# Evaluation of Three Restorative Techniques for Primary Anterior Teeth with Extensive Carious Lesions: A 1-year Clinical Study

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## ABSTRACT

**Purpose:** This study compared the clinical success rates of a new reversed metal post technique and 2 conventional methods for restoration of maxillary primary incisors with extensive carious lesions.

**Methods:** A total of 161 pulpectomized, severely decayed maxillary primary teeth, in 54 2- to 4-year-old patients presenting with early childhood caries, were randomly treated with 3 different restorative techniques: 53 composite post restorations, 54 fiber post restorations, and 54 reversed post restorations. Single-blind evaluations were made, according to the World Dental Federation criteria, at 3-, 6-, 9-, and 12-month intervals. Data were analyzed with Kruskal-Wallis and Mann-Whitney tests ($\alpha$=0.05).

**Results:** There were significant differences among the study groups at the 12-month follow-up in relation to material fracture and retention ($P$=.005). The differences were significant between the fiber post and composite post groups ($P$=.004) and between the fiber post and reversed post groups ($P$<.02). There were, however, no significant differences between the composite post and reversed post groups ($P$>.64). According to the evaluation criteria, 98% of composite post, 84% of fiber post, and 90% reversed post restorations were acceptable, at the 12-month follow-up.

**Conclusions:** The metal post technique is acceptable for the restoration of severely damaged primary anterior teeth. (J Dent Child 2013;80(2):80-7)

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KEYWORDS: COMPOSITE RESINS, DENTAL CARIES/THERAPY, POST-AND-CORE TECHNIQUE, PRIMARY TEETH

Although the rate of dental caries has significantly decreased in recent years, it is still the most prevalent chronic disease of childhood.[1,2] The American Academy of Pediatric Dentistry (**AAPD**) defines "early childhood caries" (**ECC**) as at least 1 decayed, missed, or filled surface in any primary tooth in a child 71 months old or younger[3]. Children experiencing caries as infants or toddlers are at a high risk for subsequent caries in both the primary and permanent dentition, grow at a slower pace compared to caries-free infants, might be severely underweight, and suffer from iron deficiency.[3] Such carious lesions rapidly and progressively destroy primary maxillary incisors[4] after eruption and give rise to low masticatory efficiency, loss of vertical dimension, parafunctional habit formation (tongue-thrusting and mouth-breathing), speech disturbances, and psychological and behavioral complications.[5,6] Therefore, preserving the integrity of the primary dentition is critically important until they exfoliate normally.

According to the AAPD guidelines, due to the unique and rampant nature of ECC, immediate therapeutic intervention is absolutely necessary to prevent further destruction and subsequent health problems.[3] On the

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other hand, oral rehabilitation in very young and less manageable children is a formidable challenge that often necessitates treatment under general anesthesia.[2,7,8]

Given the high prevalence rate of ECC, a large number of children should be treated for severely destroyed anterior teeth. In addition to that, no standardized techniques exist for rehabilitating such teeth. Various materials and techniques have been advocated to rehabilitate teeth with ECC; the most popular probably being pre-formed stainless steel crowns. However, endodontic treatment and use of intracanal posts or retainers may be necessary prior to restoring teeth with great coronal destruction to re-establish the morphology of the crown and increase the resistance of the restoration to mechanical loads and masticatory forces.[5,9-14] Of course, great care should be exercised not to interfere with the eruption process of permanent successors.[5,9,11,14,15] Therefore, in endodontically treated primary anterior teeth, approximately one third of the root length should be filled with restorative materials.[5] As a result of these modifications, the restoration of primary teeth is completely different from that of their permanent counterparts.

Various techniques can be used for intracanal retention in primary teeth. Some of these techniques include: resin composite posts,[9,11,12,16-20] orthodontic wires, [12,18,20-24] prefabricated metal posts,[25] nickel-chromium cast posts with macroretentive features,[26] biologic posts,[9,12,13,27,28] and reinforced fibers.[4,5,14,29-33]

Composite post restorations have been in used in primary teeth from 1986. They yield satisfactory results when there is normal masticatory function, a balanced diet, and hygiene control.[17] There are concerns, however, related to retention loss as a result of polymerization shrinkage,[5,14] restoration fracture potential due to high shear forces, especially in children with bruxism,[34] and the necessity to eliminate all centric and eccentric occlusal contacts. Therefore, crowns should be reconstructed to three fourths of their incisogingival lengths.[17]

Reinforced fibers are new materials which are reported to have some clinical advantages over traditional post-and-core materials.[4,30,35,36] Some of these advantages include proper adaptation to canal walls, retention, and stability. They have some disadvantages, however, including high cost and technique sensitivity.[32]

Recently, a new technique has been introduced for restoration of extensively damaged primary anterior teeth in which a reversed (upside down), prefabricated metal post is cemented into the canal.[37] It is claimed that this technique is a simple and effective treatment modality for such reconstructions. In an in vitro study, the tensile bond strength of reversed post was compared with those of composite post and orthodontic wire used as intracanal retainers and significant differences were observed between the reversed post and the 2 other treatment modalities.[38]

The purpose of the present study was to evaluate the clinical efficacy of restorations with this new retentive technique compared to 2 conventional methods (reinforcement fiber and resin composite post) over a 12-month period.

## METHODS

Two- to 4-year-old patients presenting with ECC were invited to participate in this double-blind randomized clinical trial in department of pediatric dentistry, Isfahan University of Medical Sciences. In order to enroll in the study, the children had to have unremarkable medical histories, and present no malocclusion nor deleterious oral habits. The inclusion criteria for the maxillary incisors were: ECC involving three fourths of the crown, sound root, sufficient amount of root structure present in radiographs (one third external root resorption at the most, compared with adjacent teeth. To achieve consensus regarding the classifying of root resportion rate, a calibration training session was performed among the three examiners by evaluating the radiographs of 20 randomly selected teeth in the study's image bank. Subsequent to this training session, a single examiner evaluated all the remaining radiographs), no mobility, no gingival recession, gingivitis, sinus tracts, and hypoplasia.

Uncooperative children and those who had teeth other than the maxillary incisors that needed to be scheduled for treatment under general anesthesia, while the cooperative patients received local anesthesia in the dental clinic.

The maxillary primary incisors were randomly assigned to receive either composite post restorations, fiber post restorations or reversed post restorations. Consecutive selection of the restoration technique was used from the first to the last patient's teeth, so that 1 to 4 maxillary primary teeth were reconstructed in each patient. All the teeth were treated by one well-experienced operator. Follow-up appointments were scheduled after 3, 6, 9, and 12 months.

The teeth were isolated with cotton rolls and a high-volume saliva ejector. Gross carious lesions were removed using a no. 8 carbide bur, and pulp tissue was extirpated. The canal was prepared using a sequence of 3 consecutive endodontic files (nos. 25 to 35; K-File, 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 to isolate the filling material, seal the canal, and make it ready for post placement.

In group 1 (composite short post), a no. 6 round bur was used to create a 360º "inverted mushroom under-

cut" in the apical 2 mm to the gingival margin of the tooth. To prepare the undercut, the bur was aligned parallel to the long axis of the root and the maximum lateral extension of the bur was limited by the shank of the bur as it contacted the dentinal wall. The prepared canal and coronal structure were then cleaned, rinsed, and air-dried. A light-cured bonding agent (Clearfil Protect Bond, Kuraray Medical Inc, Okayama, Japan) was applied according to the manufacturer's instructions as follows: the primer was dabbed to the tooth surface for 20 seconds; after drying, the adhesive was applied and cured with a light-curing unit (Clotolux 75, Coltene/Whaledent, Altstätten, Switzerland) at a power of 480 mW/cm$^2$ for 10 seconds. Light-cured composite resin (Amelogen, Ultradent, South Jordan, Utah), shade A2, was used in 2 1.5 mm increments to fabricate the composite short post. The crown was reconstructed with the same composite resin using appropriate celluloid crowns (Pedoform Strip Crowns, 3M ESPE, St. Paul, Minn., USA).

In group 2 (fiber post), the initial 3 mm of the canal was prepared and a fiber post of corresponding size (GT Light Post, Bisco Inc, Schaumburg, Ill.) was tried for proper fitting and inserted in the canal using a self-etch/self-adhesive resin cement (Biscem, Bisco Inc) according to the manufacturer's instructions. The crown was reconstructed with the use of the same materials employed in group 1.

In group 3 (reversed post), the head's line angles of a no. 1 short prefabricated metal post (Sevenska, Switzerland) were beveled to reduce the stress concentrated at the dentinal walls in contact with these post areas and then the head of the post was try-fitted with the coronal 3 mm of the canal. Next, the post was cemented into the canal upside down using zinc phosphate cement, so that the 3-mm head of the post was inserted into the canal and the remaining 5 mm of the threaded section was positioned out of the canal as a core for coronal restoration. The restoration procedure was completed in the same manner as that for groups 1 and 2.

Finally, occlusion was adjusted using articulating paper and final finishing and polishing steps were performed using fine-grit diamond burs (nos. 860, 862, and 379, Teezkavan, Tehran, Iran) and Softlex Pop On Disks (3M ESPE, St. Paul, Minn., USA). The patient and his parents were instructed on proper diet and oral hygiene, and advised to return for regular check-ups.

The restorations were followed every 3 months for a period of 1 year, according to the World Dental Federation criteria updated in 2010 for the clinical evaluation of direct and indirect restorations.[39] Marginal staining, color match and translucency, fracture of the material and retention, marginal adaptation, and tooth integrity were assessed. Restoration retention rates were calculated using American Dental Association (**ADA**) guidelines using the following equation:[40]

Cumulative retention failure (%)=[(PF + NF)/(PF + RR)]×100, where PF is the number of previous failures before the current recall, NF is the number of new failures during the current recall, and RR is the number of restorations recalled for the current recall.

Two calibrated and blinded examiners evaluated all the restorations. Calibration of the operators was carried out by one experienced clinician. During the calibration session, questions were dealt with and a consensus was reached. Each examiner evaluated the restoration in an independent manner. In case of any disagreement, a consensus was arrived at before the patient was dismissed.

Cohen's Kappa coefficient was used to assess interobserver agreement. For each FDI criterion, the scores were analyzed with the nonparametric Kruskal-Wallis and Mann-Whitney tests, using SPSS 11.5 software (SPSS Inc, Chicago, Ill., USA), to determine any significant differences among the 3 groups. Statistical significance was set at $\alpha$=0.05.

## RESULTS

The study protocol was approved by the ethics committee of Isfahan University of Medical Sciences and Torabinejad Dental Research Center, Isfahan, Iran. A total of 54 children participated. Informed consent was obtained from the parents of each patient prior to treatment. A total of 161 severely compromised primary maxillary teeth were randomly treated with 53 composite post restorations, 54 fiber post restorations, and 54 reversed post restorations. Cohen's Kappa coefficient for interobserver agreement was 0.79, which is interpreted as "substantial agreement," according to Viera and Garrett.[41]

One tooth in the composite post group and one in the fiber post group were excluded from the study at the 3-month follow-up because of the "absolute failure," according to the evaluation criteria described below.[39] Other sample drop-outs during the 12-month follow-up period, shown in Table 1, were due to failure to attend 1 or more of the recall appointments.

Data collected from the periodic recall visits were scored as follows:

0=clinically poor, replacement necessary; absolute failure
1=clinically unsatisfactory, but repairable; relative failure
2=clinically sufficient; satisfactory
3=clinically good
4=clinically excellent; very good.

The scores 0 and 1 were deemed "unacceptable" in evaluating overall scores, but scores 2, 3 and 4 were classified as "acceptable."

The sample percentage for each score of different criteria in the 3 restorative techniques at different recall visits are shown in Table 2. *P*-values demonstrate the results of comparisons between the study groups based on the Kruskal-Wallis test. Two-by-two comparison of the groups using the Mann-Whitney test revealed

the following statistically significant differences ($P<.05$; Table 3):

1. marginal staining: composite post vs reversed post at 6-month interval; reversed post vs fiber post at 6-, 9-, and 12-month intervals;
2. fracture of material and retention: composite post vs fiber post at 12-month interval; reversed post vs fiber post at 12-month interval;
3. marginal adaptation: composite post vs fiber post at 6- and 12-month intervals; composite post vs reversed post at 6- and 12-month intervals; reversed post vs fiber post at 12-month interval;
4. tooth integrity: composite post vs fiber post at 6-, 9-, and 12-month intervals; reversed post vs fiber post at 3-, 6-, 9-, and 12-month intervals; and
5. overall restoration score: composite post vs fiber post, composite post vs reversed post, reversed post vs fiber post at 3-, 6-, 9-, and 12-month intervals.

No significant differences were observed among the 3 groups regarding the color match and translucency criteria at any recall appointment ($P>.05$; Table 2).

The retention rates of the groups at each recall period are depicted in the Figure 1. No significant differences were detected in the retention rates in each recall period among the groups ($P>.05$).

## DISCUSSION

In the present study, the clinical performance of restorations of maxillary primary incisors with extensive caries based on a new retentive method—a reversed metal post technique (**RMPT**)—was compared with 2 conventional methods (fiber post and resin composite post) over a 12-month period.

During the follow-up period, one sample in the composite post group and one sample in the fiber post group showed absolute failure with complete loss of restorations, both at the 3-month recall visit. The failure in the fiber post sample was due to severe dentoalveolar trauma in a fall accident, which resulted in dislodgement of the composite build-up from the core of fiber post. The failure in the composite post sample occurred while biting on a sandwich, which resulted in the resin composite fracture at the level of the canal orifice.

Based on ADA guidelines the retention rates of the different reconstruction techniques did not differ significantly after 12 months.[40] The retention rates at 12-month recall visits were approximately 98% for composite post, 90% of fiber post, and 100% reverse post techniques. These rates are consistent with the results reported by Judd et al.[17] and Sharaf,[32] who reported 100% success rates for composite post and fiber post techniques in their studies, respectively.

The sealing capacity of restorations is usually assessed by discoloration at restoration margins. Marginal staining is believed to be one of the first clinical signs of resin composite restoration failure It may result from the presence of excess or deficit filling material at the margin, gap formation, and also retention of microscopic pigments derived from colored beverages and foods in the adhesive layer, leading to seepage or leakage of oral fluids into the restoration-tooth interface.[40,41] Based on the results of the present study, the reversed post was superior to the fiber post in relation to staining scores, which might be attributed to the metallic post stiffness. In such conditions, most occlusal loads are transferred to the periodontal apparatus through the composite resin post complex. Although this is more appropriate regarding the marginal seal of the restoration, it may result in additional trauma via increased transfer of stress to the restored tooth.

Previous studies have reported that metallic posts have inferior optical characteristics.[5,14,36] It was not a problem in the present study, however, as the color match and translucency of the 3 groups showed no statistically significant differences (Table 2). The use of an opaque composite resin, along with reversed (upside down) prefabricated metal post application, which positioned the narrow threaded part of the post coronally to permit adequate insertion of composite resin around it, might explain this finding.

Considering the fracture of the material, excellent clinical scores were exhibited by a total of approximately

**Table 1. No. of Teeth in the Study Groups According to Recall Times**

| Study group | Recall time (mos) | | | |
|---|---|---|---|---|
| | 3 | 6 | 9 | 12 |
| Composite post | 53 | 48 | 47 | 43 |
| Fiber post | 54 | 51 | 48 | 45 |
| Reverse post | 54 | 53 | 50 | 48 |
| **Total** | **161** | **152** | **145** | **136** |

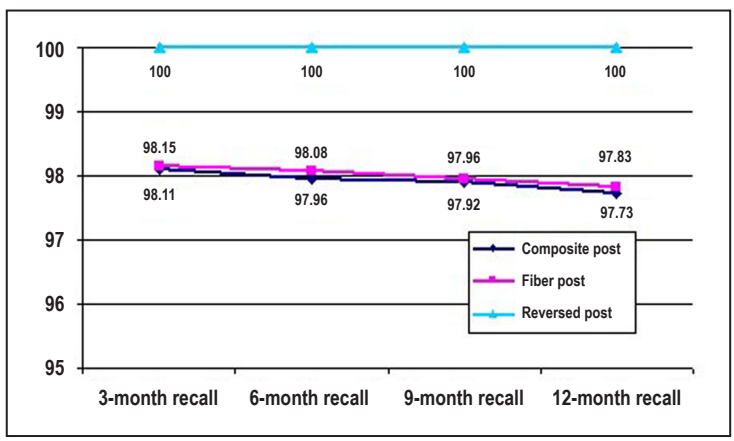


*Figure 1. Restoration retention rates (%).*

86% of composite post restorations, 58% of fiber post restorations, and 83% of reversed post restorations. The findings in relation to composite posts are supported by Judd et al.[17] The inferiority of fiber post-restorations compared to the other 2 groups, in relation to fracture of the material, might be attributed to its lower elasticity, which results in more strains in marginal areas, leading to more marginal fractures.

**Table 2. Distribution of Scores for the 3 Studied Techniques at Different Recall Times According to FDI World Dental Federation Criteria (%)**

| | FDI criteria | Marginal staining | | | | | Color match and translucency | | | | | Fracture of material retention | | | | | Marginal adaptation | | | | | Tooth integrity | | | | | Overall score | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Recalls | Score | 0 | 1 | 2 | 3 | 4 | 0 | 1 | 2 | 3 | 4 | 0 | 1 | 2 | 3 | 4 | 0 | 1 | 2 | 3 | 4 | 0 | 1 | 2 | 3 | 4 | 0 | 1 | 2 | 3 | 4 |
| 3 months | Composite post (%) | 0 | 0 | 0 | 10 | 90 | 0 | 0 | 1 | 4 | 95 | 2 | 0 | 2 | 0 | 96 | 0 | 0 | 12 | 0 | 89 | 0 | 0 | 0 | 2 | 98 | 2 | 0 | 13 | 13 | 72 |
| | Fiber post (%) | 0 | 0 | 0 | 17 | 83 | 0 | 0 | 6 | 11 | 83 | 2 | 0 | 9 | 4 | 85 | 0 | 0 | 13 | 9 | 77 | 0 | 0 | 8 | 4 | 89 | 2 | 0 | 26 | 27 | 44 |
| | Reverse post (%) | 0 | 0 | 2 | 4 | 94 | 0 | 0 | 0 | 4 | 96 | 0 | 0 | 6 | 0 | 94 | 0 | 2 | 18 | 9 | 70 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 20 | 13 | 67 |
| | *P*-value | <.17 | | | | | <.07 | | | | | <.09 | | | | | >.09 | | | | | .009* | | | | | <.02* | | | | |
| 6 months | Composite post (%) | 0 | 0 | 5 | 9 | 87 | 0 | 0 | 2 | 4 | 94 | 0 | 0 | 4 | 2 | 94 | 0 | 0 | 17 | 2 | 81 | 0 | 0 | 4 | 0 | 96 | 0 | 0 | 21 | 21 | 58 |
| | Fiber post (%) | 0 | 0 | 0 | 29 | 71 | 0 | 0 | 8 | 6 | 86 | 0 | 2 | 14 | 6 | 78 | 0 | 2 | 29 | 14 | 55 | 0 | 0 | 22 | 4 | 75 | 0 | 2 | 41 | 26 | 31 |
| | Reverse post (%) | 0 | 0 | 2 | 6 | 93 | 0 | 0 | 0 | 6 | 94 | 0 | 2 | 8 | 6 | 85 | 0 | 2 | 25 | 13 | 60 | 0 | 0 | 2 | 0 | 98 | 0 | 2 | 26 | 21 | 51 |
| | *P*-value | >.02* | | | | | >.24 | | | | | >.09 | | | | | <.03* | | | | | .001* | | | | | >.01* | | | | |
| 9 months | Composite post (%) | 0 | 0 | 11 | 9 | 81 | 0 | 0 | 2 | 6 | 92 | 0 | 0 | 5 | 8 | 87 | 0 | 2 | 19 | 18 | 61 | 0 | 0 | 6 | 6 | 87 | 0 | 2 | 30 | 23 | 45 |
| | Fiber post (%) | 0 | 0 | 4 | 35 | 60 | 0 | 0 | 6 | 6 | 87 | 0 | 2 | 13 | 15 | 71 | 0 | 2 | 29 | 29 | 40 | 0 | 0 | 23 | 27 | 50 | 0 | 2 | 44 | 42 | 13 |
| | Reverse post (%) | 0 | 0 | 8 | 4 | 88 | 0 | 0 | 0 | 5 | 94 | 0 | 2 | 8 | 6 | 84 | 0 | 6 | 28 | 16 | 50 | 0 | 2 | 10 | 2 | 86 | 0 | 6 | 30 | 24 | 40 |
| | *P*-value | >.01* | | | | | <.49 | | | | | <.16 | | | | | >.20 | | | | | .001* | | | | | <.03* | | | | |
| 12 months | Composite post (%) | 0 | 0 | 14 | 21 | 65 | 0 | 0 | 0 | 10 | 90 | 0 | 0 | 12 | 2 | 86 | 0 | 2 | 26 | 12 | 61 | 0 | 0 | 7 | 9 | 84 | 0 | 2 | 37 | 19 | 42 |
| | Fiber post | 0 | 0 | 9 | 38 | 53 | 0 | 0 | 7 | 4 | 89 | 0 | 7 | 22 | 13 | 58 | 0 | 16 | 53 | 16 | 16 | 0 | 9 | 38 | 20 | 33 | 0 | 16 | 67 | 13 | 4 |
| | Reverse post | 0 | 0 | 8 | 8 | 84 | 0 | 0 | 0 | 6 | 94 | 0 | 6 | 8 | 2 | 83 | 0 | 10 | 38 | 10 | 42 | 0 | 4 | 19 | 0 | 77 | 0 | 10 | 44 | 15 | 31 |
| | *P*-value | 0.020* | | | | | 0.438 | | | | | 0.005* | | | | | 0.001* | | | | | 0.001* | | | | | 0.001* | | | | |

*** Statistically significant.**

**Table 3. Comparison of Composite Post, Fiber Post, and Reverse Post Techniques at Different Recall Times**

| Recalls | | 3 mos | | | 6 mos | | | 9 mos | | | 12 mos | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FDI criteria | Techniques* | Composite post | Fiber post | Reverse post | Composite post | Fiber post | Reverse post | Composite post | Fiber post | Reverse post | Composite post | Fiber post | Reverse post |
| Marginal staining | Mean rank | 80.90 | 75.08 | 85.95 | 73.80 | 69.59 | 83.59 | 73.36 | 62.77 | 80.60 | 66.15 | 60.08 | 78.50 |
| | *P*-value C&F | <.27 | | | <.56 | | | >.07 | | | .44 | | |
| | *P*-value F&R | | .07 | | | .005† | | | .005† | | | .005† | |
| | *P*-value C&R | | >.45 | | | >.03† | | | >.35 | | | <.06 | |
| Color match and translucency | Mean rank | 80.39 | 74.39 | 85.13 | 78.27 | 72.40 | 78.84 | 73.36 | 70.28 | 75.27 | 70.41 | 65.78 | 69.34 |
| | *P*-value C&F | <.26 | | | <.21 | | | >.50 | | | >.24 | | |
| | *P*-value F&R | | >.12 | | | >.14 | | | >.24 | | | <.37 | |
| | *P*-value C&R | | <.22 | | | >.88 | | | <.62 | | | .74 | |
| Fracture of material and retention | Mean rank | 84.36 | 75.68 | 83.03 | 82.80 | 71.01 | 76.08 | 75.69 | 66.42 | 75.90 | 75.57 | 56.83 | 73.00 |
| | *P*-value C&F | <.06 | | | <.07 | | | >.14 | | | .004† | | |
| | *P*-value F&R | | <.12 | | | >.38 | | | >.09 | | | <.02† | |
| | *P*-value C&R | | >.68 | | | <.16 | | | <.78 | | | >.64 | |
| Marginal adaptation | Mean rank | 88.31 | 79.54 | 73.42 | 87.06 | 68.92 | 73.32 | 85.00 | 67.32 | 70.93 | 81.63 | 51.20 | 69.38 |
| | *P*-value C&F | <.18 | | | .009† | | | <.08 | | | .001† | | |
| | *P*-value F&R | | <.36 | | | <.56 | | | >.69 | | | >.02† | |
| | *P*-value C&R | | .13 | | | <.04† | | | <.22 | | | <.04† | |
| Tooth integrity | Mean rank | 82.01 | 74.46 | 83.50 | 81.29 | 65.19 | 83.05 | 80.37 | 56.13 | 80.39 | 79.81 | 47.48 | 75.39 |
| | *P*-value C&F | >.05 | | | .004† | | | .001† | | | .001† | | |
| | *P*-value F&R | | >.01† | | | .001† | | | .001† | | | .001† | |
| | *P*-value C&R | | <.31 | | | >.50 | | | >.77 | | | >.28 | |
| Overall score | Mean rank | 89.60 | 68.44 | 85.12 | 86.90 | 63.47 | 79.62 | 84.68 | 60.74 | 76.61 | 81.40 | 49.84 | 71.75 |
| | *P*-value C&F | .008† | | | .004† | | | .009† | | | .001† | | |
| | *P*-value F&R | | >.04† | | | <.05† | | | >.05 | | | .004† | |
| | *P*-value C&R | | <.56 | | | .37 | | | >.55 | | | .12 | |

*** C&F=composite post and fiber post; F&R=fiber post and reverse post; C&R=composite post and reverse post.** **† Significant P-value.**

Regarding marginal adaptation, approximately 2% of composite post, 16% of fiber post, and 10% of reversed post restorations exhibited a marginal gap greater than 250 µ at the 12-month interval. Based on the evaluation criteria, this is considered recurrent caries.[42] This finding concerning the composite post group is more consistent with Judd et al.,[17] who reported approximately a 4% rate of recurrent caries at the 12-month interval. Children presenting with ECC are susceptible to caries, and lack of compliance with the preventive measures results in recurrence of carious lesions, even in treated cases of ECC, as reported by previous studies.[7,8,43] The rate of recurrent caries in this study, however, was much lower than that in the aforementioned studies (approximately 40%), which might be attributed to the rigorous preventive instructions and counseling in relation to diet control and oral hygiene measures during treatment sessions and recall visits.

Approximately 84% of composite post, 33% of fiber post, and 77% of reversed post restorations, respectively, were excellent based on the FDI tooth integrity criterion at the 12-month interval, whereas approximately 9% of fiber post restorations and 4% of reversed post restorations needed repair.

Considering overall scores of the restorations, approximately 98%, 84%, and 90% of composite post, fiber post, and reversed post restorations, respectively, were categorized as "acceptable restorations," without any need to for repairs or replacements. This is consistent with previous studies on composite post restorations in primary anterior teeth.[9,17] However, other studies both on primary teeth[14,30,32] and permanent teeth[35,36] showed different results. This inconsistency might be attributed to differences in study design and consideration of post retention as the only criterion for success in restoring primary teeth. Conversely, the great width of the coronal part of the primary root canal and utilization of only a short length of the post in primary teeth, compared to permanent teeth, result in inadequate frictional adaptation of the post with canal walls.

In fact, techniques that obviate the patients' functional and esthetic demands and save chair time are favorable during treatment of very young children. Careful selection of an appropriate post design for each case will guarantee a successful treatment outcome. The innovative restorative technique with reversed root post for early primary teeth used in this study appears to be an alternative in restorative pediatric dentistry, due to its satisfactory clinical and in vitro[37] outcomes compared to two other conventional techniques.

With reversed metal post technique (RMPT), the clinical procedure is simple and the laboratory phase is eliminated; therefore, the restoration can be completed in only 1 session. The post stability and retention due to the quadrangle shape of its head inserted in the canal is satisfactory. Moreover, as the composite material around the core part of the post system is sufficient, more satisfactory esthetic results and shade adaptation are achieved and no metallic shade is observed in the restoration. In addition to that, the quadrangle head of the post system, which is placed in the intracanal, is only 3 mm, fills only the cervical one third of the canal, and does not interfere with the eruption of permanent tooth.[37]

## CONCLUSIONS

Based on this study's results, the reversed metal post technique is a clinically accepatable alternativen method for restoring severely decayed primary anterior teeth.

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