Original Article

Retention of custom cast and parallel sided serrated posts as influenced by cementing media: An *in vitro* comparison

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Post and core restoration is one the most common treatment modalities applied when the remaining coronal tooth structure is not sufficient to provide the necessary resistance and retention form for the restoration. The primary purpose of a post is to provide retention for the core and that the post itself should be highly retentive. The design, surface configuration and cementing media play a pivotal role in the retention of the post. This study was undertaken to evaluate the influence of design of the post and cementing media on the retention of the post. The retentive qualities of two post designs namely, parallel-sided serrated and custom cast posts and three cementing media namely, zinc phosphate, reinforced glass Ionomer and dual cure resin bonded cement were comparatively evaluated using student's unpaired '*t*' test and analysis of Variance (ANOVA). Results of the study showed that the parallel-sided serrated posts were significantly more retentive than custom cast posts. The influence of the type of cementing medium on the retention of the cast posts was not significant. However, the cementing medium had a significant role to play in the retention of the parallel-sided serrated posts, the resin bonded (dual cure) cement being the most retentive, while the zinc phosphate cement was the least retentive.

Key words: Custom cast post, parallel-serrated post, post and core restoration

The overwhelming success of the endodontic therapy has made it possible to salvage more teeth than ever before in the history of dentistry. Teeth that would otherwise be lost are saved and restored to form, function and appearance.

However, following endodontic therapy, the dentist is faced with the dilemma of deciding how to restore these teeth for use as individual units or as abutments for fixed or removable prostheses in a predictable long-term manner.

Various authors have advocated the placement of a post and core restoration when one half or more of the coronal tooth structure is missing.[1-4] The primary objective of the post and core restoration in such a situation is to replace the missing coronal tooth structure sufficiently to provide the necessary resistance and the retention form for the final restoration[5] The clinical and laboratory data are indicative of the fact that the loosening of the post is the most common cause of post and core failure.[6-8] It therefore becomes indisputable that retention of the post is an important factor for the success of the restoration.

The design of the post and cementing medium plays a pivotal role in enhancing the retention of post.[9-14] It is apparent that there is a continuous need for evaluation of various post systems and plethora of materials to make a studied decision in the clinical context. This study was therefore designed to evaluate the influence of design of the post and cementing media on the retention of the post.

MATERIALS AND METHODS

This study was conducted at the Bharati Vidyapeeth Deemed University Dental College and Hospital, Department of Prosthodontics. The testing of the samples was carried out at metallurgical services, Ghatkopar, Mumbai.

About Sixty intact mandibular single rooted premolars free from caries, restoration or cracks were selected for this study. Each tooth was sectioned with a diamond point using a high-speed hand piece (NSK) and copious water irrigation, approximately 1 mm coronal to CEJ.

The biomechanical preparation was accomplished with the *Profile Rotary Endodontic file system.*

Obturation was done using a lateral condensation method along with a non-euginol based root canal sealer (AH-26). The post canal space for each of the 60 obturated premolars was prepared using Peizoreamers no. 1-3. The post canal space was enlarged to the final size using the No. 4 Peizoreamer. The length of the post canal space was standardized at 9 mm.

At this stage, the 60 teeth were randomly divided into six groups:

Group I: Custom cast posts cemented with zinc phosphate cement.
Group II: Custom cast posts cemented with reinforced glass ionomer cement.
Group III: Custom cast posts cemented with resin-bonded cement.
Group IV: Effective groove (EG) parallel sided post cemented with zinc phosphate cement.
Group V: EG parallel sided post cemented with reinforced glass Ionomer cement.
Group VI: EG parallel sided post cemented with resin-bonded cement.

Patterns for the cast posts were fabricated in Schyuler S U summer inlay casting wax using a direct technique. The patterns were cast using a standardized procedure. 10 cast posts each for Groups I-III were fabricated.

The posts in each of the six groups were cemented using the respective cements - Zinc phosphate cement, reinforced glass Ionomer cement and resin-bonded cements.

The cements were mixed using the manufacturer's instructions. During the cementation of the posts, initially the canal was coated with the respective cements using a No. 30 lentulospiral and the remaining mix was coated on to the post. This was done to minimize incorporation of air voids within the cement layer as the post was placed into the post space.

Each tooth was then mounted into plastic cylindrical tubes using Autopolymerising acrylic resin with the help of the Ney's surveyor.

The force required to dislodge the posts was determined with a universal testing machine (Instron 5586). The greatest amount of force that was required to debond the post was detected by the universal testing machine (Instron 5586). At this point the testing was interrupted.

Table 1: Tensile force (in kilograms) required to dislodge cast posts and parallel sided serrated posts cemented with three different cements

No.	Group I	Group II	Group III	Group IV	Group V	Group VI
1	49.5	33.1	30.3	51.4	68.9	63.7
2	27.5	47.8	37.0	63.9	61.8	72.3
3	45.0	42.8	69.0	41.3	57.3	97.0
4	30.7	43.1	55.0	41.9	60.3	66.3
5	30.4	47.3	30.9	72.8	61.3	97.0
6	26.3	34.4	41.1	48.8	60.9	63.8
7	57.9	41.0	67.0	62.0	68.3	91.0
8	26.9	58.4	52.7	52.0	55.6	91.3
9	30.0	38.0	50.3	57.9	66.3	69.8
10	53.3	46.0	58.0	55.6	60.2	89.5

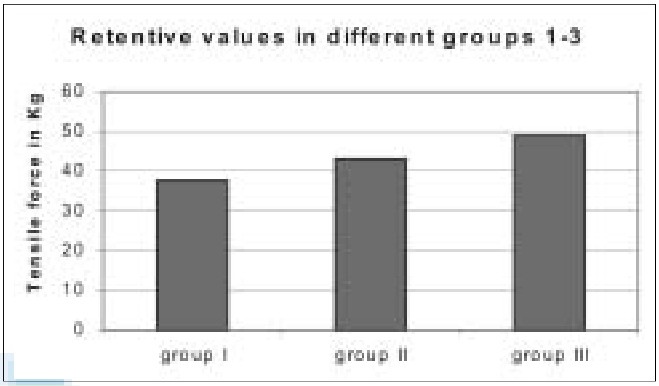

Figure 1: The mean tensile force (in Kg) required to dislodge cast posts cemented with three different cements

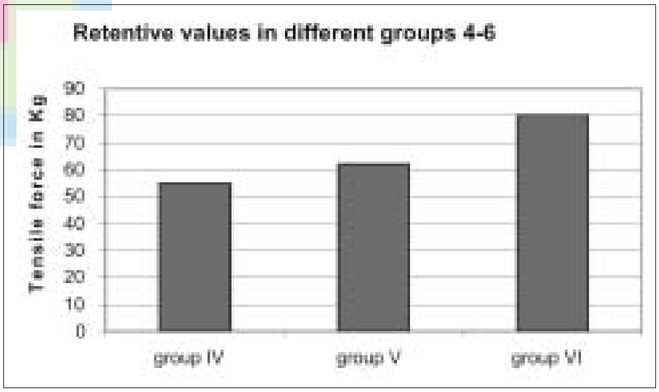

Figure 2: The mean tensile force (in Kg) required to dislodge parallel-sided serrated posts cemented with 3 different cements

RESULTS

The values obtained for the tensile force required to loosen the posts within different groups [Table 1, Figures 1 and 2] were subjected to unpaired '*t*' test and the analysis of variance test.

The unpaired '*t*' test revealed that the retentive values obtained for the parallel-sided serrated posts were significantly greater than those obtained for cast posts. Hence it is concluded that the post-design and surface configuration has a significant influence on the retentive strengths of the posts. The one-way ANOVA test revealed no statistically significant difference in the retentive values of the cast posts cemented with zinc phosphate, glass ionomer cement or resin bonded cements.

However, the difference in the retentive values of parallel sided serrated posts cemented with zinc phosphate, glass ionomer cement or resin bonded cements was statistically significant.

DISCUSSION

In this study, tensile force was applied to the posts to determine their retention. In view of Charlton's recommendation, effort was made to ensure that the tensile strength tests are carried out along the long axis of the post. The use of tensile force in this study gives a good estimate of the retention that these posts provide clinically.

The cast post systems are custom fitted to the configuration of the root and are adaptable to large, irregularly shaped canals.[1,11] In most instances the result is a tapering post within a tapering root. With these systems, it is difficult to achieve parallel sided posts, which results in decreased retention.[11]

A parallel-sided serrated post is the most retentive with the least stress [6,15-18]

EG post is of parallel-sided serrated design. In this study the parallel-sided serrated posts recorded significantly higher retentive values than custom cast posts.

All posts, to a greater or lesser extent, gain their final retention by cementation into the prepared root canal.[3,9] Several studies have shown no correlation between dowel retention and type of luting agent when conventional cements with different posts were used. However, in other studies in which resin-based cements were used, a significant increase in dowel retention was shown compared with con-ventional cements.[10,11]

In this study the parallel-sided serrated posts cemented with resin bonded cement (Group VI) recorded the highest retentive values, followed by those cemented with reinforced glass ionomer cement (Group V). The parallel-sided serrated posts cemented with zinc phosphate cement (Group IV) recorded the least retentive values.

However, with custom cast posts, there was no significant difference in the retentive values provided by the three cements. This could be explained by the reduction of the film thickness of the cement due to excellent adaptation of custom fitted cast posts to the canal walls. A reduced film thickness probably diminishes the influence of the type of cementing medium on the retention of the post.

CONCLUSION

Subject to the conditions of the present study, the following conclusions were drawn:

When the mean retentive values were compared between the custom cast posts (Groups I-III) and parallel-sided serrated posts (Groups IV-VI), the difference was statistically significant ($P<0.01$). The parallel-sided serrated posts recorded significantly higher retentive values than custom cast posts.

When the mean retentive values were compared between the custom cast posts cemented with zinc phosphate cement (Group I), reinforced glass ionomer cement (Group II) and resin bonded cement (Group III), the difference was not statistically significant ($P>0.05$).

When the mean retentive values were compared between the parallel-sided serrated posts cemented with zinc phosphate cement (Group IV), reinforced glass Ionomer cement (Group V) and resin bonded cement (Group VI), the difference was highly significant ($P<0.001$). The parallel-sided serrated posts cemented with resin bonded cement (Group VI) recorded the highest retentive values, followed by those cemented with reinforced glass ionomer cement (Group V). The parallel-sided serrated posts cemented with zinc phosphate cement (Group IV) recorded the least retentive values.

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Source of Support: Nil, **Conflict of Interest:** None declared.