A comparison of the retention of tooth-colored posts

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Objective: The aim of this in vitro study was to compare the retention of five different esthetic post systems of similar dimensions in extracted teeth using titanium posts as controls. Method and materials: Sixty recently extracted single-rooted, caries-free teeth were sectioned horizontally and mounted in acrylic resin. The samples were randomly allocated into six groups of 10 for post preparation. Post space preparation was carried out according to the individual manufacturer’s instructions. All posts were bonded using Panavia F. A 4-mm hollow, metal sleeve was luted over the free end of each post prior to mounting in a universal testing machine, and the forces required to dislodge the posts using a cross-head speed of 5 mm/min were recorded. Results: It was found that the parallel-sided Lightposts were significantly more retentive than all of the other posts. Parapost Fibrewhite posts were more retentive than tapered Lightposts and Snowposts. There was no significant difference between the retention of stainless steel Paraposts and any of the other groups. Conclusions: Serrated parallel-sided stainless steel posts were no more retentive than either parallel-sided or tapered tooth-colored posts in this study. When all groups were considered, post dimension appeared to influence retention, with parallel-sided posts being more retentive than tapered posts. (Quintessence Int 2003;34:199–201)

Key words: biomaterials, post retention, retention-testing, tooth-colored posts

CLINICAL RELEVANCE: Tooth-colored posts have the potential to replace metal posts in many clinical situations. Due to the nature of the bonding mechanism, the shape of the tooth-colored post may be less significant to its retention than it is for metal posts.

Root canal posts are commonly used to retain prosthetic cores for restoration of endodontically treated teeth. Conventionally, metal posts have been used.1 Although successful in many cases, there are significant disadvantages, including the less than optimal esthetics. Failure of restorations retained by metal posts can result in post fracture or bending, loss of retention, core fracture, or root fracture. Corrosion has also been proposed as a cause of failure.2 Manufacturers have therefore introduced systems that are esthetic, are claimed to be biocompatible, do not stress the tooth, and are strong, retentive, corrosion resistant, and compatible with other materials.

Tooth-colored posts vary in respect to several factors including chemical and physical properties and post shape. Ceramic posts and fiber-reinforced posts with an epoxy or bis-GMA resin matrix are available. Ceramic posts are rigid and strong, but should a post fail, its removal can be difficult. The properties of fiber-reinforced materials are dependent on the nature of the matrix and fibers and on the interface strength and geometry of reinforcement.3 The addition of fibers to a polymer matrix can result in significant improvement in the mechanical properties of strength, fracture toughness, stiffness, and fatigue resistance.4 While not esthetic, carbon fiber posts have the potential to replace stainless steel and other posts in many clinical situations due to their inherent rigidity, allowing smaller sizes to be used for equivalent strength.5 Although data are limited, preformed, nonmetal posts

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**TABLE 1 Forces required to dislodge posts (Newtons)**

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Parapost Titanium</td>
<td>127.53</td>
<td>48.36</td>
</tr>
<tr>
<td>2 Lightpost (tapered)</td>
<td>117.72</td>
<td>42.58</td>
</tr>
<tr>
<td>3 Lightpost (parallel-sided)</td>
<td>304.11</td>
<td>76.91</td>
</tr>
<tr>
<td>4 Parapost Fibrewhite</td>
<td>206.01</td>
<td>99.96</td>
</tr>
<tr>
<td>5 Snowpost</td>
<td>98.10</td>
<td>35.02</td>
</tr>
<tr>
<td>6 Dentatus Luscent</td>
<td>147.15</td>
<td>32.77</td>
</tr>
</tbody>
</table>

The teeth were sectioned horizontally, 1 mm coronal to the labial cementoenamel junction, and retentive grooves were cut onto the external aspect of the root surfaces using a water-cooled diamond bur running at high speed. The roots were embedded in individual acrylic blocks shaped to fit into a retention device. Mounted roots were randomly allocated into six groups of 10 for post concentration as follows:

- **Group 1:** Paraposts (titanium, No. 6, 1.5 mm, Coltene Whaledent);
- **Group 2:** Tapered Lightposts (No. 2, 1.8 mm, RTD);
- **Group 3:** Parallel-sided Lightposts (No. 2, 1.8 mm, RTD);
- **Group 4:** Parapost Fibrewhite (No. 6, 1.5 mm, Coltene Whaledent);
- **Group 5:** Snowposts (1.6 mm, Carbotech);
- **Group 6:** Dentatus Luscent Anchor (Medium, 1.6 mm, Dentatus USA).

Following coronal shaping with sizes 2 and 3 Gates Glidden burs, and irrigation using a 2% solution of sodium hypochlorite, post space preparation was carried out according to each manufacturer’s instructions. The post holes were then dried using paper points followed by oil-free air. ED Primer (Kuraray) was mixed according to the manufacturer’s directions and applied to the post preparation using a bristle brush. After 60 seconds, the post hole was gently dried with compressed air. Excess primer was removed with a paper point. All posts were washed in isopropyl alcohol and dried prior to being coated with freshly mixed Panavia F. Posts were inserted into the tooth roots using finger pressure prior to activation with a curing light. The specimens were kept in a water bath filled with saline at 37°C prior to retention testing.

A 4-mm hollow, metal sleeve was luted over the coronal part of each post prior to mounting in a universal testing machine (Instron). The post was grasped in the vice of the testing machine, and a tensile force was applied at a cross-head speed of 5 mm/min. A universal coupling was placed in the assembly to ensure that tension was applied axially along the post. The force required to dislodge the posts was recorded and the data analyzed using ANOVA and Duncan’s New Multiple Range Tests.

**RESULTS**

The mean values for retention of the six groups are shown in Table 1. It was found that the parallel-sided Lightposts (Group 3) were significantly more retentive than all of the other posts ($P < .05$). Parapost Fibrewhite posts (Group 4) were more retentive than tapered Lightposts (Group 2) and Snowposts (Group 5). There was no significant difference between the retention of titanium Paraposts and any of the other groups.

**METHOD AND MATERIALS**

Sixty recently extracted, single-rooted teeth with no surface defects or restorations in the roots and with no unfilled canal spaces were selected. The teeth were stored in saline at 37°C.

have been shown to have a fracture resistance which, although lower than that of metal posts, is adequate for clinical use. This lower fracture resistance is seen to be more favorable because if fracture occurs, it is more likely to be at the post-core interface or within the post itself, without causing fracture of the root. Two other factors that may affect the fracture strength of the post and tooth are the surface treatment (e.g., sandblasting) of the post and the presence of corrosive products.

Teeth restored with tooth-colored posts have been shown to have superior esthetics compared with traditional post-core crown systems. They have better light transmission and reflectance, providing a more natural translucency. This, combined with other positive findings for nonmetal post systems, has led to increased patient acceptance of this type of restoration. When carbon-fiber or resin-reinforced post systems are used with a dentin-bonding resin cement, it has been shown that microleakage between the post and tooth tissue is less than when a nonbonding cement is used. This is thought to be due to the insolubility of the resin and its adherence to the tooth tissue.

Although the esthetics of the final restoration are important, the retention of the post remains a significant feature of the restoration. Retention depends on several factors, including the geometry of the post, the physical nature of the post and bonding agents, their surface treatments, the nature of the bond between the dentin and post, and the luting procedures.
DISCUSSION

One of the primary requirements of a root canal post is that it is strongly retained in the root canal, as loss of retention is a documented cause of post failure. Studies have addressed retention of metal post systems. High retention is known to be associated with parallel, serrated posts and low retention for tapered, smooth posts. Tooth-colored posts differ with respect to their physical, mechanical, and chemical properties. This experiment suggests that the physical features of tooth-colored posts are less significant than of metal posts due to an increased reliance on the bonding mechanism, thus permitting more conservative tapered preparations.

In this study, natural teeth were used and posts of similar dimensions were selected. All posts were treated in the same way, and the same bonding agent was used in all cases to eliminate variables. The results of this study indicate that parallel-sided Lightposts were significantly more retentive than any of the other post systems, including titanium posts.Parapost Fibrewhite posts also performed well. This may be explained by the fact that these posts have the optimal configuration and are also bonded to tooth tissue. There is the potential for minimal microleakage. Metal posts were not found to be any more retentive than any of the tooth-colored post systems.

CONCLUSION

1. Serrated, parallel-sided titanium posts were no more retentive than the tooth-colored posts investigated.
2. Post dimension may influence the retention of tooth-colored posts, with parallel-sided posts being more retentive than tapered posts.
3. Parallel-sided Lightposts were significantly more retentive than all of the other posts considered in this study.
4. Parapost Fibrewhite posts were more retentive than tapered Lightposts and Snowposts.

REFERENCES