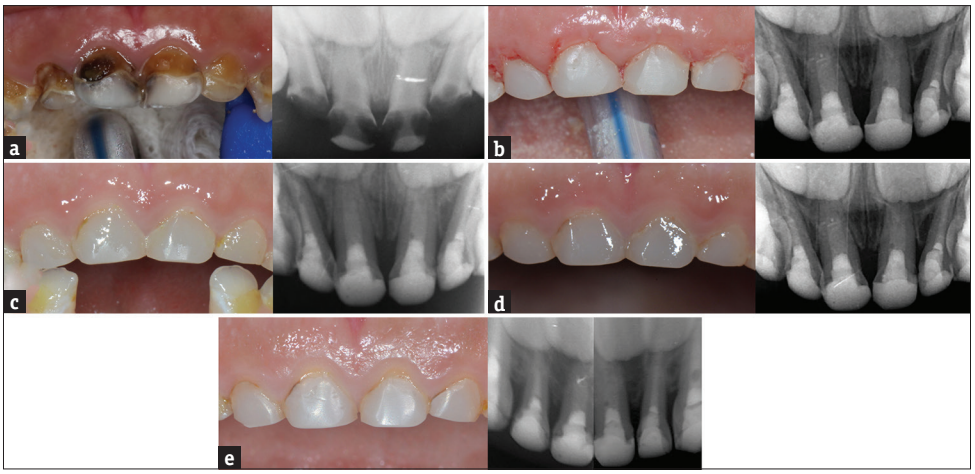

Figure 3: (a) Intra-oral photograph and periapical radiograph before treatment. (b) Intra-oral photograph and periapical radiograph immediately after treatment. (c) Intra-oral photograph and periapical radiograph 6 months after treatment. (d) Intra-oral photograph and periapical radiograph 12 months after treatment. (e) Intra-oral photograph and periapical radiograph 18 months after treatment

Table 2: Distribution of teeth according to the age and sex

Categories/Variables		Age 3		Age 4		Age 5		Overall N (%)	
		Boy N	Girl N	Boy N	Girl N	Boy N	Girl N		
Tooth	51	6	0	5	0	1	2	14 (52%)	27 (52%)
	61	6	0	4	0	1	2	13 (48%)	
	52	5	0	5	1	1	2	14 (56%)	25 (48%)
	62	3	0	4	1	1	2	11 (44%)	
Overall		20	0	18	2	4	8	52 (100%)	
N		20		20		12			

N: Number of Patients, 51: Maxillary Primary Right Central Incisor, 52: Maxillary Primary Right Lateral Incisor, 61: Maxillary Primary Left Central Incisor, 62: Maxillary Primary Left Lateral Incisor. Note: Percent numbers are based on columns

Table 3: Cumulative distribution of restoration success and problem type according to follow-up time and number of teeth

Categories/Variables			6th Month		12th Month		18th Month		Overall N		Totally Success Rate
			MF	RL	MF	RL	MF	RL	MF	RL	
Tooth	51	14	0	3	2	0	1	0	3	3	63.0%
	61	13	0	1	0	1	1	1	1	3	
	Total	27	0	4	2	5	4	6	4	6	
	N (%)		4 (14.8%)		7 (25.9%)		10 (37.0%)		10 (37.0%)		
	52	14	0	2	0	0	1	1	1	3	76.0%
	62	11	0	1	0	0	1	0	1	1	
	Total	25	0	3	0	3	2	4	2	4	
	N (%)		3 (12.0%)		3 (12.0%)		6 (24.0%)		6 (24.0%)		
Overall			0	7	2	8	6	10	6	10	
N			7		10		16		16		
Totally Success Rate			86.53%		80.76%		69.23%				

N: Number of Patients, MF: Marginal Fracture, RL: Restoration Loss 51: Maxillary Primary Right Central Incisor, 52: Maxillary Primary Right Lateral Incisor, 61: Maxillary Primary Left Central Incisor, 62: Maxillary Primary Left Lateral Incisor

fracture [Table 3]. Treatment success at the end of the 18th month was 69.23% [Table 3].

When we evaluated treatment success according to the tooth type, we calculated a 63.0% survival rate for restorative treatment of the 27 central primary incisors, and 76% for the 25 lateral primary incisors [Table 3]. None of the teeth showed apical radiolucency or pathological root resorption at the end of the 18th month.

Discussion

The primary goal of pediatric dentistry is to treat primary and/or young permanent teeth that have lost their normal form and function due various reasons such as caries and trauma.[4,21] One of the frequently observed problems at this age is early childhood caries (ECC).[22] Although mostly preventable, ECC remains the most common chronic childhood disease with approximately 1.8 billion new annual cases worldwide.[23] In Turkey, the prevalence of ECC is over 50.0%.[24,25] Despite being the most common chronic disease of childhood, they remain mostly untreated in children younger than 3 years old in Turkey as well as in many other countries.[26] Restorative treatment of anterior primary teeth that are severely decayed due to ECC pose a challenge for dentists due to difficulty with retention, aesthetic reconstruction, and lack of cooperation from younger children.[18,27] Early loss of anterior primary teeth causes not only aesthetic problems but also reduced masticatory efficacy, speech problems, emergence of abnormal oral habits, neuromuscular imbalances, and psychosocial adaptation problems for the child. Therefore, treatment of anterior primary teeth is crucial.[14,28]

When the dental crown is severely decayed, the use of intracanal retention is necessary to provide stability following endodontic treatment. Mechanical retention achieved with the use of intracanal posts in the root canals following pulpectomy procedures allows for successful restoration by providing resistance against mastication forces.[19,21,29] In our study, we treated severely decayed anterior maxillary primary teeth using a composite resin, which is a convenient, aesthetic, long-lasting and low-cost option despite the requirement of technical precision. Composite restorations are commonly used today and require sufficiently healthy dental tissue to achieve micromechanical retention, which is usually the primary mechanism of restoration.[30] In the case of unhealthy dental tissue, additional support must be used to ensure stability of the restoration.[19] For this purpose, we used the "mushroom restoration" technique in the present study. In our study, the mean patient age was 3.8 years, the patients were predominantly from a lower socioeconomical level, and all restorations were performed under general anesthesia. Therefore, we considered a mushroom restoration technique as the most appropriate treatment method for our patients since it can be rapidly applied, requires relatively lower technical precision, and costs much lesser than other alternatives.

In this study, zinc phosphate cement was used as base material after root filling. Although glass ionomer cements were said to be more resistant to degradation than zinc phosphate cements,[31] Knibbs and Walls[32] reported that glass ionomer cements were more sensitive to moisture and contamination than zinc phosphate cements. In addition, Keyf *et al*.[33] reported that zinc phosphate cements are more resistant to liquid absorption. For these reasons, zinc phosphate cement was preferred to eliminate these problems with glass ionomer cements. The mushroom-shaped post area, which is prepared by 360 degree turns of the steel burr drill around the canal chamber, is key for retention of the restoration. Failure to obtain this shape risks dislodgement of the restoration.[11] In our application, the length of the post recess inside the canal was 3 mm. Posts longer than this can inhibit the permanent dental eruption during physiological root resorption of primary teeth.[34]

It is important to avoid occlusal contact of the mushroom restorations with the corresponding anterior primary teeth to prevent excessive force on the restoration. Particular attention should be given to primary mandibular lateral incisors and canines during lateral jaw movements. Previous reports have demonstrated the need for forming the crown anatomically shorter to avoid mastication and/or lateral forces.[11,35] In particular, parents of children with parafunctional habits should be informed about the possibility of erosion and fracture caused by excessive mastication and/or lateral forces. In addition, the child should be advised to be careful not to bite anything hard with the anterior teeth.

Baghalian A. *et al*.[36] compared the fracture resistances of glass fiber posts, composite resin posts, shortened glass fiber posts, and gamma-shaped orthodontic wire posts. They found that shortened glass fiber posts had the highest fracture resistance, but no statistically significant difference was present between the groups.[36] Eshghi *et al*.[37] achieved success rates of 98% with composite posts, 84% with fiber posts, and 90% with metal posts at the end of 12 months follow-up in their study. This result suggests that the composite resin post technique is similar in success to other methods.[37]

Kırzıoglu *et al*.[38] performed 30 mushroom type crowns on 14 children aged 3–4 years and followed up these patients for 24 months in their study. They observed fractures due to impact forces in 2 restorations at the end of the first month, restoration loss due to patient falls in 3 teeth at the end of the 15th month, and found a high overall clinical success rate of restorations at the end of 24 months.[38] In their study, Judd *et al*. applied a short post technique to the anterior primary teeth using composite resins, and they reported that these composite resin crowns had no discolorations, were resistant to normal occlusal forces, and maintained integrity until

physiological resorption of the teeth. This one-year long prospective study showed that this restoration is both durable and has excellent aesthetic results.[11]

Our findings in terms of restoration loss at the end of 18 months were as follows: we achieved a 63% success rate with restorative treatment on 27 primary central incisor teeth, and a 76% success rate with restorative treatment on 25 primary lateral incisor teeth. These rates are slightly lower compared to the previous reports. This may be explained by the fact that this technique was also applied to a number of cases with severely decayed teeth that did not have sufficient dental structure at the cervix to support the restoration. Indeed, the extent of decay showed great variation between the cases included in the present study and excessive decay can significantly affect treatment success.

At the end of the 18 month follow-up period of our study, we observed restoration loss in 10 teeth and marginal fracture in 6 teeth among the 52 included maxillary primary incisors. The overall success rate at the end of the 18 months was 69.23%. Interestingly, restoration loss was observed when composite restorations extended below the gingival level at any point at the tooth cervix. The success of composite restorations can be affected by the amount of remaining tooth tissue and contamination (with saliva, blood, gingival crevicular liquid-like fluids).[39-41] Therefore, based on the results of our study, it can be said that the amount of the remaining healthy dental tissue is important for the success of the restoration, and that the mushroom restoration technique (with composite resin) should be avoided when restorations extend below the gingival level. In previous studies, composite restorations have often been applied using strip crowns. Unlike those studies, we applied composite restorations with a layering technique by attaching a matrix band, instead of using strip crowns. This method is both more practical and cost-effective compared to strip crown application. The lower success rate observed in our study cannot be explained by the fact that strip crown was not used in the present study. In fact, our results indicate that the major factors leading to failure were the amount of remaining dental structure and whether the cervix region was below the gingival level or not.

Conclusion

The findings of the present study are in support of the previous studies in the literature. Our results indicate that a short-post (mushroom restoration) technique is a clinically acceptable alternative method for the restoration of severely decayed anterior primary teeth. However, during candidate selection, attention should be paid to ensure that the tooth decay does not extend below the gingival level. The primary advantages of this method are rapid application time, no requirement for additional laboratory procedures, aesthetically satisfactory results, and low cost.

Statement of Ethics

The study has been approved by the Erciyes University Local Ethic Committee (Kayseri, Turkey; approval no. 2019-171). All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

Informed Consent

Informed consent was obtained from all participants included in the study for general anesthesia and dental treatments.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Ripa LW. Nursing caries: A comprehensive review. Pediatr Dent 1988;10:268-82.
2. Ngan P, Fields H. Orthodontic diagnosis and treatment planning in the primary dentition. ASDC J Dent Child 1995;62:25-33.
3. Motisuki C, Santos-Pinto L, Giro EMA. Restoration of severely decayed primary incisors using indirect composite resin restoration technique. Int J Paediatr Dent 2005;15:282-6.
4. Usha M, Deepak V, Venkat S, Gargi M. Treatment of severely mutilated incisors: A challenge to the pedodontist. J Indian Soc Pedod Prev Dent 2007;25(Suppl l):S34-6.
5. Paul S, Zahir S. A comparative evaluation of the esthetic crowns for primary anterior teeth. Guident 2012;5:52-4.
6. Grosso FC. Primary anterior strip crowns: A new technique for severely decayed anterior primary teeth. J Pedod 1987;11:375-84.
7. Mortada A, King N. A simplified technique for the restoration of severely mutilated primary anterior teeth. J Clin Pediatr Dent 2004;28:187-92.
8. Ozer S, Sen Tunc E. Early Childhood Caries. J Dent Fac Atatürk Uni 2009;19:115-23.
9. Eidelman E, Faibis S, Peretz B. A comparison of restorations for children with early childhood caries treated under general anesthesia or conscious sedation. Pediatr Dent 2000;22:33-7.
10. Mendes FM, De Benedetto MS, Zardetto CGDC, Wanderley MT, Correa MSNP. Resin composite restoration in primary anterior teeth using short-post technique and strip crowns: A case report. Quintessence Int 2004;35:689-92.
11. Judd PL, Kenny DJ, Johnston DH. Composite resin short-post technique for primary anterior teeth. J Am Dent Assoc 1990;120:553-5.
12. 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:e60-4.
13. Vitale MC, Caprioglio C, Martignone A, Marchesi U, Botticelli AR. Combined technique with polyethylene fibers and composite resins in restoration of traumatized anterior teeth. Dent Traumatol 2004;20:172-7.
14. Grewal N, Seth R. Comparative *in vivo* evaluation of restoring severely mutilated primary anterior teeth with biological post and crown preparation and reinforced composite restoration. J Indian Soc Pedod Prev Dent 2008;26:141-8.
15. Claudia DA, Wanderely MT. Biological restoration of primary anterior teeth. Quintessence Int 2000;31:404-6.
16. Aminabadi NA, Farahani RM. The efficacy of a modified omega wire extension for the treatment of severely damaged primary anterior teeth. J Clin Pediatr Dent 2009;33:283-8.
17. Ram D, Fuks A. Clinical performance of resin-bonded composite strip crowns in primary incisors: A retrospective study. Int J Paediatr Dent 2006;16:49-54.
18. Subramaniam P, Babu KL, Sunny R. Glass fiber reinforced composite resin as an intracanal post – A clinical study. J Clin Pediatr Dent 2008;32:207-10.
19. Viera C, Ribeiro C. 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.
20. Verma L, Passi S. Glass fibre-reinforced composite post and core used in decayed primary anterior teeth: A case report. Case Rep Dent 2011:1-4. DOI: 10.1155/2011/864254.
21. Eshghi A, Esfahan RK, Khoroushi M. A simple method for reconstruction of severely damaged primary anterior teeth. Dent Res J (Isfahan) 2011;8:221-5.
22. Mouradian WE. The face of a child: Children's oral health and dental education. J Dent Educ 2001;65:821-31.
23. Xiao J, Alkhers N, Kopycka-Kedzierawski DT, Billings RJ, Wu TT, Castillo DA, *et al.* Prenatal oral health care and early childhood caries prevention: A systematic review and meta-analysis. Caries Res 2019;53:411-21.
24. Ozsin Ozler C, Uzamis Tekcicek M, Ozdemir P, Guciz Dogan B. Pufa index and related factors among 36- to 71-month-old children in Turkey: A cross-sectional study. Oral Health Prev Dent 2018;16:467-72.
25. Abbasoğlu Z, Tanboğa İ, Küchler EC, Deeley K, Weber M, Kaspar C, *et al.* Early childhood caries is associated with genetic variants in enamel formation and immune response genes. Caries Res 2015;49:70-7.
26. American Academy of Pediatric Dentistry, Policy on early childhood caries (ECC): Classifications, consequences, and preventive strategies. Reference manual 2009-2010. Pediatr Dent 2009;31:40-2.
27. Croll TP. Primary incisor restoration using resin-veneered stainless steel crowns. ASDC J Dent Child 1998;65:89-95.
28. Waggoner WF, Nelson T. Restorative dentistry for the primary dentition. In: Nowak AJ, editor. Pediatric Dentistry. 6th ed. Elsevier; 2019. p. 304-28.
29. Pithan S, Vieira Rde S, Chain MC. Tensile bond strength of intracanal posts in primary anterior teeth: An *in vitro* study. J Clin Pediatr Dent 2002;27:35-9.
30. Roberson T, Heymann HO, Swift EJ Jr, editors. Sturdevant's Art and Science of Operative Dentistry. Philadelphia: Elsevier Health Sciences; 2006.
31. Earl MSA, Ibbetson RJ. The clinical disintegration of a glassionomer cement. Br Dent J 1986;161:287-91.
32. Knibbs PJ, Walls AWG. A laboratory and clinical evaluation of three dental luting cements. J Oral Rehabil 1989;16:467-73.
33. Keyf F, Tuna SH, Şen M, Safrany A. Water sorption and solubility of different luting and restorative dental cements. Turk J Med Sci 2007;37:47-55.
34. Rifkin AJ. Composite post-crowns in anterior primary teeth. J Dent Assoc S Afr 1983;38:225-7.
35. Kenny DJ, Johnston DH, Bamba S. The composite resin short-post: A review of 625 teeth. Ont Dent 1986;63:12, 14, 17-8.
36. Baghalian A, Ranjpour M, Hooshmand T, Herman NG, Ebrahimi A. Comparison of fracture resistance in post restorations in primary maxillary incisors. Eur J Paediatr Dent 2014;15:313-6.
37. Eshghi A, Kowsari-Isfahan R, Khoroushi M. Evaluation of three restorative techniques for primary anterior teeth with extensive carious lesions: A 1-year clinical study. J Dent Child (Chic) 2013;80:80-7.
38. Kirzioglu Z, Seven N, Yılmaz Y. Evaluation of The Modified Short-Post Technique in Anterior Primary Teeth. J Dent Fac Atatürk Uni 2000;10:10-6.
39. Chang SW, Cho BH, Lim RY, Kyung SH, Park DS, Oh TS, *et al.* Effects of blood contamination on microtensile bond strength to dentin of three self-etch adhesives. Oper Dent 2010;35:330-6.
40. Kuphasuk W, Harnirattisai C, Senawongse P, Tagami J. Bond strengths of two adhesive systems to dentin contaminated with a hemostatic agent. Oper Dent 2007;32:399-405.
41. Robinson S, Nixon PJ, Gahan MJ, Chan MFW. Techniques for restoring worn anterior teeth with direct composite resin. Dent Uptade 2008;35:551-8.