

Glass Fiber Reinforced Composite Resin as an Intracanal Post – A Clinical Study

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*Restoration of primary incisors, which have been severely damaged by early childhood caries or trauma, is a difficult task for the pediatric dentist. With the introduction of new adhesive systems and restorative materials, alternative approaches for treating these teeth have been proposed. **Materials:** Ten healthy children aged between 3-4 years who had 28 grossly destructed primary maxillary incisors requiring intra canal retention were selected for the study. Following root canal treatment, either a Glass Fiber Reinforced Composite Resin (GFRCR everStick,, Finland) or an omega shaped stainless steel wire were placed as intracanal posts in these teeth. Flowable composite was used for cementation of posts and also to build up the coronal structure using celluloid strip crowns. Both types of intracanal posts were evaluated for retention and marginal adaptation at 1, 6 and 12 months. The data obtained was subjected to statistical analysis. **Conclusion:** GFRCR intracanal posts showed better retention and marginal adaptation than omega shaped stainless steel wire posts.*

Keywords: GFRCR, Omega shaped stainless steel wire, Intracanal posts

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INTRODUCTION

The restoration of severely destructed primary incisors, either due to dental caries or trauma, can be very challenging. Premature loss of carious primary incisors may affect the pattern of speech development by interfering with the pronunciation of tongue-tip consonants (ie, t, d, s, sh and ch) and the labial sounds of f and v. Other implications are decreased masticatory efficiency and the development of abnormal tongue habits and potentially, subsequent malocclusions. The child may also suffer from psychological problems if esthetics is compromised.¹ For these reasons, a

simple restorative technique that is able to provide efficient, durable and functional restorations would enhance the management of patients presenting with carious maxillary primary incisors.¹

A problem with anterior primary incisors that are grossly decayed is the lack of coronal structure to support and provide adhesion for a composite restoration. In such cases, the use of an intracanal post in endodontically treated teeth improves the retention for a longer lasting restoration. Variety of materials can be used for this purpose, such as resin composite, metal, biological and prefabricated posts.² Orthodontic wire posts are very commonly used as intracanal posts in primary teeth. Recently, an omega shaped stainless steel wire was used as an intracanal post in a simple, quick and effective technique for restoring primary anterior teeth.²

Dental manufacturers have developed fibreglass posts, which are available in different diameters. This material allows chemical and mechanical adhesion to the restorative materials, resulting in restorations with good esthetics. They have several clinical indications such as periodontal splints, fixed orthodontic retainers, space maintainers, fixed bridges and intracanal posts.³

Hence the aim of the present study was to evaluate the clinical efficacy of Glass Fibre Reinforced Composite Resin (GFRCR) posts and compare it with that of omega shaped stainless steel wire posts in restoring severely destroyed primary maxillary anterior teeth.

MATERIALS AND METHOD

Ten normal and healthy children, aged between 3–4 years,

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having severely destructed maxillary primary anterior teeth, were selected for the study from the patients attending the Department of Pedodontics and Preventive Dentistry, The Oxford Dental College, Hospital and Research Center, Bangalore, India. A brief history was recorded and clinical examination was done. Intraoral periapical radiographs were taken in the area of grossly destructed upper anterior primary teeth. The treatment plan was explained to the parents and their written consent obtained prior to the study. The research protocol of the study was reviewed and ethical clearance to conduct the study was obtained from the institutional review board. Of the ten children, four of them were treated under general anesthesia. Twenty-eight teeth from these ten children were randomized into two groups of 14 teeth each. Group A received GFRCR posts, where as omega shaped stainless steel wire posts were given in Group B.

After completion of root canal treatment, 4 mm of the filling material was removed from the root canal for the placement of a post. A 1mm thick layer of glass ionomer cement was condensed over the remaining zinc oxide eugenol filling to prevent interference with the polymerization of composite resin restoration. For each canal an omega shaped stainless steel wire or a GFRCR (everStick, Finland) post of corresponding size was tried for proper fitting and proper length.

The omega shaped stainless steel post was fabricated and placed using the technique described by Mortada and King² (Figure 1).

The GFRCR post (everStick, Finland) was placed to a distance of 3mm into the canal and the length was adjusted such that it extended 2 mm outside the canal. An intra oral periapical radiograph was taken to ensure that the end of the post was at the level of the interdental crest or just apical to it. Any excessive length of the post was cut with a diamond bur under a water coolant.

After a trial fit of the posts, the canals were coated with the single step adhesive system (Unifilbond®3M, USA). A flowable composite (Filtek z 350®, 3M,USA) was used to coat the walls of the root canals. The posts were then inserted into the canals to the desired length following which both post and composite were cured together as a single unit. Flowable composite was further added to cover the post and coronal restoration was done with composite using celluloid strip crowns⁴ (Strip Crown Form- Pedo,3M ESPE). The occlusion was checked and final finishing of the restoration was done. Patients were recalled at 1, 6 and 12months to evaluate the retention and marginal adaptation of the intracanal retained coronal restoration. The data obtained was tabulated and subjected to statistical analysis using Chi square test and Fisher Exact test.

RESULTS

At one month, both GFRCR and omega shaped stainless steel wire posts showed 100% retention and marginal adaptation. However, at 6 month evaluation, the retention for GFRCR and omega shaped stainless steel wire posts was 79% and 72%, respectively. While 79% of GFRCR posts

were observed to have marginal adaptation, it was seen in 71% of the omega shaped stainless steel wire posts. At the end of the study period, GFRCR posts continued to show 79% retention whereas a lower retention of 54% was observed with the omega shaped stainless steel wire posts. A significantly higher percentage (79%) of GFRCR posts showed marginal adaptation compared to 15% of omega shaped stainless steel wire posts.

DISCUSSION

The successful restoration of badly mutilated primary anterior teeth in preschool children is a challenging task. The high failure rate of such restorations is due to the insufficient tooth structure available to support them. In addition, the poor adhesion of the bonding agents to the enamel and dentine of primary teeth as compared to that of permanent teeth can compromise the final restoration.²

Different resin materials and techniques have been used for reinforcing root canals. The use of an intracanal post in endodontically treated teeth improves the retention of a definitive restoration.¹ In 1990, Gudd *et al* reported a 100% success rate for composite crowns utilizing short posts for retention. Composite posts have low strength-to-load ratio and is indicated for the reinforcement of enlarged canals as seen in immature teeth and in primary dentition.¹

In a previous study, the use of metallic posts in 23 patients was reported to show improved durability of the restoration.¹ A direct composite resin restoration, which was mechanically reinforced with orthodontic wire, was described by Mortada and King (2004).² This proved to be a simple, quick and effective technique, which may be performed in one visit and present with good adaptation and high strength. However, metallic posts such as the omega shaped stainless steel wire post requires masking with an opaque resin. This may in turn affect the final appearance of the restoration.

The newly introduced GFRCR posts are esthetic, easy to use and are available in different sizes. In the present study, for purpose of comparison, both types of posts (GFRCR and omega shaped stainless steel wire posts) were used to restore the grossly destructed primary incisors in each child. Thus no child was prevented from the benefit of either type of post. This also ensured that both types of posts being in the same oral cavity would be subjected to similar dietary patterns, oral hygiene conditions and occlusal forces. The use of the single step adhesive system to bond the composite to tooth structure reduced the treatment time for the child, because there is no need for separate acid etching and priming of the enamel and dentin.

According to Judd² particular attention must be paid to mandibular lateral incisor and canine interferences during parafunctional mandibular movements or physiological forward mandibular shifts. In our study, this problem was overcome by keeping the cervico-incisal height of the restored crown slightly shorter and placing the strip crown form over the post with a slight labial proclination.³ This ensured adequate bulk of the composite resin material and simultane-

Table 1. Comparison of retention between GFRCR and omega shaped stainless steel wire posts

Type of post	Evaluation period (months)		
	1st	6th	12th
GFRCR	100%	79%	79%
Omega shaped stainless steel wire	100%	72%	54%

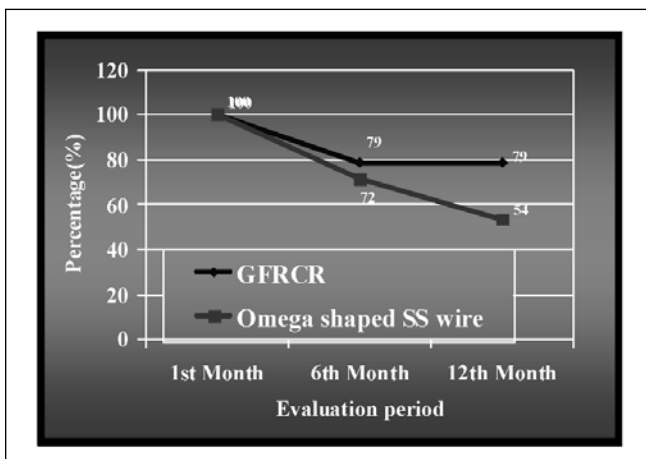
p value= 0.236 (Significant)

ously reduced the occlusal load. This approach was especially adopted in patients treated under general anesthesia, where an immediate post treatment occlusion could not be assessed.

As described by Rifkin in 1983, the posts were introduced into the canals upto the cervical third because a large length may interfere with eruption of the underlying permanent tooth during the final stage of primary root resorption. Also the technique utilizes the coronal portion of the root, which is the strongest part of the root to transmit any functional stresses, and may add to the success.¹

Application of posts to support the strip crowns on badly destroyed primary incisors will increase the surface area of the tooth structure thus enhancing the adhesion. To achieve maximum retention, a flowable composite resin with nano fillers was used to cement the posts. Prior to placement of the GFRCR posts, care was taken to cover the fibers completely with the flowable composite in order to avoid porosity. On activation, the adhesive, flowable composite and fibre post formed a single unit. The GFRCR (everStick, Finland) material used in this study has a unique patented Inter Penetrating Network (IPN) feature, which on light activation, makes the individual glass fibers form a monoblock.

In this study, at the end of one year, the retention of the GFRCR posts was 79% whereas, omega shaped stainless steel wire posts showed a retention of 54%. Partial or complete loss of the coronal restorations was due to trauma and/or biting on hard foods such as carrots and sugar cane.



Graph 1. Comparison of retention between GFRCR and omega shaped stainless steel wire posts

Table 2. Comparison of marginal adaptation between GFRCR and omega shaped stainless steel wire posts

Type of post	Evaluation period (months)		
	1st	6th	12th
GFRCR	100%	79%	79%
Omega shaped stainless steel wire	100%	71%	15%

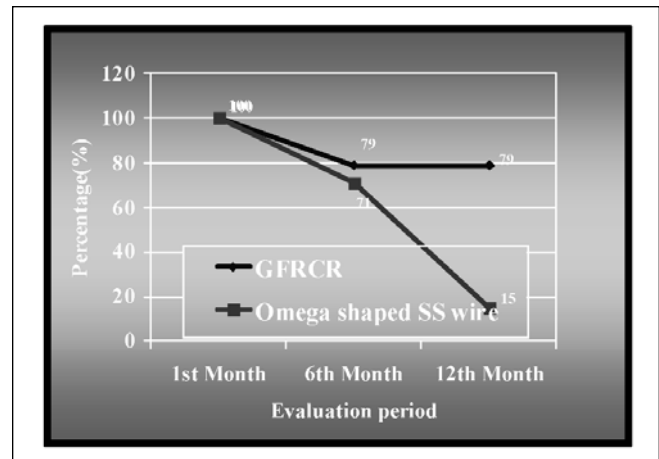
p value= 0.003 (Significant)

The type of failure seen in GFRCR and omega shaped stainless steel wire posts was debonding of the dentin composite interface. This could have been due to failure to use rubber dam and not achieve complete isolation. The GFRCR posts showed a better retention probably because of the homogeneous mechanical and chemical bonding of all components, which serves to reinforce the tooth.

When comparing the marginal adaptation of both posts, GFRCR posts had a better marginal adaptation of 79% whereas; it was only 15% with the omega shaped stainless steel wire posts. Since the fibre core content of the GFRCR material has a Young's modulus of elasticity approximating that of the tooth, there is decreased stress concentration. This could have resulted in better marginal adaptation and increased longevity of the restoration.

In a one-year follow up study, Sharaf found that restorations carried out on grossly broken down primary incisors using fiberglass posts remained intact.³ Laboratory studies have also demonstrated that this technique significantly improved the fracture resistance of teeth.³

Radiographic evaluation after post placement is important to check the level of the post. It should always be at or just apical to the level of the intercrestal bone.³ If the post is placed deep into the radicular pulp space, root fracture might result. Citron described a technique wherein a post occupied the entire length of the root canal.³ However, such posts need close monitoring especially during shedding of primary teeth.



Graph 2. Comparison of marginal adaptation between GFRCR and omega shaped stainless steel wire posts

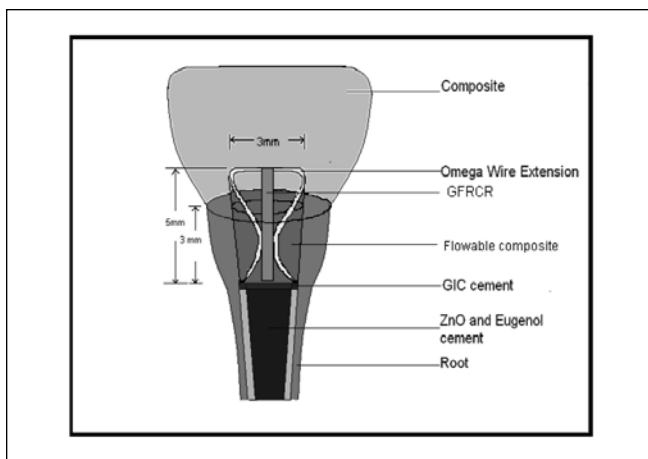


Figure 1. Schematic design of Omega shaped stainless steel wire and GFRCR posts in the root canal (Adapted from the design given by Mortada and King (J Clin Ped Dent;2004)

The use of GFRCR post appears to be an alternative option for reconstruction of extensive damaged primary incisors in view of their ability to reinforce a great volume of resin composite with adequate translucency and relatively easy manipulation. Since the method is technique sensitive it may be necessary to perform the procedure under sedation or general anesthesia considering the young age and cooperative ability of the patient. Periodic clinical and radi-



Figure 2. Radiographic assessment of both the posts immediately after strip crown removal

ographic evaluation is essential together with parent cooperation regarding oral hygiene and dietary habits.⁵

CONCLUSIONS

1. The use of GFRCR as an intracanal post in the restoration of grossly destructed primary maxillary anterior teeth appears to be a valuable clinical procedure.
2. The retention of GFRCR posts was higher (79%) than that of the omega shaped stainless steel wire posts (52%).
3. The marginal adaptation of GFRCR posts was significantly greater than that of omega shaped stainless steel wire posts.

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Figure 3. Restored primary incisors