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COMPARATIVE EVALUATION OF RETENTIVE STRENGTHS OF THREE PREFABRICATED POST SYSTEMS: I-POST, PARAPOST, FIBER POST

Dr. Lalitagauri Mandke	BDS, MDS, Professor, Department of Conservative Dentistry and Endodontics, D Y Patil University School of Dentistry, Nerul, Navi Mumbai, Maharashtra, India.
Dr. Sumita Bhagwat	BDS, MDS, Professor, Department of Conservative Dentistry and Endodontics, D Y Patil University School of Dentistry, Nerul, Navi Mumbai, Maharashtra, India.
Dr. Rashmi Mishra	BDS, MDS, Professor, Department of Conservative Dentistry and Endodontics, D Y Patil University School of Dentistry, Nerul, Navi Mumbai, Maharashtra, India.
Dr. Avantika Pawar*	BDS, Post Graduate Student, Department of Conservative Dentistry and Endodontics, D Y Patil University School of Dentistry, Nerul, Navi Mumbai, Maharashtra, India. *Corresponding Author
Dr. Tanushree Punamiya	Private Practitioner
Dr. Aranya Ray	BDS, Post Graduate Student, Department of Conservative Dentistry and Endodontics, D Y Patil University School of Dentistry, Nerul, Navi Mumbai, Maharashtra, India.

ABSTRACT **Aim-** This in vitro study was conducted to compare the retentive strengths of three different prefabricated post systems: Quartz Fiber Post, Para Post, and I Post—a newly introduced system with a unique coronal flare design. **Method-** Forty-five freshly extracted single-rooted mandibular premolars were endodontically treated, decoronated 2 mm above the CEJ, and standardized post spaces of 9 mm were prepared. The specimens were divided into three groups (n=15 per group), and each group was restored using one of the three posts, cemented with dual-cure resin cement . A universal testing machine applied a tensile load along the long axis until post dislodgement, and the retention force was recorded in Newtons. **Statistical Analysis-** Using one-way ANOVA and Scheffe's post hoc test showed that I Posts had significantly higher retention (mean = 281.17 N) compared to Fiber Posts (225.66 N) and Para Posts (199.32 N), with $p < 0.05$. **Conclusion-** I Posts exhibit superior retentive properties than Parapost and Fiber post and may offer enhanced long-term clinical performance.

KEYWORDS : Prefabricated posts, retentive strength, post design

INTRODUCTION

Post endodontic restorations play a vital role in restoring structural integrity, function, and aesthetics in teeth that have undergone root canal treatment, especially when there is significant loss of coronal tooth structure due to caries or trauma.

Various post and core restorations have been advocated varying from custom made, cast metal to prefabricated metal and nonmetal, aesthetic and bonded posts each having their own merits and demerits.[1] Prefabricated posts are of various designs but may not conform to the shape of the canal. Custom made posts conform to the shape of the root canal however they require longer clinical time and also involve an intermediate laboratory stage for its fabrication which makes the whole process costly and time consuming. In comparison, prefabricated posts can be completed in a single visit, and is easier and cheaper for the patient. As the adaptation of the prefabricated posts may not conform as accurately as custom made posts, understanding the biomechanical factors such as design of the post that affect the ability of the post to fit more accurately with minimum movement and least thickness of cement is very important.

Studies have shown that most failures that occurred in endodontically treated teeth are due to post dislodgement. Therefore the retention of post can be critical for the long-term success of the restoration.[2]Post retention refers to the ability of a post to resist vertical dislodging forces. Retention is influenced by the post length, diameter and taper, the luting cement used and whether a post is active or passive.[3]

Hence we conducted a study comparing the retentive strengths of the three prefabricated posts systems with differing post designs. PARAPOST (Coltene, Whaledent) is a stainless steel cylindrical prefabricated post system. Quartz Fiber Post (Coltene, Whaledent) is a tapered post

I post (Integrated Endodontics, India) is a post system with a unique design. It is a prefabricated metallic post of passive and parallel design, which has a coronal flare. This coronal flare of the post can compensate the anatomical coronal flare of the root canal i.e it fits well in the coronal third.

Though there are many studies for post retention, there is limited literature on I posts. Hence the aim of this study was to compare retentive strengths of three prefabricated post systems, viz. Parapost, Fiber post and I post.

METHOD:

Forty-five single-rooted freshly extracted mandibular lower premolars were selected and stored in physiologic saline solution at room temperature

The teeth were sectioned horizontally 2mm above the cementoenamel junction at 90^0 to the long axis of the root with a diamond disc under water spray. The access cavity was prepared with airotor, working length was established 0.5 mm short of the apex, the root canals were prepared with the hybrid method with Hand ProTaper files. 5% sodium hypochlorite solution and saline were used intermittently. All canals were obturated by lateral compaction technique using Protaper gutta percha cones and AH plus sealer. The specimens were individually mounted vertically in self-cure acrylic resin blocks at the level of CEJ.

The samples were divided into 3 groups of 15 teeth each and restored with the following posts:

Group I: Fiber posts.
Group II: Para posts.
Group III: I posts.

Post Space Preparation:

The most similar sizes available among the posts system was chosen in this study. The post space of 9mm depth was prepared and standardized for all the teeth. Specific post drills provided by the manufacturer was used for the preparation of the post space for the Para posts. Post space preparation of the fiber posts and the I posts was prepared using Peeso drills no 2 and 3. All the posts space preparations were done with a slow speed handpiece and under full water irrigation.

Post Cementation:

Same cementation protocol was followed for all the three posts groups. Before cementation, post spaces of teeth were cleaned with 1ml of 95%

ethyl alcohol to remove any residual contaminants from the sealer, then rinsed with normal saline and dried with paper points. The posts were disinfected with alcohol and dried. All posts were first tried inside the canals to the full prepared length, then cementation was carried out using dual cure resin cement (Para core). One drop of 37% phosphoric acid gel was applied to post spaces for 15 seconds then thoroughly rinsed with water for 30 seconds, dried with paper point and air blower. The bonding agent was then applied homogenously on dentin on post spaces as well as on the surface of the posts and allowed to set for 60 seconds then carefully dried with a faint air jet. The dual cure resin cement was then dispensed into the prepared canal and the posts were seated upto the desired length. The light-curing device was applied at the coronal margins to initiate curing mechanism of the adhesive resin cement.

Post Retention Test:

The tensile force required to dislodge the posts from their channels were measured by a universal testing machine. The acrylic holder allowed the teeth to be held firmly during retention testing. A constantly increasing vertical uniaxial tensile force was applied parallel to the long axis of the post at a cross head speed of 3mm / min until the post was displaced from the root canal. The force required to dislodge each cemented post from the canal along its longitudinal axis was recorded in Newtons to show the amount of retention.

The collected data were analyzed using ANOVA and SCHEFFE'S multiple comparison test at P<0.05 level of significance.

Results And Statistical Analyses:

Table. 1 Descriptive Statistics:

	N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
Fiber Post	15	225.6613	33.56956	8.66762	181.66	274.34
Para Post	15	199.3280	30.00130	7.74630	155.11	255.65
I Post	15	281.1740	51.96580	13.41751	193.86	341.11
Total	45	235.3878	51.90758	7.73793	155.11	341.11

Table. 2 One-Way Anova:

	Sum of Squares	df	Mean Square	F	p-value
Between Groups	52369.342	2	26184.671	16.617	4.826E-6
Within Groups	66184.126	42	1575.813		
Total	118553.468	44			

P< 0.05

Table. 3 Scheffe's Test:

Dependent Variable: Retention Force					
	(I) Groups	(J) Groups	Mean Difference (I-J)	Std. Error	Sig.
Scheffe	Fiber Post	Para Post	26.33333	14.49511	.204
		I Post	-55.51267*	14.49511	.002
	Para Post	Fiber Post	-26.33333	14.49511	.204
		I Post	-81.84600*	14.49511	.000
	I Post	Fiber Post	55.51267*	14.49511	.002
		Para Post	81.84600*	14.49511	.000
*. The mean difference is significant at the 0.05 level.					

Results indicated that the mean retentive strengths of Fiber post, Parapost and I post were 225 + 33.57, 199.32 + 30.00, and 281.17 + 51.96 respectively (Table 1). Hence I post showed superior retentive properties as compared to the other two post systems i.e. Parapost and Fiber post.

Statistical analysis was performed with ANOVA test (P< 0.05) which proved the superior retention with a significant difference between the means of Fiber post, Parapost and I post.(Table 2)

SHEFFE'S multiple comparison test was used for comparison between two groups.(P< 0.05). There was no significant difference between Means of Fiber post and Para post. However there was significant difference between Means of Fiber post and I post, as well as between Means of Para post and I post. (Table 3)

DISCUSSION:

Reinforcement of structurally weakened endodontically treated teeth can be successfully managed with posts. The decision as to what post system to use should be based on both mechanical and esthetic needs of the tooth to be restored. No single post system is ideal for all conditions.[4]

Results of our study indicated that I post showed superior retention strength, followed by Fiberpost, followed by Parapost. All 3 posts used in this study had differing post designs.

PARAPOST (Manufactured by Coltene, Whaledent) is a stainless steel passive cemented, parallel-sided post with flat head for direct post-core buildup using one appointment.[5]

In the current study Parapost showed the least retentive strength in comparison to the other 2 post systems i.e. Fiber post and I post.

A similar study carried by Cohen (1998) showed that Para post was the least retentive as compared to Flexi-post and Accesspost.[6]

Fiber post was introduced in the year 1990 by Duret. They can be considered as composite restorative materials and can be of different types like carbon, glass/ silica and quartz. In the current study quartz fiber posts were used.[7]

According to the retrospective study carried out by Ferrari M, Vichi A et al (2000) on the clinical performance of fiber posts revealed 3.2 % failure rate due to debonding of the fiber posts during removal of temporary restorations.[8]A study carried by Millstein P, Oleary J et al concluded that metal posts were significantly more retentive than fiber posts.[9]

I Post is a prefabricated passive parallel, serrated stainless steel metal post. It offers a variety of advantages: it is user friendly, the post does not need a separate drill, the posts match with Peeso reamer #2, #3, #4 and #5. Also it has the ability to compensate the natural coronal flare of the canal because of its inbuilt coronal flare design. This anatomical coronal flare, if not compensated, due to masticatory load, cement around the post will break down, leading to loosening of the post and ultimately failure of the treatment. Metal posts, which compensate the anatomical coronal flare, offer excellent and long-term retention to coronal filling.

All these qualities make I post superior and more retentive as compared to the other two post systems i.e. Fiber post and Para post. Studies carried out by Leary JM, Aquilino SA et al reported that a well adapted, passively luted parallel-sided posts provided superior retention with the least stress when compared with tapered posts.[10,11,12]

There is limited literature on I post, so there have been no comparative studies on this topic. Ours was an in vitro study, so we could not exactly replicate the clinical scenario. Hence further clinical studies and research, with a larger sample size needs to be carried out on this particular post system to substantiate these results.

CONCLUSIONS

Of the three posts, I post showed maximum retentive properties, followed by Quartz fibre post. Para Post was the least retentive of all the prefabricated post groups used in this study.

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