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Original Research

Comparative study on effectiveness of two different post & core systems in the coronal restoration of carious primary anterior teeth

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Abstract

Background: Early childhood caries frequently affects primary anterior teeth, leading to extensive coronal destruction and esthetic, functional, and psychological concerns. Post and core systems have been advocated to enhance retention of coronal restorations in severely mutilated primary teeth. **Aim:** To compare the clinical and radiographic effectiveness of two different post and core systems in the coronal restoration of carious primary anterior teeth. **Materials and Methods:** A prospective comparative clinical study was conducted on 60 severely decayed primary maxillary anterior teeth in children aged 3-6 years. Following pulpectomy, teeth were randomly allocated into two groups: Group I (Glass Fiber Post with Composite Core) and Group II (Prefabricated Metal Post with Composite Core). Clinical parameters including retention, marginal integrity, color match, fracture, and secondary caries were evaluated at 3, 6, and 12 months. Radiographic assessment was performed to evaluate periapical status and internal resorption. Statistical analysis was performed using Chi-square test and independent t-test with significance set at $p < 0.05$. **Results:** At 12 months, Group I showed significantly higher retention rates (93.3%) compared to Group II (80%) ($p = 0.04$). Fracture incidence was higher in the metal post group. Esthetic satisfaction scores were significantly better in the fiber post group ($p < 0.001$). No significant difference was observed in radiographic outcomes between groups ($p > 0.05$). **Conclusion:** Glass fiber post systems demonstrated superior clinical performance and esthetic outcomes compared to prefabricated metal posts in restoring severely carious primary anterior teeth.

Keywords: Primary anterior teeth, Early childhood caries, Fiber post, Metal post, Post and core, Pediatric restorative dentistry

Introduction

Early childhood caries (ECC) remains one of the most prevalent chronic diseases in children worldwide, frequently affecting maxillary primary anterior teeth and resulting in extensive coronal destruction. Restoration of such severely mutilated teeth presents a significant clinical challenge in pediatric dentistry.

Pulpectomy followed by intracanal post placement has been recommended to improve retention of coronal restorations in primary incisors with substantial structural loss¹. Various post systems such as prefabricated metal posts, composite posts, polyethylene fiber posts, and glass fiber posts have been used with varying degrees of success².

Glass fiber posts have gained popularity due to their modulus of elasticity being similar to dentin, resulting in better stress distribution and reduced risk of catastrophic root fractures^{3,4}. Additionally, their translucency enhances esthetic outcomes, which is particularly important in anterior restorations⁵. Clinical and radiographic studies have reported favorable performance of glass fiber posts compared to conventional post systems^{6,7}.

However, some clinicians still prefer prefabricated metal posts due to their strength and ease of use, although they may concentrate stress within the root and compromise esthetics^{2,4}. A systematic review in 2024 highlighted the need for more comparative clinical studies evaluating long-term outcomes of different intracanal post systems in primary anterior teeth⁸. Therefore, this study was undertaken to comparatively evaluate the effectiveness of glass fiber posts and prefabricated metal posts in the coronal restoration of carious primary anterior teeth.

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Materials and Methods

The present prospective randomized comparative clinical study was conducted at Department of Pediatric and Preventive Dentistry, tertiary care dental institution. 60 primary maxillary anterior teeth from 45 children aged 3-6 years. Sample size was calculated assuming 80% power and 5% significance level. Randomization was done using computer-generated random numbers. Sample were allocated equally in to two groups. Group 1 sample restore with **Glass Fiber Post + Composite Core** and group II samples restored with **Prefabricated Metal Post + Composite Core**. Patients were recalled at 3 month, 6month & 12 month for clinical and radiological evaluation.

Clinical Evaluation

- Retention (Present/Absent)
- Post fracture
- Marginal discoloration
- Secondary caries
- Color match (Esthetic score)

Radiographic Evaluation

- Periapical radiolucency
- Internal/external resorption
- Root integrity

Inclusion Criteria

- Children aged 3-6 years
- Primary anterior teeth with >2/3 coronal destruction
- Teeth indicated for pulpectomy
- No pathological root resorption >1/3 root length

Exclusion Criteria

- Non-restorable roots
- Advanced internal/external resorption
- Medically compromised children

Clinical Procedure

1. **Pulpectomy** performed using standard protocol.
2. Root canal obturation using resorbable material.
3. Post space preparation: 3-4 mm of coronal obturating material removed.

Restorative Protocol

Group I - Glass Fiber Post

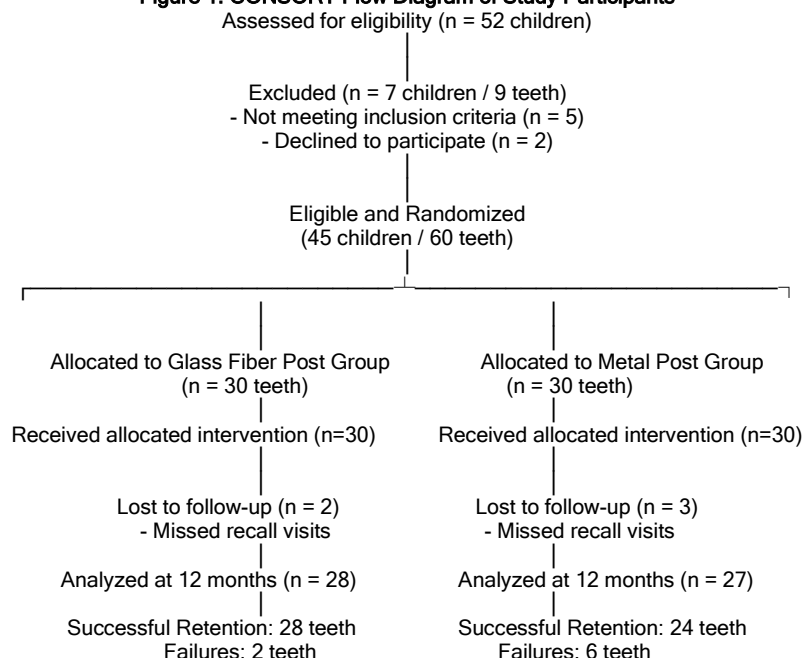
- Acid etching and bonding agent application
- Fiber post cemented using resin cement
- Composite core build-up
- Finishing and polishing

Group II - Prefabricated Metal Post

- Metal post adjusted and cemented with glass ionomer cement
- Composite core build-up
- Finishing and polishing

Statistical Analysis: Data were analyzed using SPSS software (Version 26.0) Chi-square test was applied for categorical variables and Independent t-test was applied for mean esthetic scores. Significance level set at $p < 0.05$

Figure 1: CONSORT Flow Diagram of Study Participants



Results

The present prospective randomized comparative clinical study was conducted at Department of Pediatric and Preventive Dentistry, tertiary care dental institution. 60 primary maxillary anterior teeth from 45 children aged 3-6 years. The glass fiber post group demonstrated a significantly higher retention rate compared to the metal post group at 12 months ($p = 0.040$). This suggests superior bonding efficiency and clinical stability of fiber posts in primary anterior teeth. (Table1) The incidence of fracture was significantly higher in the metal post group compared to the fiber post group ($p = 0.037$). This indicates that rigid metal posts may predispose to stress concentration and structural failure. (Table2) The glass fiber post group demonstrated significantly superior esthetic outcomes compared to the metal post group. The translucency of fiber posts contributed to improved color match and marginal blending. (Table3) Fiber posts showed significantly better marginal integrity compared to metal posts ($p = 0.047$). This may be due to better adhesive bonding and reduced microleakage. (Table4) No statistically significant difference was observed between the two groups regarding secondary caries formation. Both post systems demonstrated comparable biological compatibility. (Table5) Radiographic evaluation revealed no statistically significant difference between the two groups. Both post systems maintained acceptable periapical health over the 12-month follow-up. (Table6)

Table 1: Comparison of Retention Rate at 12 Months

Outcome	Glass Fiber Post (n=30)	Metal Post (n=30)	Chi-square (χ^2)	p-value
Retained	28 (93.3%)	24 (80%)	4.21	0.040*
Failed	2 (6.7%)	6 (20%)		

*Statistically significant ($p < 0.05$)

Table 2: Comparison of Fracture Incidence

Parameter	Glass Fiber Post	Metal Post	Chi-square (χ^2)	p-value
Fracture Present	1 (3.3%)	5 (16.7%)	4.32	0.037*
No Fracture	29 (96.7%)	25 (83.3%)		

*Statistically significant ($p < 0.05$)

Table 3: Esthetic Score Comparison (Modified USPHS Criteria)

Group	Mean Score	SD	t-value	p-value
Glass Fiber Post	4.70	0.48	8.62	<0.001*
Metal Post	3.10	0.67		

*Highly statistically significant ($p < 0.001$)

Table 4: Marginal Integrity at 12 Months

Marginal Integrity	Glass Fiber Post	Metal Post	Chi-square (χ^2)	p-value
Alpha (Ideal)	27 (90%)	22 (73.3%)	3.95	0.047*
Bravo (Acceptable)	3 (10%)	6 (20%)		
Charlie (Failure)	0	2 (6.7%)		

*Statistically significant ($p < 0.05$)

Table 5: Secondary Caries Incidence

Secondary Caries	Glass Fiber Post	Metal Post	Chi-square (χ^2)	p-value
Present	1 (3.3%)	3 (10%)	1.07	0.300
Absent	29 (96.7%)	27 (90%)		

Not statistically significant ($p > 0.05$)

Table 6: Radiographic Success at 12 Months

Radiographic Outcome	Glass Fiber Post	Metal Post	Chi-square (χ^2)	p-value
Normal Periapical Status	29 (96.7%)	28 (93.3%)	0.35	0.554
Pathological Changes	1 (3.3%)	2 (6.7%)		

Not statistically significant ($p > 0.05$)

Discussion

The restoration of severely carious primary anterior teeth remains a clinical challenge due to limited remaining tooth structure, small root dimensions, and high esthetic demands. Intracanal post systems have been widely advocated to enhance retention and reinforce coronal restorations in such cases^{1, 12, 15}. The present study compared glass fiber posts and prefabricated metal posts with respect to retention, fracture resistance, esthetics, and radiographic success.

Retention and Clinical Longevity

Retention is the primary determinant of success in post-retained restorations. In the present study, glass fiber posts demonstrated significantly higher retention rates compared to metal posts. This finding is consistent with several recent clinical investigations^{1, 7, 10, 14, 18}.

Jaiswal et al. (2023) reported superior retention of composite restorations retained by glass fiber posts in primary incisors¹. Similarly, Ibrahim and Nourallah (2020) observed improved clinical and radiographic outcomes when fiber posts were used instead of composite posts⁷. A 12-month clinical evaluation by Goyal et al. (2022) further confirmed that fiber posts exhibited better stability and lower dislodgement rates than polyethylene posts¹⁰.

The enhanced retention of fiber posts may be attributed to adhesive bonding between dentin, resin cement, and composite core, creating a "monoblock" configuration^{3, 11}. Patel et al. (2023) also demonstrated high survival rates of fiber post restorations over follow-up periods¹⁴. Retrospective data from Rahman and Rahman (2024) similarly showed greater longevity of fiber-reinforced restorations compared to rigid post systems¹⁸.

In contrast, metal posts rely primarily on mechanical retention rather than adhesive bonding, which may explain the relatively higher dislodgement rates observed in the present study^{2, 13}.

Fracture Resistance and Failure Pattern

Fracture resistance is particularly critical in primary teeth due to thinner dentinal walls and physiologic root resorption. The metal post group in the present study showed a higher incidence of fracture compared to the fiber post group.

This observation is supported by multiple in vitro and finite element studies^{4,9,11,16,19}. Hassan et al. (2025) demonstrated that fiber posts exhibited more favorable fracture patterns and required greater load to failure compared to metal posts⁴. Bhatia et al. (2021) also reported significantly higher fracture resistance in fiber-reinforced post systems⁹.

The difference in performance may be explained by variations in modulus of elasticity. Glass fiber posts possess elasticity similar to dentin, enabling more uniform stress distribution^{3,11}. Finite element analysis conducted by Abdelaziz and Ahmed (2024) confirmed that fiber posts reduced stress concentration at the cervical and radicular regions compared to metallic posts¹⁶. Gupta et al. (2022) further demonstrated that metal posts tend to produce unfavorable root fracture patterns due to stress concentration¹⁹.

Metal posts, being rigid, may act as stress concentrators within the canal space, increasing the risk of catastrophic failure^{2,4}. These biomechanical considerations strongly favor fiber-reinforced systems in pediatric anterior rehabilitation.

Esthetic Considerations

Esthetics is a major concern in anterior primary teeth, as restoration appearance significantly influences child confidence and parental satisfaction. The present study demonstrated significantly better esthetic scores in the fiber post group.

This finding aligns with multiple clinical reports^{8,14,17}. Afraa et al. (2021), in a 3-year follow-up study, reported excellent color stability and esthetic integration with fiber-reinforced posts⁸. Patel et al. (2023) also documented superior esthetic outcomes and parental satisfaction with glass fiber posts¹⁴.

Chhabra and Chhabra (2021) emphasized that fiber posts eliminate the grayish discoloration often associated with metallic posts under composite restorations¹⁷. In contrast, metal posts may create shadowing effects, particularly in thin composite buildups, negatively affecting the final appearance².

Given the psychological and social implications of anterior tooth loss in children, esthetic superiority represents a significant clinical advantage of fiber posts.

Radiographic and Biological Outcomes

Radiographic assessment in the present study revealed no statistically significant difference between the two post systems regarding periapical health or pathologic resorption.

This finding is consistent with prior comparative studies^{6,7,18}. Mansour (2024) found no significant radiographic differences among different post systems when proper pulpectomy protocols were followed⁶. Similarly, Ibrahim and Nourallah (2020) observed comparable radiographic success rates between glass fiber and composite posts⁷.

Rahman and Rahman (2024) further confirmed that post material did not significantly influence long-term periapical outcomes in primary incisors¹⁸. These findings suggest that biological compatibility depends more on endodontic success than on post material selection.

Comparison with Systematic Reviews and Broader Evidence

A recent systematic review by Shanmugam (2024) highlighted the growing preference for fiber posts in pediatric anterior restorations but emphasized the need for more controlled comparative trials⁵. The findings of the present study contribute additional clinical evidence supporting the superiority of fiber posts in retention and esthetics without compromising biological safety.

Thomas and Joseph (2025) also described fiber posts as a promising advancement in intracanal reinforcement techniques due to their biomechanical compatibility and adhesive properties²⁰. Moreover, Sanjana et al. (2025) reported similar conclusions in their comparative evaluation of post and core systems³.

Collectively, the evidence from clinical trials, in vitro studies, finite element analyses, and systematic reviews strongly supports the preferential use of fiber-reinforced posts over rigid metallic posts in primary anterior teeth restoration.

Conclusion

Within the limitations of this study Glass fiber posts demonstrated superior retention and esthetic outcomes. Metal posts showed higher fracture rates. Both systems showed comparable radiographic success. Fiber posts can be considered a reliable and esthetic alternative for coronal restoration of severely carious primary anterior teeth.

Clinical Implications: Fiber posts enhance esthetics in pediatric anterior restorations. They reduce fracture risk due to better stress distribution. Recommended in children with high esthetic demands. Technique-sensitive but clinically rewarding option.

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