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Original Research Article

Efficacy of intracanal biological and fiber posts in the rehabilitation of grossly mutilated primary incisors: a clinical study

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ABSTRACT

Background: The aim of this study was to assess the efficacy of conventional fiber posts with biological posts followed by strip crowns in the restoration of grossly mutilated primary anterior teeth.
Methods: A total number of 10 patients with 20 grossly mutilated primary anterior teeth were selected. After pulpectomy, samples were randomly divided into 2 groups, group I and II, post space was prepared in both the groups, followed by placing conventional fiber posts and biological posts in group I and group II respectively. Finally, samples in both the groups were then restored with strip crowns. Patients were recalled for follow up examination at 3, 6 and 9 months intervals by an independent operator who was blinded about the procedure to assess longevity, gingival health, color change of crowns and parents' acceptability of restorations.
Results: After 9 months follow up period 100% of the biological posts survived while only 60% of the conventional fibre posts were able to survive ($p>0.05$). Only 20% of the cases in group I showed mild gingival inflammation around the post while no gingival inflammation was seen in group II. Non - significant results were found on comparing color change of crowns and parents acceptance at 6 months follow up.
Conclusions: Both conventional fiber post & biological proved to be clinically successful in terms of their survival, gingival health, parents' acceptability and color stability of crowns. Biological restorations proved to be a viable alternative for the restoration of grossly mutilated primary anterior in terms of longevity, gingival health, parents' acceptability and color change of crown.

Keywords: Biological restoration, Dental caries, Rehabilitation, Tooth bank, Intracanal post

INTRODUCTION

A healthy oral cavity is a vital prerequisite for an attractive phase. Regardless of the various ways of prevention, caries is one of the most prevalent chronic diseases of people worldwide and individuals are susceptible to this disease throughout their lifetime.[1] Early childhood caries is an infectious disease of the primary dentition and if not treated at the initial stage, can lead to severe damage not only to the primary dentition but also adversely affect their successors.[2-3] The structural loss of primary anterior teeth leads to poor aesthetics, poor phonetics, compromised mastication along with difficulty in social adjustments. Therefore, aesthetic and functional rehabilitation of the decayed primary teeth is of major concern and should always be the prime treatment objective.[4] In grossly carious teeth, since the remaining tooth structure is very less, it cannot bear the occlusal forces without any support, so to preserve and restore grossly decayed tooth, there is a need to use an intracanal post following endodontic treatment & before placement of full coverage restoration for better retention and long lasting results.[5]

The intracanal posts in primary teeth should shed in a timely manner to allow unimpeded eruption of their permanent successors in normal undeflected position. The ideal post material should exhibit the modulus of elasticity, compressive strength, thermal expansion, and aesthetics similar to that of dentin. It should also bond predictably to root dentin.[6] A number of methods have been used for intracanal reinforcement for primary anterior teeth, namely composite posts, wire posts (omega loop), Ni-Cr coil spring posts, glass fiber posts, polyethylene fiber post/ribbond and metal screw post etc.[7] Biological posts or dentinal post made from human extracted tooth provide better resilience as compared to artificial posts. They also provide good bonding to the tooth structure by composite resin and seems to be feasible option for improving the strength of the root canal as these reduce stress on to the radicular dentin, at the same time preserve the internal dentin walls and adapt to the canal configuration. Biological posts also act as a shock absorber and get resorbed with time under normal conditions.[8,9] The aim of this study was to assess the efficacy of conventional fiber posts with biological posts followed by strip crowns in the restoration of grossly mutilated primary anterior teeth.

METHODS

The present study was conducted in the department of pediatric and preventive dentistry, Subharti dental college and hospital, Meerut. Informed consent was taken from parents/guardians of the children participating in the study. Considering a two group study with a normally distributed outcome, with a single baseline and single post randomisation assessment of outcomes, sample size was calculated using ANOVA model for the number of subjects per group ANOVA (assuming equal sample sizes and equal standard deviation, at baseline and post randomisation per group). Twenty primary anterior teeth from 10 children aged 3-5 years with less than half crown structure remaining but more than 2/3rd of the root length were randomly selected from the out patient department of pediatric and preventive dentistry at Subharti Dental College and Hospital, Meerut called as samples. The teeth with excessive pathologic root resorption involving more than one-third of the root or radiographically visible internal root resorption were not included.

Pulpectomy was performed in all the grossly mutilated primary anterior teeth and at subsequent appointment, post space was prepared using Hedstrom files by removing coronal 1/3rd of the obturating material from the root canal. Then cleaning of the prepared space was done with saline, dried with paper points and coronal 1/3rd portion was etched with 37% phosphoric acid for 15 seconds. Bonding agent was brushed on the etched surface and air blowing was done using chip blower to evenly spread the bonding agent and light cured for 20 sec. The teeth were then randomly divided into group I (conventional fiber post) and group II (biological post) each comprising 10 teeth.

Group I

The material selected for this group was conventional fiber post (Ribbond). Post space was measured and then double the length of post space, fiber reinforced post and core material (ribbond) was taken and folded in equal proportion to provide adequate strength to the post. Then, the prepared post was etched for 15 seconds and was brushed with bonding agent and light cured for 20 seconds. The ribbond fiber post was placed in the canal and cemented using dual cure resin cement (Relyx U200 3M ESPE, Germany) (Figure 1).

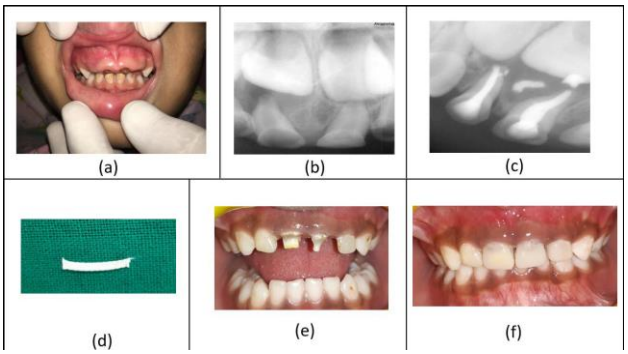

Figure 1: Conventional fibre post as a post and core: (a) preoperative picture; (b) preoperative radiograph; (c) pulpectomy performed w.r.t 61; (d) fibre post preparation; (e) fibre post cementation w.r.t 51; (f) post-operative strip crown restoration w.r.t 61.

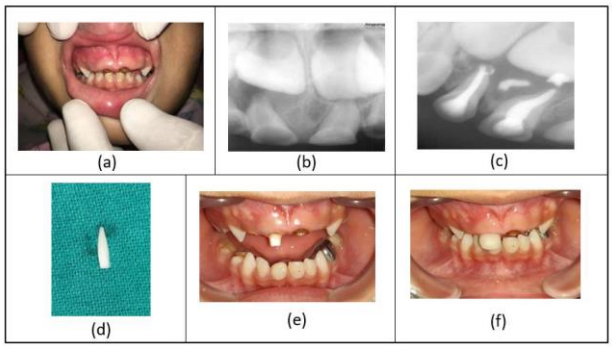

Figure 2: Biological restoration as a post and core: (a) preoperative picture; (b) preoperative radiograph; (c) pulpectomy performed w.r.t 51; (d) biological post preparation; (e) biological post cementation w.r.t 51; (f) post-operative strip crown restoration w.r.t 51.

Group II

Biological post was selected for this group. The biological post was prepared from extracted human teeth (biological restorations) stored in the Tooth Bank after following preparation. Teeth were scaled, polished, and freed of soft tissues and periodontal remnants. Disinfection of the collected teeth was done by keeping it them in 10% formalin solution for 1 week.[10] The pulp tissue was extirpated from the canals and root canal irrigation was

done with 2.5% NaOCI, and saline. Then canal were dried with paper points and crown portion of the selected extracted teeth was separated from the root using a diamond disk. The prepared teeth to be used as biological post were then stored in freezer until used. The root was then reshaped into a post according to the prepared post space utilizing crown preparation kit. After evaluating the proper fit and adjustment, biological post and coronal 1/3rd portion of the canal was conditioned by 37% phosphoric acid for 15 seconds. The bonding agent was brushed on the etched surface, uniformly dispersed & cured for 20 sec. Then biological post was placed in the canal and cemented using dual ™ cure resin cement (Relyx U200 3M ESPE, Germany). After the post cementation in both the groups full coverage restorative was given using strip crowns. Patients were recalled for follow up examination at 3, 6 and 9 months intervals by an independent operator who was blinded about the procedure to assess longevity, gingival health, color change of crowns and parents' acceptability of restorations. The data collected were statistically analysed using SPSS v20 software (Figure 2).

RESULTS

The intergroup comparison of longevity of the posts amongst the two groups at different time interval (3, 6 and 9 months) (Table 1). Score 0 and 1 were considered successful while score 2 and 3 were considered to be failure in terms of survival time. At 9 month follow up interval, 3 out of 10 posts in group I showed no apparent mobility while 3 post showed perceptible mobility of <1 mm in buccolingual direction (score 1) but 4 posts developed mobility of >1 mm but <2 mm (score 2). In group II, 9 out of 10 posts showed no apparent mobility (score 0) except 1 post which showed perceptible mobility of <1 mm in buccolingual direction (score 1). However, on intergroup comparison there was no statistically significant difference between groups I and II at 3, 6 and 9 months time interval in terms of longevity (p>0.05).

Table 1: Intergroup comparison of longevity of posts at different time intervals.

Mobility index		3 months		6 months		9 months	
		Group I	Group II	Group I	Group II	Group I	Group II
Score 0	N	9	10	8	10	3	9
	%	90.0	100	80.0	100	30.0	90.0
Score 1	N	1	0	2	0	3	1
	%	10.0	00.0	20.0	00.0	30.0	10.0
Score 2	N	0	0	0	0	4	0
	%	00.0	00.0	00.0	00.0	40.0	00.0
Score 3	N	0	0	0	0	0	0
	%	00.0	00.0	00.0	00.0	00.0	00.0
Total	N	10	10	10	10	10	10
	%	100	100	100	100	100	100
Mean		0.10±0.32	0.00	0.20±0.42	0.00	1.10±0.88	0.90±0.32
P value		0.739		0.481		0.579	

Table 2: Intergroup comparison of gingival health at different time intervals.

Gingival index		3 months		6 months		9 months	
		Group I	Group II	Group I	Group II	Group I	Group II
Score 0	N	10	10	8	10	8	10
	%	100	100	80.0	100	80.0	100
Score 1	N	0	0	2	0	2	0
	%	00.0	00.0	20.0	00.0	20.0	00.0
Score 2	N	0	0	0	0	0	0
	%	00.0	00.0	00.0	00.0	00.0	00.0
Score 3	N	0	0	0	0	0	0
	%	00.0	00.0	00.0	00.0	00.0	00.0
Total	N	10	10	10	10	10	10
	%	100	100	100	100	100	100
Mean		0.10±0.32	0.00	0.00	0.20±0.42	0.00	0.20±0.42
P value		0.739		1.000		0.481	

Intergroup comparison of gingival health between the two groups at different time intervals (1, 3 and 6 months) is shown in (Table 2). At 3 month follow up, all the 10 posts in both the groups showed normal gingiva (score 0) whereas after 6th and 9th months, mild gingival inflammation was seen around 2 posts of group I (score 1)

while normal gingiva was seen around all the 10 posts in group II at 6th and 9th month follow up interval. No significant difference in gingival health was found between group I and group II at 3, 6 and 9 months follow up ($p>0.05$). When comparison for parents' acceptance was done between the two groups, highly significant results were found in both the groups at 3 and 6 months follow up while statistically non- significant results were seen at 9 months follow up. On intergroup comparison, statistically non-significant difference was found between Group I (conventional fiber post) and Group II (biological post) (Table 3). Comparing change in color of crown between group I and group II, it was observed that after 3rd and 6th month follow up, all the 10 samples in group I showed no discoloration while only 1 sample in group II showed slight discoloration (A1 to A2, within the perceptible limits). After 9 months, 3 samples showed slight discoloration in group I while in group II, 4 samples showed slight discoloration. However statistically non-significant differences were observed at 3, 6 and 9 month intervals (Table 4).

DISCUSSION

Clinically, the application of both conventional fiber post and biological post to rehabilitate grossly mutilated primary anterior teeth is a beneficial clinical treatment option as shown in this study. When the longevity/ survival time of the post for Group I (conventional fiber post) and Group II (biological post) was evaluated it was found 4 out of 10 posts of group I developed mobility of >1 mm but <2 mm (score 2) at 9 months follow up (60% success) which was considered as failure (mobility of >1 mm but <2 mm in labio lingual direction) while all the 10 samples in group II were considered to be successful as none of them showed mobility >1 mm. (100% success).

Table 3: Intergroup comparison of parents acceptance of posts at different time intervals.

Parents satisfaction		3 months		6 months		9 months	
		Group I	Group II	Group I	Group II	Group I	Group II
Score 1	N	0	0	0	0	0	0
	%	00.0	00.0	00.0	00.0	00.0	00.0
Score 2	N	0	0	0	0	0	0
	%	00.0	00.0	00.0	00.0	00.0	00.0
Score 3	N	0	0	0	0	3	0
	%	00.0	00.0	00.0	00.0	30.0	00.0
Score 4	N	7	0	9	0	3	7
	%	70.0	00.0	90.0	00.0	30.0	70.0
Score 5	N	3	10	1	10	4	3
	%	30	100	10.0	100	40	30.0
Total	N	10	10	10	10	10	10
	%	100	100	100	100	100	100
Mean		0.10±0.32	4.30±0.48	5.00±0.0	4.10±0.32	5.00±0.00	4.10±0.88
P value		0.739		0.007		0.001	

Table 4: Intergroup comparison of color change of crowns at different time intervals.

Parents satisfaction		3 months		6 months		9 months	
		Group I	Group II	Group I	Group II	Group I	Group II
Score 0	N	10	9	10	10	7	6
	%	100	90.0	100	100	70.0	60.0
Score 1	N	0	1	0	0	3	4
	%	00.0	10.0	00.0	00.0	30.0	40.0
Score 2	N	0	0	0	0	0	0
	%	00.0	00.0	00.0	00.0	00.0	00.0
Score 3	N	0	0	0	0	0	0
	%	00.0	00.0	00.0	00.0	00.0	00.0
Score 4	N	0	0	0	0	0	0
	%	00.0	00.0	00.0	00.0	00.0	00.0
Total	N	10	10	10	10	10	10
	%	100	100	100	100	100	100
Mean		0.10±0.32	0.00	0.00	0.00	0.00	0.30±0.48
P value		0.739		0.007		0.001	

On comparison of longevity/survival time of the posts in different time intervals, highly significant results were found in both the groups at 3, 6 and 9 months follow up interval. However, on intergroup comparison there was no statistically significant difference between groups I and II at 3, 6 and 9 months time interval in terms of longevity

(p>0.05). The cause of mobility of all the posts in both the groups remained same i.e debonding of the post due to loss of cement. The reason for the failure of post was similar to a systematic review by Amarnath et al which stated that the most common reason for the failure of the post was debonding of the post due to loss of cement. [11] Mehra et al stated that the reason for least retention of polyethylene post was resin polymerization contraction, enhancing microleakage leading to possible fractures.[12] There could also be some local factors such as trauma, dietary habits which were responsible for the low retention rate. Gingival health remained the same for 1st month follow-up for both the groups. In Group I (conventional fiber post), the mild inflammation was seen around the gingiva during at 6 and 9 months interval (mean=0.20). In Group II (biological post) all the 10 posts showed normal gingiva (score 0) at 6th and 9th month follow up interval. Statistically non significant results were found in both the groups at 3, 6 and 9 months interval. On intergroup comparison for gingival health at 3, 6 and 9 months statistically non-significant differences were observed between both the Groups. Higher gingival index score for Group I (conventional fiber post) was seen when compared to Group II (biological post). However, group I showed mild gingival inflammation around the gingiva over the period of 9 months due to significant increase in plaque formation.[13] The findings of the present study emphasize the importance of maintaining new oral hygiene and plaque control in group I cases. Hence, biological post was more effective in terms of gingival health as compared to conventional fiber post. Also, in the present study parent satisfaction was assessed in both the groups using Likert 5-point scale as parent acceptability is now considered a key part to the improved health care quality. On comparison at different time intervals, highly significant results were found in both the groups at 3 and 6 months follow up while statistically non- significant results were seen at 9 months follow up. On intergroup comparison, statistically non -significant difference was found between Group I (conventional fiber post) and Group II (biological post). Parents of Group II were more satisfied because of the fact that biological post are natural dentinal post and mimic the natural property of the tooth. Glendor et al and Busato et al in their study found that the allogeneic technique of biological restoration was preferred among the clinicians since it restored the function and esthetics of the teeth with much ease, convenience and speed due to the use of part of the biological restorations.[14,15] Thus the use of preserved extracted teeth, also called biological restoration is considered a viable alternative for the rehabilitation of the dental ailments.[15] When comparing change in color of crowns between the two groups, slight discoloration (within the perceptible limits) was seen in both the groups. Statistically significant differences were found between group I and group II after 3 and 6 month follow up (p<0.05). However, no significant difference was found in color change after 9 month follow up (p>0.05). The discoloration in composite restoration can be attributed to the fact that it caused formation of colored degradation products, changes in surface morphology because of wear and by extrinsic staining. Mehra et al stated the reasons for crown staining as plaque accumulation or due to extrinsic factors such as green stains due to chromogenic bacteria or yellow stains due to bile pigments from gingival crevicular fluid.

CONCLUSION

Both the posts proved to be clinically successful in terms of their survival, gingival health, parents' acceptability and color stability of crowns. In terms of gingival health, mild gingivitis was seen only in 20% of cases in conventional fiber post at till 9 months follow up, while no gingival inflammation was seen in biological post. Though the difference was statistically non - significant, the gingival health was found superior in Group II as compared to Group I. With regard to survival rate, 40 % of cases of Group I failed at 6 months whereas all the cases in group II survived till 9 months follow up. Crowns restored with biological posts showed better parental acceptance as compared to the teeth restored with fiber posts. Color change of restored crowns was seen in more number of cases restored with biological posts than fiber posts, however the color change after 9 months was within the acceptable limits and the difference was found to be non- significant statistically. Thus to conclude, biological restorations proved to be a viable alternative for the restoration of grossly mutilated primary anterior in terms of longevity, gingival health, parents' acceptability and color change of crown. However, further studies are needed to be conducted with a larger sample size and with long term follow up to evaluate the clinical efficacy of biological post in pediatric dental practice.

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