ADA®
Professional Product Review™
PUBLICATION OF THE ADA COUNCIL ON SCIENTIFIC AFFAIRS

VOL. 1 | SPRING 2006

IN THIS ISSUE

ADA®
American Dental Association
www.ada.org

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Endodontic Posts

An endodontic post is only part of a restorative system (crown-cement-core-post-cement-tooth). Thus, the success of the post depends on the success of the system and vice versa. That said, there are some post-related factors clinicians must consider when restoring an endodontically treated tooth. For example, mechanical features related to post material and design as well as translucency and radiopacity. This report offers such information for several posts, based on practitioner input and laboratory testing data.

Practitioner Input. Using a web-based survey, we collected clinical performance information on six endodontic posts: CeraPost®, DT Light Post®, IntegraPost™, Luscent Anchors™, ParaPost® Fiber White, and ParaPost® Plus.

Based on their experience with these products, 152 respondents offered input on radiopacity, ease of trimming, esthetics, and buyer satisfaction (noted as whether they would buy the post again). Table 1 summarizes the respondent ratings for the products in these categories. Note that these ratings are more reliable for products that have higher numbers of respondents (e.g., ParaPost® Plus, n=69) than for those products with fewer respondents (e.g., DT Light Post®, n=5 and Luscent Anchors™, n=5).

Table 1. Clinical Survey Results*‡

Brand (No. of Survey Responses)	Visibility on Radiograph	Trimming Ease	Esthetic Result	Buyer Satisfaction
CeraPost® (n=6)	Excellent	Fair	Very Good	Very Good
DT Light Post® (n=5)	Good	Good	Excellent	Good
IntegraPost™ (n=15)	Excellent	Very Good	Good	Excellent
Luscent Anchors™ (n=5)	Excellent	Excellent	Excellent	Excellent
ParaPost® Fiber White (n=20)	Very Good	Very Good	Very Good	Excellent
ParaPost® Plus (n=69)	Excellent	Very Good	Fair	Very Good

* Survey results based on the percentage of dentists responding "excellent" and "good" or "yes." The following scale was used to get the rating in the table: Excellent (91-100% responded "excellent" and "good" or "yes"), Very Good (81-90%), Good (71-80%), Fair (61-70%) and Poor (51-60%).
‡ Note that clinical ratings are more reliable for products that have higher numbers of respondents (e.g., ParaPost® Plus, n=69) than for those products with fewer respondents (e.g., DT Light Post®, n=5 and Luscent Anchors™, n=5).

Laboratory Testing Data.
We tested the six posts included in the practitioner survey plus the following five products, which were introduced to the market after the survey had closed: FibreKleer™, FRC Postec® Plus, ParaPost® Fiber Lux™, ParaPost® XH™, and Twin Luscent Anchors™. All the posts were purchased from a dental supplier and tested to document mechanical properties (flexural strength and flexural rigidity), radiopacity, retention of a core build-up to the post, and the cement-to-post bond. We also recorded light transmission, a key esthetic quality, for the fiber posts (DT Light Post®, FibreKleer™, FRC Postec® Plus, Luscent Anchors™, ParaPost® Fiber Lux™, ParaPost® Fiber White, Twin Luscent Anchors™). Since size can influence mechanical properties, all of the tested posts were 1.5 mm in diameter (or as close as possible).

Mechanical Properties

Clinical Significance: We tested the post's flexural strength and flexural rigidity, which indicate its ability to withstand flexural force.

Testing Method: Using an electromechanical testing machine, we did a three-point bend test with a span of 5 mm, at a crosshead speed of 1 mm/min. Load was applied 10 mm from the pointed tip of the tapered posts and at the center of the parallel posts. From the tests, we determined the flexural strength and flexural rigidity for each post.

Wanting More? Check Out ADA.org

More information about endodontic posts is available on the Association's website at "www.ada.org/goto/ppr".

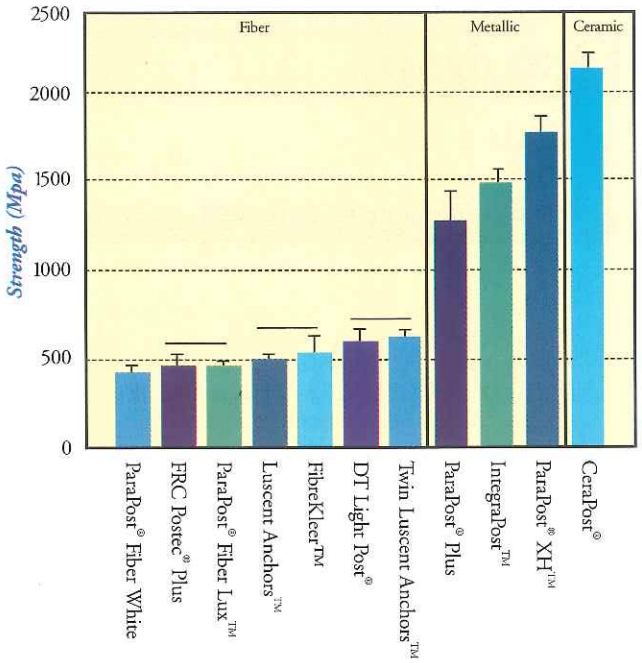
The website features

- post-related tips to help improve restorative success;
- complete lab reports detailing the tests summarized here; and
- links to abstracts of post-related scientific articles.

The website also offers an overview of the Association's new professional product evaluation program, including how to join the ADA Clinical Evaluator (ACE) Panel. The ACE Panel is an integral piece to this program, offering the clinician's perspective on how featured products work in the practice.

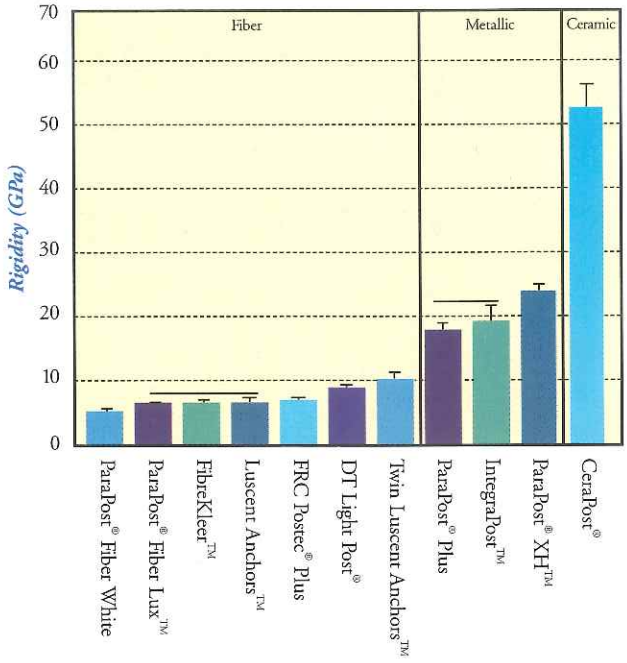
Endodontic Posts *continued*

Flexural Strength of Posts*



* Strength was measured at the proportional limit for the metallic posts and at fracture for other posts. Horizontal black bars indicate results that have no statistically significant difference between them.

Flexural Rigidity of Posts*



* Horizontal black bars indicate results that have no statistically significant difference between them.

Radiopacity

Clinical Significance: Documents the ability to detect a post within the root canal on a radiograph, making the post easier to identify should the tooth need subsequent treatment.

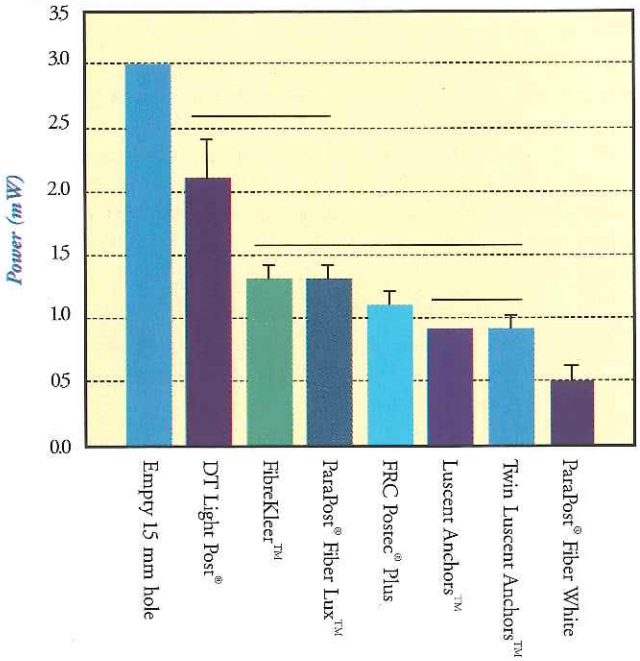
Testing Method: We took radiographs of posts alongside an aluminum step-wedge. Using a calibrated densitometer, we took optical density readings from the radiograph of the posts and the step-wedge. We plotted the optical densities of each step-wedge against the thickness of each step. From the plot, we determined the optical density of the post with respect to an equivalent thickness of aluminum.

Results: According to the International Organization for Standardization[1], root canal sealers should have a radiopacity of 3 mm of aluminum. We used this standard when assessing radiopacity. All of the metal and ceramic posts satisfied this requirement as did DT Light Post®, ParaPost® Fiber Lux™, and FRC Postec® Plus among the fiber posts. Other fiber posts may require use of a radiopaque cement for easier identification on a radiograph.

Reference

1. International Organization for Standardization. ISO 6876: Dental root canal sealing materials. Geneva: ISO, 2001.

Light Transmission Through Fiber Posts (20 sec)*



* Horizontal black bars indicate results that have no statistically significant difference between them.

Light Transmission (Fiber posts only)

Clinical Significance: Measures the ability of light to transmit through the post, which offers a more esthetic restoration and enables one to use dual-cure binding agents and cements.

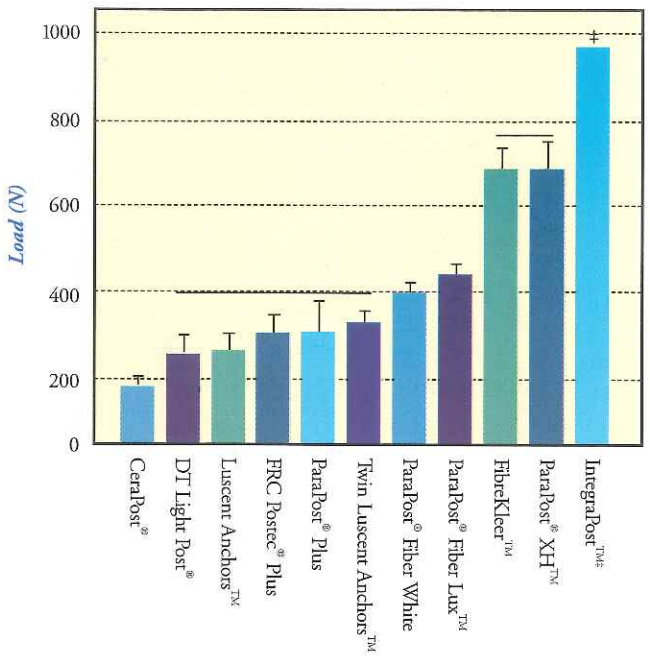
Testing Method: We set and trimmed the posts in a mold filled with RTV silicone. Using a curing light, we measured light transmission through the post every 10 seconds for 20 sec.

Core Retention

Clinical Significance: Determines the retentive capacity of the post to the core material.

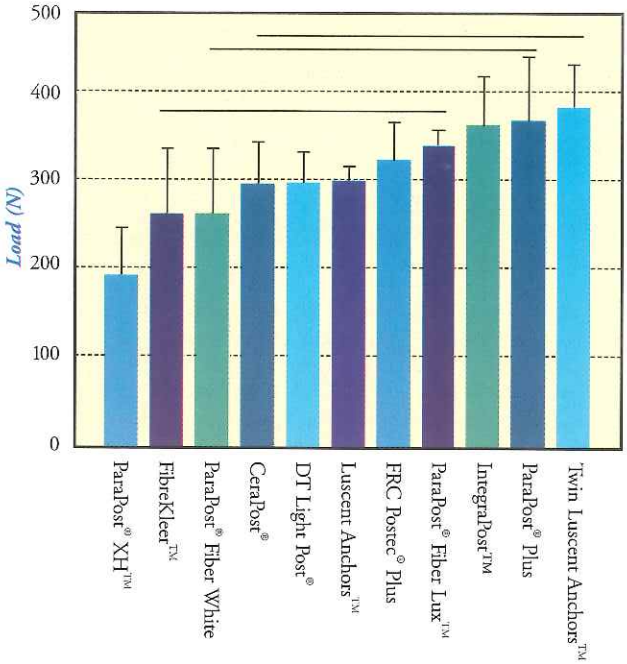
Testing Method: When required, we pre-treated the posts according to the manufacturers' instructions. We placed the posts in a custom-made split mold and covered the post head to 4 mm from the top with the core material recommended for use by the manufacturer (FibreKleer™ and IntegraPost™ heads were completely covered). The material was cured according to the manufacturers' instructions and allowed to set for 10 min. The sample was removed from the mold and stored for 24 h in distilled water at 37°C. After those 24 h, we used an electromechanical testing machine to apply a tensile load to the sample at a crosshead speed of 1 mm/min and recorded the load at which the restoration sample failed.

Bond Between Post and Core Material*



* Horizontal black bars indicate results that have no statistically significant difference between them.
‡ IntegraPost™ withstood loads that exceeded our testing device (> 1000 N).

Bond Between Post and Cement*



* Horizontal black bars indicate results that have no statistically significant difference between them.

Cement-to-Post Bond

Clinical Significance: Determines the adhesive capacity of the post to the cement.

Testing Method: When required, we pre-treated the posts according to the manufacturers' instructions. We placed the posts in a custom-made split mold so that 4 mm of the parallel portion of the post was embedded in the cement. The material was cured according to the manufacturers' instructions. The sample was removed from the mold and stored for 24 h in distilled water at 37 °C. After those 24 h, we used an electromechanical testing machine to apply a tensile load to the sample at a crosshead speed of 1 mm/min and recorded the load at which the sample failed.

Expert Input

Editor's Note: *The following is a panel discussion that was conducted at ADA headquarters via telephone conferencing in March 2004 as part of the feasibility investigation into the Professional Product Review program.' Moderator: Dr. Jeff Hutter, Dept. of Endodontics Chair, Boston University Goldman School of Dental Medicine; Participants: Dr. Dan Nathanson, Professor and Chair, Dept. of Restorative Sciences & Biomaterials, Boston University Goldman School of Dental Medicine; Dr. Robert Ahlstrom, Associate Professor, Dept. of Removable Prosthodontics, University of the Pacific, Private Practice, Reno; Dr. Michael Leary, Professor, Dept. of Family Dentistry University of Iowa College of Dentistry; Dr. Thomas Ziemiecki, Associate Professor, Dept. of Prosthodontics, University of North Carolina*

Hutter: When do you use a metal post versus a ceramic post? Why?

Nathanson: I am starting to favor the composite fiber-reinforced post because of its ability to protect the root by transferring less stress, and I prefer them when there is enough remaining tooth structure above the gingival level to support the post.

Ahlstrom: I usually use metal posts. One of the concerns I've had about fiber posts is that they seem a lot bigger than the conventional metal posts. While I understand the esthetic concerns with using metal posts, I worry more about whether there is enough structural strength to support a post system.

Ziemiecki: I mainly use metal posts, but ultimately, the canal shape and remaining tooth structure determines the post I select. I am starting to get some experience with the fiber-reinforced posts. The more ferrule effect I have, the more I tend to use the fiber-reinforced post.

Hutter: What conditions would require an active versus a passive post?

Ziemiecki: I would consider using an active post in cases that don't offer enough post length to allow for good retention of a passive post (for example, teeth with a short or a curved root). In both of those situations you have more dentin in the coronal area of the root to absorb the stress of an active post's threads.

Leary: I am concerned with the internal pressure that I exert on the tooth so I've gone to a more passive post, also.

Ziemiecki: The more I do of these restorations, the more I feel the need for that post really to be passive, even when it's cemented into place. But the question becomes how loose is too loose?

Hutter: How does one prepare the canal to improve post retention? What about cements?

Ziemiecki: I think the prime requisite is that it's a good clean dentin surface, including removal of the smear layer. I remove all the sealer, gutta percha, and get the clean dentin usually using a Gates Glidden drill. As for cement choice, we mainly look at post length. When we are limited by the post length, we move toward a resin cement to improve retention, even though these are very technique sensitive. However, we're still cementing with glass ionomers for the perceived benefit of fluoride.

Leary: I tend to go toward the post that fits the canal rather than make the canal fit the post approach. With cements, I still use a lot of zinc phosphate; sometimes I go to the resin-type cements.

Ahlstrom: I get down as far as I can without jeopardizing the integrity of the root structure, trying to get the longest length possible even if that means going to a smaller diameter post. I try to get the canal completely clean using Gliddens and a micro-abraser when needed, and cement with glass ionomers or zinc phosphates.

Nathanson: Caputo and Standlee did several studies that showed the more parallel the post, the better the retention. However, there is no correlation with the width of the post; [retention is about the same whether you put a wide or a thin post]. As far as cements, right now we are in the midst of a change; there are several new cements on the market that do not require any bonding procedures, and I think we may be drifting in that direction. For metal posts, glass ionomer is a great material.

For a complete transcript of the panel discussion, go to www.ada.org/goto/ppr.

The Back Page

Endodontic Posts: Overall

The laboratory evaluated 11 endodontic posts and 152 dentists rated six posts in a clinical survey. The results are summarized in Table 2.

Calculating the Laboratory Scores. To get the overall percentage score, we averaged the results from our laboratory tests.

For two of the tests (flexural strength and radiopacity), we grouped the results by material (i.e., fiber and metal) and normalized to the highest score for each group. CeraPost® was the only ceramic post tested; thus, the data could not be normalized to the highest score in the category, and we did not calculate an overall laboratory score (CeraPost®'s individual test results appear in the report). Because translucency is one of the advantages of fiber posts, light transmission was evaluated for fiber posts only and included in their overall laboratory score. From a clinical point of view, the core retention and cement-to-post retention tests are independent of the type of post material; therefore those results were normalized to the highest score among all the posts.

Calculating the Clinical Rating. To achieve the Clinical Rating in Table 2, we combined the percentage of dentists who responded "excellent" and "good" or "yes" to the following clinical questions:

- *How would you rate this endodontic post in radiographic visibility?*
- *How would you rate this endodontic post in ease of cutting?*
- *How would you rate the esthetic results for this endodontic post?*
- *Would you purchase this endodontic post again?*

After combining those percentages, we calculated the average for each of the six posts evaluated by the survey and assigned an overall clinical rating of Poor (50-60 points), Fair (61-70 points), Good (71-80 points), Very Good (81-90 points), or Excellent (91-100 points). Some of the posts were introduced to the market after the survey, so there is no clinical rating for these posts (FibreKleer™, FRC Postec® Plus, ParaPost® Fiber Lux™, Twin Luscent Anchors™, and ParaPost®XH™).

Table 2. Overall laboratory score and clinical rating

Brand	Material	Lab Score (% average)	Clinical Rating*	Retentive Head Design‡	Price† Starter Kit (refills price/post)	Kit Contents
CeraPost®	Ceramic	Not Available††	Excellent (n=6)	No	$130 ($13)	3 drills 3 roughening instruments 5 posts 3 depth gauges
DT Light Post®	Fiber	74	Very Good (n=5)	No	$275 ($9)	4 drills 20 posts
FibreKleer™	Fiber	63	Not Available (n=0)	Yes	$224.95 ($6.80)	3 drills 30 posts Silicone stopper Tweezers
FRC Postec® Plus	Fiber	69	Not Available (n=0)	No	$175 ($13)	2 reamers 10 posts
Luscent Anchors™	Fiber	51	Excellent (n=5)	No	$172 ($8.70)	3 drills 9 posts§ Probos II instrument Core forms
ParaPost® Fiber Lux	Fiber	67	Not Available (n=0)	Yes	$229 ($10.80)	6 drills 15 posts
ParaPost® Fiber White	Fiber	49	Very Good (n=20)	Yes	$166.43 ($10.13)	4 drills 10 posts Hand driver
Twin Luscent Anchors™	Fiber	60	Not Available (n=0)	No	$182 ($8.70)§	3 drills 9 posts§ Probos II instrument Core forms
IntegraPost™	Metal	92	Very Good (n=15)	Yes	$294.85 ($8.60)	5 drills 20 posts IP carrier/probe Post organizer Peeso brushes
ParaPost® Plus	Metal	75	Very Good (n=69)	No	$380.89 ($9.60)	5 drills 20 posts
ParaPost® XH™	Metal	80	Not Available (n=0)	Yes	$315.12 ($9.10)	7 drills 25 posts

*Based on survey responses of 152 dentists, the number of survey responses per individual post is shown in parentheses under the post score (i.e., n=6). For some posts there were no clinical survey responses, so a clinical rating is not available. Note that clinical ratings are more reliable for products that have higher numbers of respondents (e.g., ParaPost® Plus, n=69) than for those products with fewer respondents (e.g., DT Light Post®, n=5 and Luscent Anchors™, n=5).

‡Based on laboratory testing results, the posts with retentive head designs had significantly stronger bonds between the post and core materials.

† MSRP as of November 2005. Prices may vary by supplier.

††An overall laboratory score was not calculated for CeraPost® because it was the only ceramic post tested.

§ Corrections to the original publication: Luscent Anchors starter kit includes 12 posts; Twin Luscent Anchors refill price per post is $9.25 and the starter kit includes 15 posts.

The Bottom Line

There is no clear cut advantage of one type of post material over another. The choice of materials and techniques should be dictated by the clinical factors such as diameter, length, and curvature of the tooth root, esthetic demands, and the dentist's experience. Also keep in mind that the endodontic post type becomes less important when adequate apical extension of the crown margins beyond the core is achieved.