**FIBER POST BIBLIOGRAPHY**

**By study subject (updated June, 2018)**

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**I. Post Fit and Shape**

\*Ananviriyaporn, S., Salimee, P, **Fiber Post Sizes Effect on Fracture Resistance of RCT Teeth.** *J Dent Res. Vol 87 (Spec. Iss. C) Abstract #0131, 2008(www.dentalresearch.org)*

**Objective:** To study the fracture resistance of RCT teeth restored with different diameters and lengths of fiber posts. **Materials and method**: Thirty maxillary central incisors were divided into 3 groups. After RCT-treated, spaces for post were prepared 8 mm. deep with drill of post #2. All groups were restored with fiber post (**D.T. Light-Post**). The first group used the size that properly fit the canal (post #2). The second group used the post with the same canal length but smaller diameter (post #1). The third group used the post that bigger diameter than the canal (post #3), inserted into canal untilled fit the cervical part of the canal that the length was considered to be 4 mm. resulted the post shorter than the canal length. After cementing with resin cement (Panavia F 2.0), a core build-up with composite was performed, the teeth were embedded in self cure acrylic resin block. The samples were loaded on a universal test m chine with a crosshead speed of 2 mm/min on the palatal surfaces at 90๐ angles to the long axis of the tooth until failure occurred. **Result:** Fracture resistance of group 1, group 2 and group 3 were 108.33± 11.59 N, 79.08± 12.15 N and 94.87± 14.48 N, respectively. ANOVA and Bonferroni test revealed that there was no significant difference of the fracture resistance between group 1 and group 3 (p<0.05). But group 2 was significantly different from the other groups (P<0.05). No root fractures occurred in any of the experimental groups. **Conclusion:** RCT teeth restored with fiber post that the diameter properly fit the cervical part of canal were significantly stronger than those restored with the entire length of post but diameter was not fit the canal.

\*Baldissara, P., Zicari, F., Ciocca, L., Zamboni, S. C. ,Valandro, L. F. **Effect of fiber post emerging diameter on composite core stabilization.** .*J Dent Res. Vol 86 (Spec. Iss. A) Abstract #2623, 2007* *(www.dentalresearch.org)*

**Objectives:** The relatively low elastic modulus of fiber posts reduce the risk of root fracture, but also decrease the composite core stabilization. To compensate for the lack of rigidity, larger post sizes are needed when restoring crownless teeth. The aim of this study was to evaluate the effect of the post emerging diameter on the composite core stabilization of restored flat root human teeth. **Methods:** Forty single rooted, crownless human teeth were divided in 8 groups and randomly restored with quartz (**Endo Light-Post and DT Light - Post,** RTD, St Egreve, France) and glass (Premier Anatomic and Compaq, Innotech, Italy) fiber posts, each type represented with #1 and #2 sizes. Single tapered and double tapered post shapes were used. The posts were inserted 10mm deep in the root canal and cemented using Duo-Link and One-Step adhesive (Bisco, USA). The emerging diameter ranged from 1.00 to 1.50mm. The core was realized using Light-Core (Bisco) placed in transparent standardized shells. The specimens were stored in 100% humidity until the Instron loading tests, carried out at a 45° angle. The force required to detach the core from the dentin flat surface was considered as the fracture strength (FS). Data obtained were statistically analyzed with ANOVA and linear regression. **Results**: FSs ranged from 264±95N (Endolightpost #1) to 425.1 +/- 55N (DT Light-Post #2: RTD; St Egreve, France) (P<0.05). Single tapered posts were weaker than double tapered ones. FS was directly correlated to post emerging diameter (P=0.017). Notwithstanding the loss of dentin required to place larger posts, the root fracture rate was not significantly correlated to the post diameter (P=0.8). **Conclusion:** The emerging diameter of fiber post is extremely important to stabilize the core. When restoring crownless teeth, it is advisable to use fiber posts having large emerging diameters. Data obtained suggest that diameters of 1.5mm do not jeopardize the root dependability.

\*Baldissara, P., Filonzi, C., Zicari, F., Ciocca, L. **Establishing an improved fiber post shape using a 3-D analysis.** *J Dent Res. Vol 84 (Spec. Iss. A) Abstract #0535, 2005.* *(www.dentalresearch.org)*

**Objectives:** When restoring endodontically treated teeth with fiber post, the coronal third of the root canal is often much more larger than both medium and apical portion. Fiber posts are frequently too small in diameter at this level, particularly in teeth previously treated, and a large amount of cement is required to fill the post/dentin gap. The aim of this study was to determine the root canal shape immediately prior the post space preparation, to obtain data for an improved post design**. Methods**: After gutta-percha removal, 40 poly-vinyl polysiloxane impressions of the root canal of endodontically treated teeth scheduled for fiber post restorations were taken by a single operator. Molars and lower incisors were excluded. Stone casts were obtained from the impressions. The casts were progressively grinded, taking a standardized microphotograph every 1mm. The canal length and both bucco-lingual and mesio-distal diameters were measured, obtaining a mean computer-designed 3-D canal profile. The canal shapes were compared to different fiber posts using graphics software. **Results:** the coronal and central thirds of the incisors, canines and 2nd bicuspids were found significantly larger than standard fiber posts. In these teeth, **DT Light-Post** (RTD, St Egreve, France) showed the best fit (although not ideal) when compared to single tapered or parallel sided posts. The mean canal length was 8.9„b1.4mm. When graphically superimposed on the 3-D images, extremely good adaptation was found with a post having a tapered root portion of 6¢X, 12mm in length, and parallel-sided coronal head 5mm in length. The head diameters should vary from 1.8 to 2.4mm to match the different tooth sizes. **Conclusions:** The canals of endodontically treated teeth are larger than available fiber posts, particularly at the coronal segment. An increased tapering and a larger coronal diameter have been introduced in a new post design obtaining a better post/dentin adaptation.

\*Boudrias, P, Sakkal, S, Yulian, **Anatomical post design applied to quartz fiber/epoxy technology: A conservative approach**. *Oral Health, Nov., 2001*:*9-16*

**Abstract/conclusions:** A wide variety of prefabricated posts systems are manufactured with different materials and offered with different shapes. Post and core adaptation presents an important element in the biomechanical performance of the prosthetic restoration. The double taper post system was designed with the purpose of providing close canal adaptation with minimal tooth structure removal. The association of a quartz fiber/epoxy material with a more anatomical double taper shape provides a conservative and esthetic approach for the restoration of endodontically-treated teeth. The double taper post (**D.T. Light-Post**; RTD, St Egreve, France) allows one to rebuild the missing tooth structure using adhesive technology without obstructing the esthetics of the all-ceramic restorative systems. The double taper post closely imitates the post-endodontic shape of a radicular canal, and leaves a thin and uniform thickness of cement at the post/canal interface. This improved adaptation of the post promotes the mechanical properties of the quartz fiber/epoxy material, instead of the weaker composite resin cement. In as much as in vitro and early clinical follow-up are encouraging, long-term clinical study is needed to evaluate the behavior of this post system and the prosthetic prognosis of teeth with extensive coronal destruction. **PDF**

\*Boudrias, P., Sakkal, S., and Petrova, Y. **Anatomical post design meets quartz fiber technology: Rationale and case report**.  *Compendium*. *22: 337-348, 2001.*  
   
**Abstract/conclusions:** Endodontically treated teeth frequently require a post and core to serve as a foundation for the coronal restoration. Remaining tooth structure, physical properties of the post material, post shape, and cement type all contribute to the success of the restoration. Post adaptation to the canal walls also represents an important element in the biomechanical performance of the prosthetic restoration. A double taper post system made of quartz fiber and epoxy was developed to conform more precisely to the shape of endodontically treated canals. Immediate benefits of this post system include minimal tooth structure removal during canal reshaping, greater post-to-canal adaptation in the apical and coronal half of the canal, and good post retention. The use of a quartz fiber/epoxy material with a lower modulus of elasticity also reduces the incidence of root fracture. Furthermore, the esthetic nature of the colors offered with this post system (**D.T. Light-Post**; RTD, St Egreve, France) provide a favorable foundation for eliminating discoloration caused by a metallic post placed under all-ceramic crown systems. **PDF**

\*Medioni, E., Griva, J. **Fiber post adaptation when using root canal shaping NiTi files** *J Dent Res. Vol 87 (Spec. Iss. A) Abstract #1503, 2008. (www.dentalresearch.org)*

One of the most difficult steps when restoring endodontic treated teeth is the post space preparation: a bad post space preparation can occur and induce irreversible damage to the tooth. **Objectives:** evaluation of adaptation of two different fibre posts after shaping the root canal by two different NiTi rotary files. **Methods**: 40 healthy teeth, freshly extracted were selected. Twenty root canals were shaped using RaCe System (FKG, La Chaud de Fond, Switzerland) and twenty using Protaper system (Dentsply-Maillefer, Ballaigues, Switzerland). PeerlessPost System (Sybron Endo, USA) and **D.T. Light-Post** system (VDW Dentsply/ RTD, St Egreve, France) were fixed into the root canal using an impression paste, without post space preparation. After embedding roots into an epoxy resin and longitudinal cutting, the adaptation of posts was assessed by measuring the length of penetration and the thickness of “sealer”. Statistical analyses to compare post adaptation were made using non-parametric tests. **Results:** Regarding the length of post penetration, there is a statistical significant difference between the different posts when different root canal shaping instruments are used (p=0,013). When using RaCe rotary files, penetration length of Peerless posts is greater than with DT posts. There is no statistical significant difference for the thickness “sealer” at the tip (p=0,972) and at 3mm from the tip of the post (p=0,2344), but at the ECJ, there is a statistical significant difference (p=0,011). The “sealer” is less thick (p=0,0073) with Peerless Posts than with DT posts when root canal is shaped by Protaper system, and thicker (p=0,0008), when using Peerless posts comparing RaCe shaping and Protaper shaping. **Conclusion**: In the conditions of this experimentation, the post space preparation with specific drills is not necessary if root canal shaping is preformed with RaCe or Protaper NiTi rotary files and when Peerless posts or D.T. Posts are used.

\*\*Portigliatti, RP, Tumini, JL, Bertoldi Hepburn, AD, Aromando, RF, Olmos, JL. **Correspondence between fiber post and drill dimensions for post canal preparation.** *Am J Dent. 2017 Dec;30(6):295-298*

#### Purpose: To compare fiber posts of several calibers and trademarks to their corresponding root canal preparation drills.

#### Methods: Three widely used endodontic post brands and their drills were evaluated: Exacto, ParaPost Taper Lux, and Macro-Lock Illusion X-RO. Fiber posts and drills were microphotographed with a scanning electron microscope and images were analyzed using ImageJ image processing software. Fiber post diameter on apical extreme (Pd0), fiber post diameter at 5 mm from the apical extreme (Pd5), drill diameter on apical extreme (Dd0) and drill diameter at 5 mm from the apical extreme (Dd5) were analyzed. The data were statistically analyzed using student t-test. Results: Exacto posts 0.5 showed larger dimensions than their corresponding drills (P< 0.05) at Pd0. Macro-Lock posts showed no significant differences vs. their drills at Pd0 in any of the studied groups. ParaPost drills 4.5, 5 and 5.5 were statistically significantly larger than their posts at Dd0 (P< 0.05). Exacto posts 0.5 and 1 showed larger dimensions than their drills measured at Pd5 (P< 0.05). Exacto posts number 2 showed smaller calibers than their corresponding drills at Pd5 (P< 0.05). Macro-Lock drills number 4 and ParaPost drills number 5 were larger than their posts at Dd5 (P< 0.05). Clinical Significance: Poor spatial correspondence between post and drill dimensions can adversely affect the film thickness of the resin cement, diminishing bond strength due to polymerization shrinkage. The lack of correspondence in size between posts and drills may lead to the formation of empty chambers between the post and endodontic obturation with excessive luting cement thickness, thus inducing critical C-Factor stresses. PDF

###### II. Physical Properties; the posts by themselves

1. FLEXURAL STRENGTH

\*Barceleiro, M., Soares, L.P., Poiate, I., Portero, P.P., Vasconcellos, A.B., Teixeira, C.A **Influence of autoclave sterilization on flexural strength of fiberglass posts**. *J Dent Res.Vol 92 (Spec Iss A) Abstract #3130, 2013* *(*[www.dentalresearch.org](http://www.dentalresearch.org)*)*

**Objectives:** The sterilization of fiber-reinforced resin posts may be necessary if during adaptation tests, they are changed by other with different diameter. The sterilization in autoclave, however, may generate some kind of structural change that may prejudice their mechanical properties and clinical performance. The aim of this study was to evaluate the influence of sterilization method on the physical structure of reinforced fiberglass posts (FRC Postec - Ivoclar and Transluma - Bisco) or fiber quartz posts (**DT Light-Post**  RTD, St Egreve France) after 1 or 2 cycles of sterilization. **Methods:** Eight posts of each brand, divided into 3 groups (FRC, TRL and DT), were subdivided into three subgroups, according to the number of sterilization cycles: a subgroup with no sterilization (control), one with one sterilization (Subgroup 2) and Subgroup 3 with 2 sterilization cycles. After sterilization procedures, the posts were submitted to three-pointing bending test (ASTM D2344). **Results:** The main values of maximum force required to fracture the pin in different groups were: DT1 (202 ± 8.39 N), DT2 (190.2 ± 10.02 N), DT3 (177.9 ± 14.75 N); FRC1 (152.6 ± 27.19 N); FRC2 (130.9 ± 25.99 N); FRC3 (128.1 ± 18.41 N); TRL1 (143.5 ± 6.15 N); TRL2 (144 ± 8.62 N); TRL3 (134 ± 6.51 N). The results treated by ANOVA and SNK (p ≤ 0.05) showed significant differences within the groups DT (1 = 2> 3) and TRL (1 = 2> 3). **Conclusions:** It was concluded that the posts tested can be sterilized by an autoclave cycle with no loss in flexural strength. The FRC Postec Post can be sterilized by two cycles without mechanical damage.

\*Beck, P., Ghuman, T., Cakir, D. Ramp, L. Burgess, J*.***Evaluation of flexural strength and elastic modulus of endodontic posts.***J Dent Res. Vol 88 (Spec. Iss. A) Abstract # 3065, 2009. (www.dentalresearch.org)*

Post fracture is a frequently reported failure for restored endodontically treated teeth. Current reports suggest that the rigidity of the post should be equal or close to that of the tooth structure in order to distribute the occlusal forces along the length of the root. **Objective:** To determine and compare modulus of elasticity and flexural strength of endodontic posts. **Methods:** Five fiber posts (Unicore/Ultradent, **DT Light-Post**/Bisco/RTD St Egreve, France, RelyX/3M ESPE, Snowlight/Danville, Parapost Fibre White/Coltene Whaledent) and 1 metal post (Parapost XT/Coltene/Whaledent) were used for this study (n=10). They were measured for length and diameter and placed on a 3- point bending test fixture.  The posts were loaded in a universal testing device, (Instron, Model 5565) using flexural test method until failure having a 1 mm/min crosshead speed. The fracture data was compared using a one-way ANOVA and Tukey post-hoc tests to examine for intergroup differences (p=0.05). Two samples were randomly selected from each group and evaluated using a scanning electron microscope (SEM) to determine the adaptation & orientation of the glass fibers. **Results:** Flexural strength results are displayed in(MPa±SD) and modulus of elasticity results are displayed in (GPa±SD). Unicore fiber post had significantly (p<0.05) higher flexural strength compared to the Parapost Fibre White post. Parapost XT titanium alloy post had a significantly higher flexural strength and modulus (p<0.05) compared to the fiber posts. **Conclusion:** Posts should be selected in part for their mechanical properties.  Supported in part by a grant from Ultradent.

Cheleux, N., Sharrock, P.J., **Mechanical properties of glass fiber-reinforced endodontic posts.** *Acta Biomater. 2009 Oct;5(8):3224-30. Epub 2009 Apr* 24.

Five types of posts from three different manufacturers (**AesthetiPlus, Light-Post**, RTD, France, Carbotech, France and Ivoclar-Vivadent, Liechenstein) were subjected to three-point bending tests in order to obtain fatigue results, flexural strength and modulus. Transverse and longitudinal polished sections were examined by scanning electron microscopy and evaluated by computer-assisted image analysis. Physical parameters, including volume % of fibers, their dispersion index and coordination number, were calculated and correlated with mechanical properties. The weaker posts showed more fiber dispersion, higher resin contents, larger numbers of visible defects and reduced fatigue resistance. The flexural strength was inversely correlated with fiber diameter and the flexural modulus was weakly related to coordination number, volume % of fibers and dispersion index. The interfacial adhesion between the silica fibers and the resin matrix was observed to be of paramount importance. **PDF**

[Chieruzzi, M](http://www.ncbi.nlm.nih.gov/pubmed?term=chieruzzi%25252520m%2525255bauthor%2525255d&cauthor=true&cauthor_uid=22917560), [Pagano, S](http://www.ncbi.nlm.nih.gov/pubmed?term=pagano%25252520s%2525255bauthor%2525255d&cauthor=true&cauthor_uid=22917560), [Pennacchi, M](http://www.ncbi.nlm.nih.gov/pubmed?term=pennacchi%25252520m%2525255bauthor%2525255d&cauthor=true&cauthor_uid=22917560), [Lombardo, G](http://www.ncbi.nlm.nih.gov/pubmed?term=lombardo%25252520g%2525255bauthor%2525255d&cauthor=true&cauthor_uid=22917560), [D'Errico, P](http://www.ncbi.nlm.nih.gov/pubmed?term=d'errico%25252520p%2525255bauthor%2525255d&cauthor=true&cauthor_uid=22917560), [Kenny, JM](http://www.ncbi.nlm.nih.gov/pubmed?term=kenny%25252520jm%2525255bauthor%2525255d&cauthor=true&cauthor_uid=22917560)**. Compressive and flexural behaviour of fibre reinforced endodontic posts. *J*** *Dent. 2012 Nov;40(11):968-78. doi: 10.1016/j.jdent.2012.08.003. Epub 2012 Aug 21.*

**Objectives:** The aim of this study was to investigate the mechanical properties of five types of fibre-reinforced composite (FRC) posts and compare them with traditional metal post. **Methods:** Five FRC posts and a metallic post having different geometry and type of fibre (glass, carbon or quartz fibre) were loaded to failure in compression and bending. The transverse sections of FRC posts were observed using SEM to evaluate the fracture mode and the percentage of fibres (compared with burn-off test). Densities and voids content were also evaluated. **Results:** Mechanical results were subjected to a one-way ANOVA and Tukey test (p<0.05). In compression, quartz fibre posts **(Light-Post; RTD**; St Egreve, France) exhibited the greater maximum load and ultimate strength, carbon fibre posts showed a poor compressive behaviour. All posts had similar compressive moduli. Carbon posts showed the highest flexural properties (p<0.0001) while glass posts the greater maximum load. The fracture load values correlated to the diameters of posts showed a parabolic behaviour. The flexural strengths of all posts were four and seven times higher than dentine. The elastic moduli of almost all posts were similar to dentine. The compressive strengths were lower than flexural strengths. The fibre diameters ranged from 5.2 to 26 μm, the volume percentage of fibres was about 64%. The content of voids of some posts lower their mechanical behaviour. **Conclusions:** Compressive properties of FRC posts were lower than in bending. The flexural properties of FRC posts were higher than the metal post and similar to dentine. The mechanical behaviour is influenced by voids. **PDF**

\*Galhano, GA, Valandro, LP, deMelo, R., Scotti, R., Bottino, MA. **Evaluation of the flexural strength of carbon fiber, quartz fiber and glass fiber –** **based posts.** *JOE Vol. 31. No. 3, March 2005, 209-211*

This study investigated the flexural strength of 8 fiber posts (one carbon fiber, one carbon/quartz fiber, one opaque quartz fiber, two translucent quartz fiber and three glass fiber posts). Eighty fiber posts were used and divided into 8 groups (n=10): G1- **Composipost / C-Post** (RTD), G2-**Aestheti-Post** (RTD), G3-**Aestheti-Plus** (RTD), G4- **Light-Post** (RTD), G5- **D. T. Light-Post** (RTD), G6- ParaPost White (Coltene/Whaledent), G7-FibreKor (Pentron) and G8-Reforpost (Angelus). All of the samples were tested using a three-point bending test. Statistical analysis of the outcomes was conducted by means of analysis of variance and the post factor was significant (p<0.001). The critical value for comparison revealed that G2 (677.4 MPa +/18.3) and G3 (666.2 +/- 18.1) presented the highest flexural strength values. G1 (616.3 +/- 24.8) and G3 presented similar strengths. G1, G4 (607.2 +/- 19.5), G5 (608.7 +/-69.5), G6 (585.2 +/- 24.2) and G7 (562 +/- 59.6) were statistically similar. Reforpost-G8 (433.8 +/- 46.4) revealed the lowest flexural strength value compared to the other groups. **PDF**

\*Khatter, R, Singh, RD., Sroa, R. Rigidity, **retention, and resistance of titanium versus double taper light root canal posts: An in vitro evaluation***. Indian J Dent Res [serial online] 2011 [cited 2013 Jan 27];22:879.*

**Aim:** to evaluate and compare the physical properties of titanium posts and double taper DT Light-Posts. **Methods:** Sixty posts (30 titanium post and 30 **DT Light- Post**, RTD; St Egreve, France) were selected and divided into three groups. In Group I: Ten posts of each type were subjected to a three-point bending test. In Group II: 20 posts extracted maxillary central incisors were restored with ten posts of each type and subjected to tensile loading. In Group III: 20 posts extracted maxillary central incisors were restored with ten posts of each type and subjected to compressive loading at an angle of 135°. **Results:** The results showed that DT Light-Posts were significantly less rigid (P <0.001), more retentive and significantly less resistant to fracture (P <0.001) as compared to titanium posts. **Conclusion**: It is suggested that although the DT Light-Post system does not completely fulfill the requirements claimed by manufacturer but it would meet the requirements to combat the physiological forces operating in the oral cavity.

Novais, V.R., Quagliatto, P.S., Bona, A.D., Correr-Sobrinho, L, Soares, C.J.. **Flexural modulus, flexural strength, and stiffness of fiber-reinforced posts.** *Indian J Dent Res. 2009 Jul-Sep;20(3):277-81.*

**Background:** The radiopacity degree of posts is not enough for adequate visualization during radiographic analyses. Glass fiber post with stainless steel reinforcement has been fabricated in an attempt to overcome this limitation. AIM: This study was designed to determine the influence of this metal reinforcement on the post mechanical properties. **Methods:** This study evaluated flexural modulus (E), flexural strength (sigma), and stiffness (S) of five different fiber post systems (n = 5): RfX (Reforpost Glass Fiber RX; Angelus, Londrina, PR, Brazil); RG (Reforpost Glass Fiber, Angelus); RC (Reforpost Carbon Fiber, Angelus); FP (Fibrekor Post; Jeneric Pentron Inc., Wallingford, CT, USA); and CP (**C-Post/Composipost**, RTD, St Egreve, France, USA), testing the hypothesis that the insertion of a metal reinforcement (RfX) jeopardizes the mechanical properties of a glass fiber post. Posts were loaded in three-point bending using a testing machine with a crosshead speed of 0.5 mm/min. **Results:** The results were statistically analyzed using one-way ANOVA and Tukey's multiple range tests (a = 0.05). Mean and standard deviation values of E (GPa), s (MPa), and S (N/mm) were as follows: RfX: 10.8 +/- 1.6, 598.0 +/- 52.0, 132.0 +/- 21.9; RG: 10.6 +/- 1.0, 562.0 +/- 24.9, 137.8 +/- 5.5; RC: 15.9 +/- 2.4, 680.5 +/- 34.8, 190.9 +/- 12.9; FP: 10.9 +/- 1.4, 586.8 +/- 21.9, 122.4 +/- 17.3; CP: 6.3 +/- 1.7, 678.1 +/- 54.2, 246.0 +/- 41.7. Carbon fiber posts showed the highest mean s values (P < 0.05). In addition, RC showed the highest mean E value and CP showed the highest mean S value (P < 0.05). **Conclusion:** The hypothesis was rejected since the metal reinforcement in the glass fiber post (RfX) does not decrease the mechanical property values. Posts reinforced with carbon fibers have a higher flexural strength than glass fiber posts, although all posts showed similar mechanical property values with dentin. **PDF**

\*Seefeld, F, Wenz, HJ, Ludwig, K, Kern, M. **Resistance to fracture and structural characteristics of different fiber reinforced post systems.** *Dent Mater. 2007 Mar;23(3):265-71*

**Results:** The aim of this study was to investigate the ultrastructure and resistance to fracture of eight different types of fiber post, and to verify the existence of a correlation between structural characteristics and flexural strength. **Results:**: Eight types of fiber post were selected for this study. Fiber Kor (Jeneric-Pentron), Para Post Fiber White (Coltene), Luscent Anchor (Dentatus), Twin-Luscent Anchor (Dentatus), Style Post (Metalor), DT White-Post (VDW), **DT Light-Post** (VDW / RTD, St Egreve, France) and ER Dentin Post (Brasseler). Ten posts of each experimental group were selected for a three-point bending test, and one was processed for SEM evaluation. A universal testing machine loading at an angle of 90 degrees was employed for the three-point bending test. The test was carried out until fracturing of the post. After fracture testing, the posts with the highest and the lowest values of flexural strength of each system were additionally processed for SEM analysis. SEM evaluation was performed using a PC-measurement program to assess the fiber/matrix ratio and fiber dimensions. **Results:** The fracture load of the tested systems ranged from 60 to 96 N and the flexural strength from 565 to 898 MPa. **DT White-Post** and D.T. Light-Post (898 and 842 MPa, respectively) had significantly higher flexural strengths than the other posts. Style Post (565 MPa) showed a significantly lower flexural strength than all other posts. The differences in fiber diameter ranged from 8.2 to 21 micron and for the fiber/matrix ratio from 41 to 76%. Of the various structural characteristics investigated, only the fiber/matrix ratio showed a significant correlation to the flexural strength (r=0.922, p=0.003). **Significance:** The FRC-posts investigated displayed significant differences with regard to fracture load and flexural strength. A strong and significant linear correlation between the fiber/matrix ratio and the flexural strength was found. **PDF**

[Stewardson, DA](http://www.ncbi.nlm.nih.gov/pubmed?term=%25252522stewardson%25252520da%25252522%2525255bauthor%2525255d), [Shortall, AC](http://www.ncbi.nlm.nih.gov/pubmed?term=%25252522shortall%25252520ac%25252522%2525255bauthor%2525255d), [Marquis, PM](http://www.ncbi.nlm.nih.gov/pubmed?term=%25252522marquis%25252520pm%25252522%2525255bauthor%2525255d), [Lumley, PJ](http://www.ncbi.nlm.nih.gov/pubmed?term=%25252522lumley%25252520pj%25252522%2525255bauthor%2525255d). **The flexural properties of endodontic post materials.** *Dent Mater. 2010 Aug;26(8):730-6. Epub 2010 Apr 21*

**Objectives:** To measure the flexural strengths and moduli of endodontic post materials and to assess the effect on the calculated flexural properties of varying the diameter/length (D/L) ratio of three-point bend test samples. **Methods**: Three-point bend testing of samples of 2mm diameter metal and fiber-reinforced composite (FRC) rods was carried out and the mechanical properties calculated at support widths of 16 mm, 32 mm and 64 mm. Weibull analysis was performed on the strength data. **Results:** The flexural strengths of all the FRC post materials exceeded the yield strengths of the gold and stainless steel samples; the flexural strengths of two FRC materials were comparable with the yield strength of titanium. Stainless steel recorded the highest flexural modulus while the titanium and the two carbon fiber materials exhibited similar values just exceeding that of gold. The remaining glass fiber materials were of lower modulus within the range of 41-57 GPa. Weibull modulus values for the FRC materials ranged from 16.77 to 30.09. Decreasing the L/D ratio produced a marked decrease in flexural modulus for all materials. **Significance:** The flexural strengths of FRC endodontic post materials as new generally exceed the yield strengths of metals from which endodontic posts are made. The high Weibull modulus values suggest good clinical reliability of FRC posts. The flexural modulus values of the tested posts were from 2-6 times (FRC) to 4-10 times (metal) that of dentin. Valid measurement of flexural properties of endodontic post materials requires that test samples have appropriate L/D ratios. **PDF**

[Stewardson, DA](http://www.ncbi.nlm.nih.gov/pubmed?term=%25252522stewardson%25252520da%25252522%2525255bauthor%2525255d), [Shortall, AC](http://www.ncbi.nlm.nih.gov/pubmed?term=%25252522shortall%25252520ac%25252522%2525255bauthor%2525255d), [Marquis, PM](http://www.ncbi.nlm.nih.gov/pubmed?term=%25252522marquis%25252520pm%25252522%2525255bauthor%2525255d). **The effect of clinically relevant thermocycling on the flexural properties of endodontic post materials**. *J Dent. 2010 May;38(5):437-42. Epub 2010 Feb 25.*

**Objectives:** It is suggested that fibre-reinforced composite (FRC) posts have lower elastic moduli than metal posts and this will reduce the incidence of root fracture. However, the mechanical properties may be altered in the oral environment. The aims of this study were to determine the effect on the flexural properties of FRC and metal post materials produced by: (1) a thermocycling regime which was clinically relevant and representative of that which would occur during 1 year in the mouth and (2) storage for 1 year at body temperature. **Methods:** Nine FRC and two metal post material samples were sealed in polythene sleeves and thermocycled between 10 degrees C and 50 degrees C for 10,000 cycles. Additional samples were stored dry at 37 degrees C for 1 year. The flexural strength and moduli were determined by three-point bending and compared with untreated control samples. **Results:** Thermocycling and storage at 37 degrees C for 1 year decreased the mean flexural modulus of all materials. This was statistically significant for 8 of 11 materials after thermocycling, and 4 of 11 materials after storage at 37 degrees C (p<0.05). Thermocycling and storage at 37 degrees C produced a non-significant increase in yield strength for both metal post materials. Thermocycling significantly increased the flexural strength of Postec while it decreased for the other FRC materials. Storage at 37 degrees C increased the flexural strength of three FRC materials (significantly for Postec) while it was decreased among the other materials. **Conclusions:** Although some of the changes noticed in flexural properties were statistically significant, it is doubtful that they are of sufficient magnitude to affect clinical performance. **PDF**

\*Tomazinho, F.S.F., Zaitter, S., Silva, S.R.C., Alfredo, E. and Y.T.C. Silva-Sousa, Y.T.C*.* **Flexural properties of fiber reinforced root canal posts.** *J Dent Res. Vol 89 (Spec. Iss. B) Abstract #3115, 2010 (www.dentalresearch.org)*

**Objectives:** Fiber-reinforced composite (FRC) root canal posts have been introduced to be used instead of metal alloys and ceramics. The aim of this study was to investigate the fracture resistence of five different types of fiber post. **Methods:** The fiber posts selected for this study were DT Light-Post (RTD St Egreve, France), White Post DC (FGM), Exacto (Angelus), ReforPost (Angelus), Everstick (Sticktech). Five posts of each experimental group were subjected to three-point bending test in a universal testing machine an angle of 90◦. The test was carried out until fracturing of the post. Mean flexural strength and SDs were calculated and data statistically analyzed by ANOVA and Tukey's test. **Results:** Means and SDs of flexural strength (N) were: DT Light-Post: 99.88 (3.92), White Post DC: 108.56 (9.99), Exacto: 113.18 (2.26), ReforPost: 58.7 (5.24), Everstick: 84.6 (1.81). ANOVA indicated significant differences among de groups (p<0,05). The fracture load of the tested systems ranged from 51 to 116N and the flexural strength from 869 to 1414MPa. DT Light-Post (1345MPa) showed significantly higher flexural strengths than the other posts. ReforPost (988MPa) showed a significantly lower flexural strength than all other posts. **Conclusion:** The FRC-posts investigated showed significant differences regarding to fracture load and flexural strength.

Vadavadagi, SV, Dhananjaya, KM, Yadahalli, RP, Lahari, M, Shetty, SR, Bhavana, BL. **Comparison of different post systems for fracture resistance: an in vitro study.***J Contemp Dent Pract. 2017 Mar 1;18(3):205-208.*

Endodontic restoration becomes a challenging task for the clinician because of severe loss of coronal tooth structure owing to trauma, caries, restorative, and endodontic procedures. The restoration of these teeth requires the use of a post and core as individual units or as abutment supports for fixed or removable restorations in a predictable long-term manner. **Aim:** To compare and assess the compressive bond strength of glass, quartz, and carbon fiber posts restored with porcelain-fused-to-metal (PFM) crown. **Materials and methods:** A total of 45 upper central incisor teeth having straight root canals, similar anatomically root segments, and fully developed apices were selected. Teeth were divided into three groups of 15 teeth after endodontic treatment. Group I: Teeth inserted with the prefabricated glass fiber post. Group II: Teeth inserted with **the quartz fiber post**. Group III: Teeth inserted with carbon fiber post. The posts were placed and core was fabricated using composite restoration followed by PFM crown cementation using adhesive resin. Compressive load required to fracture the tooth was measured using a universal loading machine. The difference between the variables was assessed by one-way analysis of variance, followed by Tukey's post hoc test. **Results:** The compressive strength exhibited by carbon fiber posts was highest with a mean of 668.33 ± 26.397, followed by quartz fiber post (635.80 ± 30.390). Least compressive strength was exhibited by glass fiber post (567.53 ± 26.632). An analysis of variance shows statistically highly significant difference (p < 0.005) among the posts used. **Conclusion:** This study concluded that the carbon fiber posts had higher compressive strength than other quartz, glass fiber posts. **Clinical significance:** Endodontic treatment results in loss of a significant part of the tooth structure. Posts restore these teeth and provide retention.

Vichi, A, Vano, M, Ferrari, M. **The effect of different storage conditions and duration on the fracture strength of three types of translucent fiber posts.** *Dent Mater. 2008 Jun;24(6):832-8. Epub 2007 Dec 3*

**Objectives:** (a) To evaluate the effects of storage duration, storage condition and type of fiber post on post fracture strength. (b) To morphologically evaluate the post structure before and after storage. **Methods:** Three types of fiber posts were divided in different groups (n=14) according to the storage duration (1, 6, 12 months), and storage condition (dry at 37 degrees C; saline water at 37 degrees C; mineral oil at 37 degrees C and storage inside the roots of extracted human teeth immersed in saline water at 37 degrees C). Specimens were loaded in a universal testing machine with a compressive load until fracture. A 3-way ANOVA and Tukey's test (alpha=.05) were used to compare the effect of the experimental factors on the fracture strength. Two posts of each group were observed before and after the storage using a scanning electron microscope. **Results:** Storage conditions and post type, had a significant effect on post fracture strength (p<0.05). The interaction between these factors was significant (p<0.05). Water storage significantly decreased the fracture strength, regardless of the post type and the storage duration. Storage inside roots, in oil, and at dry conditions did not significantly affect post fracture strength. SEM micrographs revealed voids between fibers and resin matrix for posts stored in water. Posts stored under the other conditions showed a compact matrix without porosities. **Significance:** Fiber posts placed inside human root canals immersed in water are not affected by the detrimental effect of water.

1. **FATIGUE RESISTANCE**

\*Grandini, S., Goracci, C., Monticelli, F., Borracchini, A., Ferrari, M. **An evaluation, using a three-point bending test, of the fatigue resistance of certain fiber posts.** *II Dentista Moderno, March, 2004, 70-74*

**Aim:** The aim of the present study was to assess the fatigue resistance of several types of fiber posts by using a 3-point bending test and to observe their ultrastructure through Scanning Electron Microscopy (SEM) before and after undergoing the fatigue test. **Methods:** Six types of fiber posts were selected for this study, EasyPost (Group 1), ParaPost Fiber White (Group 2), FibreKor (Group 3), **D. T. Light-Post** (Group 4), Lucent Anchors (Group 5), and SnowPost (Group 6). Each group contained 15 posts; 5 posts in each group were observed with SEM, the other ten were used for the fatigue test. A three-point bending machine, loading at an angle of 90 degrees and a frequency of 3 Hz, was employed for fatigue testing. The test was carried out until 2 million cycles were completed or until the post fractured. After the fatigue test had been completed, further evaluations were carried out with SEM on the fractured posts and the posts that went to the end of the fatigue cycles. **Results:** The fatigue test showed statistically significant differences among the different posts. Group 4 (D.T. Light-Post; RTD, St Egreve, France)) performed better than all the other groups, withstanding the entire load cycles without fractures. **Conclusions:** There are great variations in the responses of different kinds of fiber posts to a fatigue resistance test. Structural integrity is already very different even before undergoing the fatigue test, and this proves that many of the performance differences noted are due to the differences in the manufacturing processes of the fiber posts. **PDF**

\*Grandini, S., Goracci, C., Monticelli, F., Tay, F., Ferrari, M. **Fatigue resistance and structural characteristics of fiber posts: three-point bending test and SEM evaluation.** *Dental Materials (2005) 21,75-82*

**Objective:** This study evaluated the fatigue resistance of different types of fiber posts subjected to a fatiguing procedure with a 3-point bending machine. **Methods:** Eight types of fiber posts were selected for this study: Group 1 Easypost (Krugg, Milano, Italy), Group 2 ParaPost Fiber White (Coltene/Whaledent, Mahwah, NJ, USA), Group 3 FibreKor Post (Pentron Technologies, Wallingford, CT, USA), Group 4 Ghimas White (Ghimas, Casalecchio, Bologna, Italy), Group 5 **D.T. Light-Post** (RTD, St Egreve, France), Group 6 FRC Postec (Ivoclar/Vivadent, Schaan, Liechtenstein), Group 7 Lucent Anchor (Dentatus, New, York, USA), and Group 8 Fototech (Isasan Carbotech, Caronno Petrucella, Italy). Each group included 10 posts. A three-point bending machine, loading at an angle of 900 and a frequency of 3 Hz was employed. The test was carried out until 2,000,000 cycles were completed or the post fractured. One-way ANOVA, followed by the Bonferroni test for multiple comparisons was performed to evaluate the 8 groups. The level of significance was set at p<0.05. **Results:** The fatigue test showed statistically significant differences among the different posts. Groups 5 (D.T. Light-Post) and 6 (FRC Postec) performed significantly better than all the other groups; withstanding the entire cycle of loads. All of the other posts fractured before the end of the test. **Conclusions:** the statistical analysis is highly significant: different kinds of posts give different results when they undergo a fatigue resistance test. **PDF**

\*Grandini, S., Chieffi, N., Cagidiaco, M.C., Goracci, C., Ferrari, M. **Fatigue resistance and structural integrity of different types of fiber posts.** *Dent Mater J. 2008 Sep;27(5):687-94.*

The study aimed at assessing and estimating the fatigue resistance of different fiber posts and to observe their ultrastructures through SEM. Six types of fiber posts were used: GC Fiber Post (Group 1), ParaPost Fiber White (Group 2), FibreKor (Group 3), **DT Light-Post** radiopaque (Group 4), FRC Postec (Group 5), and Luscent Anchors (Group 6). Ten out of 15 posts within each group were used for the fatigue test, and the other five were processed for SEM evaluation. The fatigue test revealed that Groups 1, 4, and 5 performed better than all the other groups, and that their performance differed significantly from the other tested groups from a statistical standpoint. For SEM analysis, Groups 1, 4, and 5 also obtained better results. Through correlation analysis, an absence of correlation between fatigue resistance and structural characteristics suggested that the latter reflected more of the divergence inherent in the manufacturing process of fiber posts.

1. **RADIOPACITY**

\*Denny, D., Heaven, T., Broome, J., Weems, R. **Radiopacity of luting cements and endodontic posts .** *J Dent Res. Vol 84 (Spec. Iss. A) Abstract #0675, 2005* (www.dentalresearch.org)

The lack of radiopacity found with some nonmetallic prefabricated radicular posts in combination with the luting cement can make radiographic interpretation difficult. Objective: This study evaluated the radiographic density of nine cements and eleven posts. Methods: Cements tested were: ZnPO4 (Z) Mizzy; Duolink (DL), Hi-X (HX) Bisco; Ketac Cem (KC); Rely X ARC (RA), Rely X Luting (RL), Rely X Unicem (RU) 3M ESPE; Panavia F (PF) Kuraray; Variolink (V) Ivoclar. Posts tested were: **D.T. Light Post** (DT) RTD, St Egreve, France; Twin Luscent Anchor (TLA) Dentatus; Parapost XP steel (XP); Parapost XT titanium, (XT); Fiber White (FW), Whaledent; Achromat (A) Axis; Fibrekor (FK) Pentron; FRC Postec (FRC) Ivoclar. Individual radiographs of each specimen and a continuous aluminum ramp were made using D-speed film (Kodak). These films were scanned and analyzed with NIH Image software. Data were analyzed with a one-way ANOVA and Tukey-Kramer at α=0.05. Results: The mean (sd) density of the cements in terms of equivalent thickness of aluminum were: Z 4.50 (0.45)a, V 3.82 (0.19)b, HX 3.42 (0.27)c, RU 1.57 (0.23)d, RA 1.07 (0.10)e, KC 1.06 (0.17)e, RL 1.02 (0.21)e, DL 0.64 (0.14)f, PF 0.60 (0.24)f.  The density of the posts were: XP 11.12 (0.15)a, XT 5.56 (0.18)b, **A 1.74** (0.07)c, DT 1.65 (0.12)c, FRC 1.34 (0.12)d, FK 1.05 (0.14)e, FW 0.61 (0.10)f, TLA 0.38 (0.10)g, Means of groups with the same superscript were not significantly different. Conclusion: ISO 4049 (2000) for polymer-based materials stipulates that a material must exhibit the radiopacity of an equivalent thickness of aluminum to be deemed radiopaque. Seven of the nine cements and six of the eight posts were found to meet the criteria.

\*Furtos, G., Baldea, B., Bratu,D, Prejmerean, C., Moldovan M. , Silaghi-Dumitrescu L**., Radiopacity of fiber posts.** *J Dent Res. Vol 88 (Sectional) Abstract #142, 2010* (www.dentalresearch.org)

**Objectives:** The aim of this study was to analyse the radiopacity of some glass/carbon fibers and metal post and to compare with the radiopacity of human enamel and dentin.  **Methods**: Four disks of each post (21 materials), mesiodistal sections of human molar (1±0.01 mm thickness) and aluminium step wedges were radiographed on dental X-ray films. After development, dental films were digitized by scan and radiopacity values were recorded for each sample. The radiopacity of the samples was expressed in terms of the equivalent thickness of aluminium per 1mm unit thickness of material. **Results:** ParaPost XP (Coltene Whaledent), FRC Postec Plus (Ivoclar Vivadent), Danville Ice Light (Danvile), **Light Post, DT Light Post** (RTD), showed radiopacity values higher than enamel, Glassix (NORDIN S.A), UniCore Post (Ultradent), Danville Ice Post (Danvile), ParaPost Fiber Lux, ParaPost TaperLux (Coltene Whaledent) showed radiopacity values significantly greater than dentin, while ParaPost FiberWhite (Coltene Whaledent), RelyX™ Fiber Post (3M ESPE), Mirafit White, Mirafit Carbon (Hager & Werken), Fibrapost (PDSA), Saremco posts Non-Stop Fibre (Saremco Dental AG), Aestheti-Plus, DT White Post (RTD), materials showed radiopacity values lower than dentin. Composites from Reforpost Glass Fiber (Angelus), Core post - Glass fiber post, Core post - Carbon fiber post (DenMat) had a radiopacity lower than dentin while the second component of these posts metal had a greater radiopacity than enamel. The results recorded showed statistically significantly differences (significance level = 0.05) when evaluated with One-Way ANOVA statistical analysis. **Conclusions:** Future fiber posts are recommended to have higher radiopacity values than dentin and perhaps ideally similar to or higher than that of enamel for improved of clinical detection. The posts with a lower radiopacity than 1 mm Al could be considered sufficiently radiopaque if the posts would be cemented with higher radiopaque cement. Further works in this direction are needed.

\*Goracci, C, Juloski,J, Schiavetti, R, Mainieri, P, Giovannetti, A, Vichi , A, Ferrari, M. **The influence of cement filler load on the radiopacity of various fibre posts ex vivo.***Int Endod J. 2015 Jan;48(1):60-7. doi: 10.1111/iej.12275. Epub 2014 Mar 20.*

**Objective:** To verify whether the filler load of luting agents influences the radiopacity of intraradicularly placed posts. **Methodology:** Digital radiographs of the following posts were taken: RelyX Fiber Post (3M ESPE), GC Fiber Post (GC Corporation), **DT Light-Post Illusion** (RTD), **DT Light - Post SL** (RTD), Endo-Composipost (RTD), FibreKleer Parallel Post (Jeneric Pentron Incorporated), FRC Postec (Ivoclar Vivadent), Parapost Taper Lux (Còltene/Whaledent AG), Radix Fiber Post (Dentsply Maillefer), EverStick Post (Stick Tech Ltd), Dentin Post X (Komet), Tech 21 X-op (Isasan), ENA Post (Micerium). Post radiopacity was measured in millimetres of aluminium (mmAl) with reference to an aluminium step wedge. Two extracted contralateral premolars were root filled. After post space preparation, taking the midpoint of the post hole as a reference, each tooth was cut longitudinally into two halves in a mesiodistal direction. On each half, the exposed root dentine was ground flat to the deepest point of the post space, and an even layer of cement was placed and light-cured. To obtain a clinically relevant layer of cement, the material thickness was reduced to 75 μm by grinding with wet abrasive paper. A cement formulation with 30 wt% of filler was tested in one premolar, whilst a formulation with 70 wt% of filler was utilized in the contralateral tooth. Posts were then placed between the two facing root halves of each premolar, and radiopacity was measured in mmAl. Data were analysed using t-test for paired samples (P < 0.05). **Results:** Radiopacity of posts ranged between 1.44 (ENA Post) and 5.78 mmAl (FibreKleer). In the presence of the more heavily filled cement, significantly higher values of post radiopacity were measured (P < 0.001). **Conclusion:**The radiopacity of the luting agent contributed to the overall post radiovisibility within the root. Even when the cement with lower filler content was used in combination with the least radiodense dowels, the post was detectable within the root.

\*McClendon, K., Ripps, A., Fan,Y.**Comparative study on radiopacity of fiber posts and resin cements**. *J Dent Res. Vol 89 (Spec. Iss. A) Abstract #253, 2010* (www.dentalresearch.org)

**Objective:** Various articles describe concern for the lack of opacity of glass fiber posts and resin cement bonding systems. The objective of this study is to compare the radiopacity of five different fiber post systems and the opacity of two commonly used resin cement systems to bond the fiber posts. **Methods:** The five fiber post systems [RelyX (R), Parapost (P), **DT Light-Post** Bisco/ RTD (B), Ivoclar (I), and Unicore (U)] and a Fluke Biomedical mammographic aluminum step wedge ranging from 0.4mm to 6mm thick with 15 steps were radiographed on a single film. RelyX Unicem and Ivoclar resin cements were also radiographed with the aluminum step wedge on a separate film. The opacity of each fiber post was converted to aluminum equivalents, as were the opacities of the two bonding resins, taking into consideration the diameter of the posts and thickness of the cement samples. **Results:** The average aluminum equivalent for RelyX was 1.764 ± .04, Parapost 1.62 ± 0.04, Bisco/RTD **2.400 ±** **0.11**, Ivoclar is 2.425 ± 0.03, and Unicore 1.986 ± 0.05. RelyX Unicem resin cement yielded an aluminum equivalent of 4.243 ± 0.62 and Ivoclar yielded an equivalent of 3.194 ± 0.25. **Conclusion:** Statistical analysis revealed significant differences between all posts' mean normalized aluminum equivalent levels with the exception of Bisco and Ivoclar. Bisco and Ivoclar produced notably higher aluminum equivalents, signifying these fiber posts are much more radiopaque. The RelyX Unicem resin cement also had a considerably higher mean normalized aluminum equivalent level than Ivoclar, revealing a much more radiopaque.

1. **LIGHT CONDUCTIVITY**

\*Coutinho, M., Guerisoli, D., Faustino, F., Oliveira, S., Caires, C. **Degree of conversion of luting cement through translucent fiber posts.** *J Dent Res. Vol 96 (Spec. Iss. A) Abstract #1357, 2017(www.dentalresearch.org)*

**Objectives**: Quantify the intensity of light transmitted through translucent fiberglass posts (FP, Phase 1); the efficacy of this transmitted light on the degree of conversion (DC) of a dual resin cement (DRC, Phase 2) and; the DC of DRC by the light emitted by the curing unit through the FP (Phase 3). **Methods**: The FP (n=12/gp) used in this experiment were: White Post DC (WP), Exacto (EX) and **DT Light-Post Illusion X-RO (LP).** During phases 1 and 2, an opaque barrier was used to allow light transmission only through the FP, while during phase 3 the light was cast directly over the FP and the DRC system, on the cervical third of the simulated root canals. After 24hs, samples of the DRC were analyzed under FT-IR. Quantifications of the light transmitted through the FP and the DC of the DRC were performed at 2, 5 and 8mm. **Results**: Data were statistically analyzed (ANOVA and Tukey’s, p>0.05), which showed that transmission of light through FP is similar between the different posts and decreases as they gain distance from the light emitting source. During phase 2, it was not possible to collect the DRC, since it dissolved during the sectioning of the samples, thus indicating that the light transmitted through the FP is not able to activate the setting reaction of the DRC. No differences were detected among the depths of DRC setting at phase 3 (p>0.05). A correlation was found between the DC and the amount of light transmission through FP. When comparing the radicular thirds, the apical portion presented a lower DC than the cervical and middle (p<0.0001) portions. **Conclusions**: It can be concluded that direct light incidence allowed a satisfactory DC of the DRC only at the cervical and middle portions of the canal, independently of the FP used.

\* Dogar, A., Altintas, S.C., Kavlak, S., Guner, A. **Determining the influence of fibre post light transmission on polymerization depth and viscoelastic behaviour of dual-cured resin cement***. Int Endod J. 2012 May 24. doi: 10.1111/j.1365-2591.2012.02085.x. [Epub ahead of print]*

**Aim:** To evaluate the effect of quartz-fibre posts on the depth of polymerization of a dual-cure resin cement using Raman spectroscopy and to determine the physical properties of the polymerized cement using a dynamic mechanical analyzer (DMA). **Methodology**: Twenty-five fibre (**DT Light-Post,** RTD St Egreve, France) and 25 CrNi posts were used to evaluate depth of polymerization. Posts were cemented with dual-cure resin into root canals formed from silicone moulds, without using bonding or etching agents. After polymerization, resin layers on each sample were removed using a curette and cut into three equal parts (apical, middle and coronal). All resin specimens for every third were gathered and crushed. Resin powder samples were analysed using Dynamic Mechanical Analysis and Raman spectroscopy for each third. **Results:** The numerical data revealed that the thermal transitions of the materials took place at higher temperatures from the apical to the coronal sections in both groups. C=C double bond intensity was lower in fibre post-resin cement samples when compared to their intensity in metal post-resin cement samples. **Conclusion:** Dual-cured resin cements had more rigid properties and better polymerization for fibre posts when compared with metal posts. Polymerization quantity was affected by position in the canal. **PDF**

Faria, E. Silva, AL, Arias, V.G, Soares, LE, Martin, AA, Martins, LR .**Influence of fiber-post translucency on the degree of conversion of a dual-cured resin cement**. *J Endod. 2007 Mar;33(3):303-5.*

This study evaluated the degree of conversion of one dual-cured resin cement when used to lute fiber posts with different translucencies. To measure the degree of conversion, polyvinylsiloxane molds were prepared to simulate root canals. The posts, **Aestheti-Post** or **Light-Post,** were cemented in these molds and, after photoactivation, were removed to obtain the resin cement spectrum by FT-Raman spectroscopy. Spectra were acquired at three depths: superficial, medium, and deep. For Light-Post, the resin cement at deep depth showed the lowest degree of conversion and no significant difference in degree of conversion was found between the other depths. For Aestheti-Post, the superficial depth presented a higher degree of conversion values than those in the medium and deep depths, which were not significantly different from each other. Light-Post exhibited a higher degree of conversion than that of Aestheti-Post only at medium depth. Light-Post effectiveness regarding the degree of conversion is dependent on the depth. **PDF**

\*\*Goracci, C., Corciolani, G., Visci, A., Ferrari, M. **Light- transmitting ability of marketed fiber posts**. *J Dent Res87 (12):1122 -1126, 2008.*

If proper polymerization of resin-based cements is to be achieved for fiber post luting, light activation is needed for photo-curing agents, recommended for self-curing materials. The study was aimed at verifying whether the light-transmitting

with a curing unit. Spectrophotometric measurements of the amount of photons reaching different post levels were taken. Data were statistically analyzed (linear regression, two-way ANOVA; alpha = 0.05). No light transmission was recorded through FibreKleer and Tech21 X-OP. For the other posts, light intensity decreased from coronal to apical and rose again at the apical tip, where it peaked for GC Fiber Post, **Macro-Lock Illusion Post**, and Radix Fiber Post. Light transmission was significantly higher at the coronal level. A statistically significant difference in translucency was found for Dentin Post X and FRC Postec Plus in comparison with Reforpost, FibreKleer, Tech21 X-OP, and Composipost. **PDF**

\*Kim, Y.K., Kim, S. K. , Kim, K.H. Kwon, T.Y.. **Degree of conversion of dual-cured resin cement light-cured through three fibre posts within human root canals: an *ex vivo* study.** *International Endodontic Journal Volume 42 Issue 8****,****Pages 667 – 674*

**Aim**To evaluate the degree of conversion of one dual-cured resin cement light-cured through three fibre posts within extracted human teeth. **Method:**Fifteen mandibular premolars were root filled and then divided into three groups. Variolink II was light-cured through the posts (LP, **D.T. Light-Post;** PP, FRC Postec Plus; SP, Snowpost) within the root canal. The degree of conversion was obtained at 1 mm intervals in 9 mm-deep longitudinally sectioned root canals using an optical microscope connected to an FTIR spectrophotometer (*n*=10). The light transmission of each post tested was also examined using UV–Vis spectroscopy. Data were analysed using anova and Tukey's test (*α*= 0.05). **Results:**The LP and PP posts revealed a light transmission of 10.2% and 7.7%, respectively, whereas the SP post exhibited a significantly lower value of 0.5%. The degree of conversion mean value ranged from 32.78% to 69.73% depending on the depth and type of post. For all the groups, there were significant decreases in the degree of conversion values for the middle region when compared with those for the cervical region (*P*<0.05). Except at a depth of 1 mm, the SP group consistently exhibited significantly lower degree of conversion values than the other groups (*P*<0.05). The linear regression analysis revealed a strong correlation between the light transmission of the posts and the overall degree of conversion value for each group (*R*2 = 0.9888). **Conclusions:**The decrease in the degree of conversion for Variolink II relative to the depth was dependent on the light transmission capacity of the posts tested. **PDF**

\*Navarra, CH, Goracci, C, Breschi, L., Vichi, A., Corciolani, G, Cadenaro, M, Ferrari, M. **Influence of post type on degree of conversión of a resin-based luting agent.** *Am J Dent 2012;25: 17-20*

**Purpose:** to assess the degree of conversion (DC) at different levels of a resin-based looting agent used with different commercial posts. **Methods:** a resin-based alluding agent (Variolink II) was light-cured in a simulated dowel space in combination with a different fiber posts GC Fiber post (GC) , **DT Light-Post Safety Lock (SL)** , Rely X Fiber post (RX), Reforpost (RE) **DT Light-Post Illusion** (LPI), FRC Postec Plus, (FP), Radix (RA), Snowpost (SP), Dentin Post (DP) **Macro-Lock Illusion** (MI) and Composipost (CP). After 24 hours,DC was accessed through micro-Raman analysis at the coronal, middle, and apical thirds. 2-way AVOVA and Tukey test were used for the post -hoc comparisons (P<0.05). **Results**: the results demonstrated that the post type, doll space level, and between-factor interaction were statistically significant (P<0.001) . Differences in DC were observed at different depths for RX, RE, LPI, SL, DP, MI and CP, decreasing from the coronal to the apical third. Although the resin-based luting agent should be able to polymerize in the absence of light, a higher DC was found following light irradiation (with a decreasing effect from the coronal to the apical third). **Clinical significance:** fiber post type influence the degree of conversion of the tested resin-taste moving agent.**PDF**

\*Ozturk,O., Turp, V., Sen, D., Tuncelli, B., Ulukapi, H.**Evaluation of fiber post cementation with adhesive techniques.** *J Dent Res. Vol 89 (Spec. Iss. B) Abstract #4487, 2010 (www.dentalresearch.org)*

**Objective:** The aim of this study was to compare the interfacial strength of dual-cured and self-cured resin cements when used in translucent fiber post cementation. **Methods:** Twenty endodontically treated, single canal, extracted human upper central incisors were selected. Translucent fiber posts (**D.T. Light-Post**, Bisco Dental / RTD-St Egreve France) were luted into the root canal using two different resin luting systems with dual-cured (Bisco Duo-Link) and self-curing (Bisco C&B) according to the manufacturer's instructions (n=10). The specimens were transversally sectioned into four slices of 1.00 +/- 0.05 mm thickness in order to perform the push-out tests. Push-out tests were performed at a crosshead speed of 1 mm/min by using a universal testing machine (Shimadzu AG-IS, Shimadzu, Japan). **Results:** The Data was statistically analyzed with One-way ANOVA and Tukey HSD tests (P < .05). Micro push-out bond strengths were significantly affected by the type of luting agent. Fiber-posts luted with self-cured resin cement showed higher bond strengths compared to posts cemented with dual-cured resin cement (P < .05). In both groups, adhesive failures between dentin and cement were observed. **Conclusion:** Self-cured resin cements showed high bond strength values where dual-cured resin cements were less effective. Therefore, self-cured resin cements are recommended for the cementation of transluscent fiber posts.

Ozcan, M, Zamboni, S, Valandro, F, Bottino, M, Bagis, B. **Microhardness of dual-polymerized resin cement around a translucent fiber post in the intraradicular environment.** [J Conserv Dent.](http://www.ncbi.nlm.nih.gov/pubmed/22144805)*2011 Oct;14(4):370-373.*

**Objectives:** In this study, we evaluated the effect of photopolymerization on Vickers microhardness of dual-polymerized resin cement at three locations when a translucent quartz fiber post was used. **Methods:** Single-rooted bovine teeth received quartz fiber post systems (length: 12 mm) using a dual-polymerized resin cement. In Group 1, the posts were cemented but not photopolymerized, and in Group 2, the posts were both cemented and photopolymerized. After cementation, approximately 1.5-mm thick sections were obtained (two cervical, two middle, and two apical) for regional microhardness evaluations. **Statistical analysis:** Statistical analyses were performed using the SPSS software (ver. 11.0 for Windows; SPSS, Inc., Chicago, IL, USA). Microhardness (kg/mm(2)) data were submitted to two-way analysis of variance (two-way ANOVA) and repeated measures with micro-hardness values as the dependent variable and polymerization status (two levels: with and without) and root region (three levels: cervical, middle, and apical) as independent variables. Multiple comparisons were made using Dunnett's T3 post-hoc test. P values of <0.05 were considered to indicate statistical significance in all tests. **Results:** Photopolymerization did not significantly change the microhardness values when compared with no photo-polymerization. Micro-hardness values also showed no significant difference between the three regions in the root canals in both groups. **Conclusions:** The mode of polymerization of the cement tested in combination with the translucent quartz fiber post system did not affect the microhardness of the cement at the cervical, middle, or apical regions of the root. **PDF**

\*Radovic, I., Gabriele Corciolani, G., Magni, E., Krstanovic, G., Pavlovic,V. Zoran, R. Vulicevic, P., Ferrari, M. **Light transmission through fiber post: The effect on adhesion, elastic modulus and hardness of dual-cure resin cement**. *Dental Materials 25 (2009) 837–844*

**Objectives:** The aim of this study was to investigate the effect of fiber post light transmitting ability to the continuity of resin cement-root dentin (C-RD) and resin cement-fiber post (C-FP) interface, elastic modulus and hardness of a dual-cure resin cement. **Methods:** Spectrophotometric measurements were applied for the determination of light transmission at coronal, middle and apical level as well as at the apical tip through Tech 21 X-OP (TECH) and **DT Light- Post** (DT) (RTD; St Egreve, France). Posts were cemented using dual-cured resin cement (Calibra). Roots were sectioned longitudinally through the post. Epoxy resin replicas were made and used to evaluate C-RD and C-FP interface under SEM. Modulus of elasticity (E) and Vicker’s hardness (VH) of the cement layer were assessed. **Results:** No light transmission was detected through TECH. Light transmission through DT decreased from coronal to apical and rose at the apical tip. TECH presented a significantly lower percentage of continuous C-RD and C-FP interface in comparison to DT. Coronal third of C-RD interface in TECH specimens had a significantly higher percentage of continuity than apical third. No regional differences in continuity of C-RD interface were found in DT specimens. E and VH were significantly lower when TECH was used, and decreased from coronal to apical for both posts. **Significance:** Cementation of fiber post with no light transmitting ability using a dual-cured resin cement resulted in lower E and VH of the cement layer, and a lower percentage of continuous C-RD and C-FP interface in comparison to cementation of light transmitting fiber post. **PDF**

Sawada, N, Hikage, S, Sakaguchi, K, **Shape of composite resins photopolymerized by the translucent post**. *J Dent Res.81 IADR Abstract #2569; 2002* *(www.dentalresearch.org)*

**Objectives**: The purpose of this study was to investigate light transmission of a glass fiber post (GFP **Light-Post** #3; RTD St Egreve, France/Bisco) from the shape of polymerized dental resins. **Methods**: The GFP was inserted into composite resins (Lite-Fil II A Shade E1 and Lite-Fil II P Shade A3 (Shofu) in a 1.5ml microtube. The upper end of the post was irradiated with a visible light generator (Griplight II, Shofu) for 20, 40 or 60 seconds. After polymerization, the unpolymerized resin around the GFP was measured. The length (A) of the polymerized resin, the diameter (B) of the upper surface and the diameter (C) of the resin 10mm below (B) were measured. Three samples were measured for each set of conditions. The data were statistically analyzed by Student’s t-test. **Results**: Results showed that irradiation for 20 seconds was insufficient for polymerization, and the measurements of the samples were not possible. In the E1 resin, the value for (A) after irradiation for 60 seconds (15.5 +/- 0.3mm) was significantly larger than after 40 seconds (13.7 +/- 1.1mm) (p<0.05). In addition, the diameters of (B) were 3.7 +/-0.3 (40 seconds) and 5.3 +/- 0.3 (60 seconds), and the diameters of (C) were 6.7 +/- 0.7 (40 seconds) and 8.8 +/- 0.2 (60 sec). In the A3 resin, the extent of the resin polymerization was smaller than that in E1, although the value for (A) in the A3 resin was not significantly different from that in E1. **Conclusions**: Consequently, it was concluded that the composite resins were photopolymerized using the GFP. These results suggest that irradiation of a GFP (Light-Post #3) for over 40 seconds can effectively polymerize a highly translucent resin in clinical practice.

\*Teixeira, C.S., Felippe, M.C.S., Felippe, W.T., Silva-Sousa, Y.C., Sousa-Neto, M.D..**Storage-period influence on the composite resin hardness after root reinforcement.** *J Dent Res. Vol 88 (Spec. Iss. B) Abstract #4568, 2010 (www.dentalresearch.org*)

**Objectives**: This study verified the Vickers hardness (VHN) of a composite resin (CR) after root reinforcement, according to the light-curing time, root region and storage period. **Methods:** Twenty 17-mm long roots were used. Twenty-four hours after obturation, the canal was emptied to a depth of 12 mm, enlarged with diamond points, filled with CR and light-activated through the **DT Light-Post** fiber post for either 40 s or 120 s. After 24 h, each root was sectioned into 3 slices at depths of 2, 6 and 10 mm (n = 30). The initial VHN of the CR was measured as the average of 3 indentations (100g/15s), at lateral distances of 50, 200 and 350 μm from the cement/post. The specimens were stored in water for 18 months and the final VH was measured. **Results**: The ANOVA for repeated measures (α = 0.05) indicated that the factors light-curing time, reinforced region and storage period influenced VH values. In the deepest regions, the hardness of CR was lower, regardless of the storage period. The mean VHN values of CR light-activated for 40 or 120 s were similar in the initial period (p > 0.05) but different after storage for 18 months (p < 0.001). In the group cured for 40 s, there was reduction and statistically significant difference (p < 0.001) between mean VHN values of the RC obtained initially and after 18 months of storage. In the specimens cured for 120 s, there was no statistical difference between the periods (p > 0.05). **Conclusions:** The 18 months storage period reduced mean VHN values in specimens light-activated for 40 s. The light-curing time of 120 s was able to maintain the hardness of composite resin stable over time in all regions.

\*\*Zamboni, S., Nogueira Junior, I., Vanderlei, A,. Bottino, M.A., Zamboni,T*.* **Does the light activation through post is enough?** *J Dent Res. Vol 89 (Spec. Iss. B) Abstract #2192, 2010 (www.dentalresearch.org)*

**Objectives:** The purpose of this study was evaluated the microhardness of a dual cement used at the cementation of translucent posts, in differents depths, with or without light cure activation. **Methods:** Ten single-rooted bovine teeth were used. The crownes were removed, and standardized sizes of 16mm were used. The canal root was prepared with burs nº 3 of **Macro-Lock Post** system (RTD). The roots were painted with black nail varnish to block the passage of light. The teeth were treated with Adhesive System All Bond 2 (Bisco), and the posts Macro-Lock /RTD) with Duo-link dual cement, which changed the activation method: A- without light-cured activation; B- with light cured activation (Optilight Plus, Gnatus, 500mW/cm²). The specimens were cut transversally, obtaining six slices with a thickness of 1,5mm. The cuts were divided according to their places (cervical, middle and apical) and the microhardness FM 700, Futuretech (Vickers, 50g/ 70s) of cement was estimated. The set groups were: G1- cervical without light cure activation; G2- middle without light cure activation; G3- apical without light cure activation; G4- cervical light cured; G5- middle light cured; G6- apical light cured. **Results:** Data were submitted by the statistics (ANOVA and TUKEY–α=5%). The light-cured groups (G4: 29,12±2,47, G5: 28,17±1,85, G6:28,52±1,67) obtained more significant values than the groups without light-cure activation (G1:24,64±1,87, G2:15,72±0,89, G3:14,90±0,45). Among the places, were could observe that a harder part was noticed in those group without light cure activation; meanwhile the places of this group didn't show any significant difference. **Conclusion:** The activation of polymerization with halogen light of dual cement and the transmission of light through of translucent post were able to increase the cement hardness.

\*Zanatta, RF., Tavares, RDP, Barreto, BC, Soares, C.J. **Polymerization effect through translucent fiberglass posts in self-adhesive resin cements.** *J Dent Res. Vol 91 (Spec. Iss. B) Abstract #2744, 2012* *(www.dentalresearch.org)*

**Objective:** Test capacity of 3 translucent fiberglass posts to transmit light to cure self-adhesive resin cement simulating different depths of root canal. **Method:** Degree of conversion (%DC) was monitored using the Fourier Transform Infrared Spectroscopy (FTIR).  A Teflon device with a central orifice correspondent to the posts geometry was produced to simulate the root canal. The device consists of 5 rings (2mm in height each) that enable measure % DC in 10, 8, 6, 4 and 2 mm of the posts, and a last ring (1mm in height and 1.5mm of central orifice) where self-adhesive resin cement was set. The device was placed on spectrometer sample holder; cement was manipulated according manufactory instructions and after chemical polymerization (3 minutes) it was light-activated. Halogen and LED light was tested. Data were submitted to homogeneity analysis and 3-Way Anova test (p<0.05) **Result:** Table 1 shows means and standard deviation of %DC for fiberglass post and polymerization lights. Great depths showed smaller %DC for all posts. **Conclusion:** Translucent fiberglass posts are able to transmit light to cure self-adhesive resin cement and the length of the post interfered negatively in the cement polymerization.

1. **Diametral Tensile Strength**

\*\*Chaney, A., Schulze, K., Roetzer, P., Chann, G., Alenezi, H., Bhattacharyya, M. **Diametral tensile strength and cost-effectiveness of commercially available fiber posts.** *J Dent Res. Vol 96 (Spec. Iss. A) Abstract #0739, 2017 (www.dentalresearch.org)*

**Objectives**: The goal in this study was to evaluate the difference of diametral tensile strength (DTS) obtained from commercially available fiber posts for cementation in root canals. The price of each fiber post was then compared with the DTS to evaluate the cost-effectiveness. The null hypothesis was that there is no difference between the cost-effectiveness among the manufacturers. **Methods**: Commercially available fiber posts from 12 different companies were selected (size 1.5 in diameter). The following manufacturers and post types have been included in the study. 3M ESPE–RelyX Fiber Post; Synca-Biolight DUAL; Denmat–Core-Post; GC–Fiber Post; Danville–Ice lite; RTD–**Macro-Lock Post X-RO;** Ultradent–Unicore; VOCO–Rebilda Post; Kerr Achromat-Axis; Bisco-**D.T. Light-Post**; Pentron-FibreKleer; Henry Schein-Precision Post. All posts can be used for build-up placements after root canal performance. Ten posts from each group were sectioned perpendicular to the long axis with a slow-speed-diamond saw (Buehler) to obtain 1mm thick slices from the parallel end of the post. The slices were then subjected to a diametral tensile strength test in a universal testing machine (INSTRON-1011) at a crosshead speed of 1mm per min until failure in static testing mode. Regression analysis using R statistical software has been used at a 95% confidence interval. Prizes have been compared to mean strength values to determine the cost-effectiveness of the fiber posts. **Results**: Average diametral strength values in MPa (±std dev) have been evaluated. A statistical significant difference among groups has been found p= 2e-16. The three most cost-effective manufacturers were: Henry Schein, RTD and Pentron with 0.21, 0.22, 0.23, respectively. The null hypothesis was rejected. **Conclusions**: RTD had the highest DTS while Henry Schein had the best cost-effectiveness.

\*\*Chaney, A., Schulze, K., Roetzer, P., Alenezi, H., Bhattacharyya, M. **Diametral tensile strength tests of different commercially available fiber posts.** *J Dent Res. Vol 95 (Spec. Iss. A) Abstract #1862, 2016 (www.dentalresearch.org)*

**Objectives**: The goal in this study was to evaluate the difference of diametral tensile strength obtained from commercially available fiber posts for cementation in root canals. The null hypothesis was that there is no difference between the manufacturers in strength. **Methods**: Commercially available fiber posts from eight different companies were selected in two different size ranges(1.2mm and 1.5mm in diameter).The following manufacturers and post types have been included in the study. Group 1:3M ESPE–RelyX Fiber Post; Group 2: Synca-Biolight DUAL; Group 3: Denmat–Core-Post; Group 4:GC–Fiber Post; Group 5: Danville–Ice-Light; Group 6: RTD–**Macro-Lock Post X-RO**; Group 7:Ultradent–Unicore; Group 8:VOCO–Rebilda Post. All posts can be used for build-up placements after root canal performance. Ten posts from each group were sectioned perpendicular to the long axis with a slow-speed-diamond saw (Buehler) to obtain 1mm thick slices from the parallel end of the post. The slices were then subjected to a diametral tensile strength test in a universal testing machine INSTRON 1011 at a crosshead speed of 1mm per min until failure in static testing mode. Regression analysis using R statistical software has been used at a 95% confidence interval. **Results**: A statistical significant difference among groups has been found p= 2e-16. The null hypothesis was rejected. **Conclusions**: Group 6, the Macro Lock Post X-RO system from RTD, had the highest diametral tensile strength among all the groups tested.

# III. Mechanical Properties; interaction with tooth

1. **Fracture Strength of restored teeth (see also Customized Low-Modulus Restoration section)**

[Abo El-Ela, OA](http://www.ncbi.nlm.nih.gov/sites/entrez?db=pubmed&cmd=search&term=%25252522abo%25252520el-ela%25252520oa%25252522%2525255bauthor%2525255d&itool=entrezsystem2.pentrez.pubmed.pubmed_resultspanel.pubmed_discoverypanel.pubmed_rvabstractplus), [Atta, OA](http://www.ncbi.nlm.nih.gov/sites/entrez?db=pubmed&cmd=search&term=%25252522atta%25252520oa%25252522%2525255bauthor%2525255d&itool=entrezsystem2.pentrez.pubmed.pubmed_resultspanel.pubmed_discoverypanel.pubmed_rvabstractplus), [El-Mowafy, O](http://www.ncbi.nlm.nih.gov/sites/entrez?db=pubmed&cmd=search&term=%25252522el-mowafy%25252520o%25252522%2525255bauthor%2525255d&itool=entrezsystem2.pentrez.pubmed.pubmed_resultspanel.pubmed_discoverypanel.pubmed_rvabstractplus). **Fracture resistance of anterior teeth restored with a novel nonmetallic post.** *J Can Dent Assoc. Jun;74(5):441 2008*

**Objective:** To determine the fracture resistance of endodontically treated anterior teeth restored with a novel nonmetallic post in combination with self-etching adhesives. **Methods:** Extracted maxillary anterior teeth were sterilized with gamma irradiation, and each crown was severed 2 mm above the cementoenamel junction. Endodontic treatment was performed, and the teeth were divided into 7 test groups according to the post-adhesive combination used (n = 8 in each group). The following combinations of posts and adhesives were used: group 1, ParaPost stainless steel post with glass ionomer cement (control group); group 2, **Light-Post** post with Clearfil SE Bond bonding agent and Panavia-F adhesive; group 3, Light Post post with Xeno-III bonding agent and Panavia-F adhesive; group 4, ParaPost Fiber White post with Clearfil SE Bond bonding agent and Panavia-F adhesive; group 5, ParaPost Fiber White post with Xeno-III bonding agent and Panavia-F adhesive; group 6, everStick post with Clearfil SE Bond bonding agent and Panavia-F adhesive; and group 7, everStick post with Xeno-III bonding agent and Panavia-F adhesive. Core build-ups to restore anatomic form were made from light-cured composite (TPH3). Specimens were stored in water at 37 degrees C. The roots of each tooth were embedded in an acrylic base, and the teeth were mounted at 135 degrees to the horizontal. The teeth were loaded in an Instron machine, and loading was applied to the point of fracture. Fracture loads were recorded, means and standard deviations (SDs) were calculated, and the data were analyzed with analysis of variance (ANOVA) and Tukey"s tests. **Results:** The mean fracture load (and SD) for each group was as follows: for group 1, 536.8 (75.1) N; for group 2, 1,000.1 (190.9) N; for group 3, 1,049.9 (231.5) N; for group 4, 1,548.5 (290.0) N; for group 5, 1,171.3 (296.9) N; for group 6, 1,711.7 (516.7) N; and for group 7, 1,825.7 (527.3) N. ANOVA revealed significant differences among the groups (p < 0.001). In addition, the mean fracture value for group 7 was significantly higher than those of the other groups p < 0.05) except for groups 4 and 6. **Conclusions:** Use of a novel glass fibre post (the everStick post) was associated with the highest mean fracture force for maxillary anterior teeth, regardless of the bonding agent used, whereas the stainless steel post was associated with the lowest mean fracture force. **PDF**

**\***Adanir, N, Ureyen Kaya, B, Kececi, AD. **Fracture resistance of roots restored with four different fiber-reinforced composite posts.** *Med Princ Pract. 2015 Jun 23. [Epub ahead of print]*

**Objective:** The aim of this study was to compare the resistance to vertical root fracture of root-filled teeth restored with four different fiber-reinforced composite (FRC) post systems and two types of dual-cured resin luting agents. **Methods:** Ninety extracted human maxillary central incisors were selected and decoronated to obtain a standardized root length of 14 mm. After root canal obturation, post spaces were prepared to a depth of 10 mm with a No. 3 post drill. The specimens (n = 80) were divided into two groups (n = 40) according to the resin luting agents used: group 1, Variolink II + ExciTE DSC; group 2, RelyX Unicem. These groups were subdivided into four subgroups (n = 10) and restored with one of the following post systems: (a) **DT Light-Post**, (b) **DT Light-Post SL**, (c) FRC Postec and (d) Everstick, while the remaining 10 teeth served as controls. The roots were subjected to axial compressive loading using a 2.2-mm-diameter metal sphere in a universal testing machine (0.5 mm/min). A factorial experiment with a single control group (analysis of variance) was used to test the resistance of the specimens. **Results:** Groups 2a (DT Light + RelyX Unicem; 398.5 N) and 1b (DT Light SL + Variolink II + ExciTE DSC; 431.1 N) had significantly higher resistance to fracture than the control group (334.1 N; p < 0.05). DT Light SL and FRC Postec Plus were more resistant to fracture when Variolink II was used as the luting cement. DT Light and Everstick had higher fracture resistance when they were luted with RelyX Unicem (p < 0.05). **Conclusion:** The results of this study indicate that the use of quartz fiber posts (DT Light and DT Light SL) with an adhesive luting cement in root-filled teeth may reinforce the root to some extent. **PDF**

\*Akkayan, B., Gulmez, T.: **Resistance to fracture of endodontically treated teeth restored with different post systems.**  *J Prosthet Dent* *2002; 87:431-7*

**Statement of problem**: Very little is known about the resistance to fracture of endodontically treated teeth restored with newly developed esthetic post systems. **Purpose:** This in vitro study compared the effect of 1 Titanium and 3 esthetic post systems on the fracture resistance and fracture patterns of crowned, endodontically treated teeth. **Methods:** A total of 40 recently extracted human maxillary canines with their crowns removed were endodontically treated. Four groups of 10 specimens were formed. Teeth were restored with Titanium (Filpost), quartz fiber (**D.T. Light-Post**), glass fiber (ParaPost White) and Zicronia (Cosmopost) posts and numbered as groups 1, 2, 3 &4, respectively. All posts were cemented with Single Bond dental adhesive system and dual-polymerizing RelyX ARC adhesive resin cement. All teeth were restored with composite cores, and metal crowns were fabricated and cemented with glass ionomer cement. Each specimen was imbedded in acrylic resin and then secured in a universal load testing machine. A compressive load was applied at a 130-degree angle to the long axis of the tooth until fracture, at a crosshead speed of 1mm / min. One-way analysis of variance and a Tukey test were used to determine the significance of the failure loads between groups (P<.001). A non-parametric **X**2 test was conducted for evaluation of the mode of failure (P<.001). **Results:** The mean failure loads (kg) were 66.95, 91.20, 75.90, and 78.91 for groups 1 – 4, respectively. Teeth restored with quartz fiber posts (group 2) exhibited significantly higher resistance to fracture (P<.001) than the other 3 groups. Teeth restored with glass fiber and zirconia posts (groups 3 and 4) were statistically similar (P<.05). Fractures that would allow repair of the tooth were observed in groups 2 and 3, whereas unrestorable, catastrophic fractures were observed in groups 1 and 4 (P<.001). **Conclusion:** Within the limitations of this study, significantly higher failure loads were recorded for root canal treated teeth restored with quartz fiber posts (D.T. Light-Post: RTD, St Egreve, France). Fractures that would allow repeated repair were observed in teeth restored with quartz fiber and glass fiber posts. **PDF**

\*Akkayan, B. **An in vitro study evaluating the effect of ferrule length on fracture resistance of endodontically treated teeth restored with fiber-reinforced and zirconia dowel systems.** *J Prosthet Dent. 2004 Aug;92(2):155-62*

**Statement of problem:** There are few published studies analyzing the effects of different ferrule lengths of endodontically treated teeth in relationship to newly developed fiber-reinforced and zirconia dowel systems. **Purpose:** This in vitro study compared the effect of 3 different ferrule lengths on the fracture resistance and fracture patterns of crowned endodontically treated teeth restored with 4 different esthetic dowel systems. **Methods:** The crowns of 123 human maxillary canines were removed at the cementoenamel junction and the roots were endodontically treated. Three master tooth models were prepared to ferrule lengths of 1.0 mm, 1.5 mm, and 2.0 mm to produce 3 master analogs. Each root was embedded in autopolymerizing resin with a 0.2-mm layer of silicone impression material to simulate the periodontal ligament. Forty analogs of each master tooth, with ferrule lengths of 1.0 mm, 1.5 mm, and 2.0 mm were produced with copy-milling (Celay system). Each group was further subdivided into 4 groups of 10 specimens each and restored with 4 different esthetic dowel systems: quartz fiber (**D.T. Light-Post-** RTD St Egreve, France), glass fiber ER DentinPost/Brasseler-Komet, Germany), glass fiber plus zirconia (EasyPost, Dentsply-Maillefer, Switz.), and zirconia (CosmoPost, Ivoclar-Vivadent, Liechtenstein). All dowels were luted with adhesive resin cement (RelyX ARC), restored with composite cores (Valux Plus), and Ni-Cr alloy (Wiron 99) complete crowns. All specimens were loaded at 130 degrees to the long axes in a universal testing machine at a crosshead speed of 1 mm/min until fracture. Fracture patterns were classified as failures above or below the incisal third of the roots. The data were analyzed with 2-way ANOVA and Tukey HSD tests (alpha=.05). A Fisher exact test was conducted for evaluation of the mode of failure (alpha=.05). **Results:** Mean failure loads (kg) for quartz fiber, glass fiber, glass fiber plus zirconia, and zirconia groups, respectively, with the 3 ferrule lengths were: 1.0-mm ferrule specimens: 98.09 +/- 2.90, 85.36 +/- 2.82, 80.24 +/- 1.88, 70.11 +/- 2.48; 1.5-mm ferrule specimens: 101.0 +/- 2.88, 87.58 +/- 2.83, 89.8 +/- 2.09, 82.71 +/- 2.14; 2.0-mm ferrule specimens: 119.5+/-1.78, 99.84+/-1.23, 98.6 +/- 1.64, 95.42 +/- 1.02. Teeth prepared with 2.0-mm ferrules demonstrated significantly higher fracture thresholds (P<.001). There were no significant differences in fracture patterns. **Conclusions:** Increasing the ferrule length of the endodontically treated teeth from 1 mm to 1.5 mm in specimens restored with quartz-fiber and glass-fiber dowels did not produce significant increases in the failure loads (P=.084, P=.119, respectively). No significant difference was detected between glass-fiber and glass-fiber plus zirconia dowels with 1.5-mm and 2.0-mm ferrules (P=.218, P=.244, respectively). However, fracture thresholds were higher for all 4 dowel systems when the specimens were prepared with a 2.0-mm ferrule length (P<.001). **PDF**

\*Antonson, S.A., Yilmaz, Z., Kilinc, E., Antonson, D.E,, Hardigan, P*.***Fracture resistance of endodontically treated lower incisors with fiber posts.** *J Dent Res. Vol 88 (Spec. Iss. A) Abstract # 1912, 2009. (www.dentalresearch.org)*

**Objectives:** To compare the effects of four fiber post systems with three luting cements on the fracture strength of endodontically treated and crowned lower anterior teeth. **Methods:** The root canals of 104 lower incisors were prepared to a #40 size. Roots covered in adhesive-tape to simulate PDL were mounted in acrylic-resin. Post spaces were prepared at 9mm leaving 5mm apical gutta-percha. Samples were divided into 12 study groups including four fiber post systems(Parapost Taperlux/ColteneWhaledent;  **D.T.Light-Post** (RTD, St Egreve, France / Bisco);  PeerlessPost/SybronEndo; SpirapostPFS/ZenithDental) and three cements(RelyX-Unicem /3MESPE; Nexus2-Dual-cure/Kerr; DualSyringe/Bisco). Control group included gutta-percha without posts. All teeth were restored(Parapost Paracore dual-cure-corematerial) and prepared in standard manner(4mm core-height, 1.2mm chamfer-finishline, 2mm ferrule). Base-metal full crowns including labial-step design(1x1mm) were fabricated and cemented with respective cements. Samples were statically loaded(Instron, 0.5mm crosshead-speed,18°angle on labial-step) until failure. Failure load(N) was statistically analyzed using One-way ANOVA with Tukey'sHSD. Samples were ranked by χ2 test for independence for the type of failure(catastrophic/favorable). Results: No differences were found between post or cement groups (p>0.05). Type of failure was not significant in any particular group. **Conclusions:** The different fiber posts with various cements performed similarly both in fracture toughness and failure mode, having the control group performing the best. Inclusion of ferrule may have an effect on the comparable results. Materials were supplied by respective companies.

\*Ayad, MF, Bahannan, SA, Rosenstiel, SF. **Fracture resistance of structurally compromised roots with aesthetic dowel systems** *J Dent Res.87 (Special Issue A) AADR Abstract #1036; 2008* *(www.dentalresearch.org)*

**Objectives:** This study evaluated the validity of composite resin and glass ionomer cement for reinforcement of flared root canals before aesthetic dowel system application. **Methods:** To simulate weakness, the entire surfaces of 140 extracted human single-rooted teeth were enlarged to reduce the thickness of dentin wall to 0.5 mm. The teeth were equally divided into 7 test groups (n=20) according to the canal irrigant used: no irrigant (control), 5% hydrogen peroxide, 5% sodium hypochlorite, a combination of 5% hydrogen peroxide and sodium hypochlorite, 15% ethylenediaminotetraacetic acid (EDTA), 10% lactic acid, or 20% lactic acid. Within each group, half of treated root canals (n=10) were filled with composite resin (PermaFlo, Kerr) and the other half were filled with glass ionomer (Fuji One, GC America). A light-transmitting plastic post (Luminex, Dentatus) was used to create space for the fiber-reinforced posts (**D.T. Light-Post**, RTD, St Egreve, France/ Bisco) and (**Aestheti-Post,** (RTD, St Egreve, France/ Bisco) (n=5) and to cure the restorative materials All posts were cemented with adhesive resin cement (Panavia 21, Kurrary). Compressive load was applied at 130¨¬ on lingual surface of the composite core (Corestore 2, Kerr) to obtain the fracture resistance on an Instron universal testing machine. The data were analyzed with 1-way ANOVA followed by Ryan-Einot-Gabriel-Welsch Multiple Range Test (a=.05). **Results:** Lactic acid solutions and EDTA created micromechanical retention in the dentin with composite resin. Moreover, a hybrid layer was detected along the dentin wall and fracture resistance was significantly higher than other groups (p<.001). **Conclusions:** Composite resin bonding systems are an efficient method to reinforce structurally compromised roots with a lactic acid irrigant. Moreover, aesthetics can be enhanced with aesthetic dowel rehabilitation.

Burmann, P, Cardoso, P., Santos, J, Soares, L. **Post Systems: compressive strength of roots prepared at 2/3 and ½** **length restored with post systems**. *J Dent Res.81 IADR Abstract #1933; 2002* *(www.dentalresearch.org)*

**Objectives:** Evaluate the mechanical resistance of roots restored with prefabricated posts. **Methods:** 40 sound upper human central incisors had the crown removed and the roots were endodontically treated. After 24 hours, the root canals were prepared using low rotation, going 2/3 or ½ down the depth of the root, and were divided into 4 groups (n=10). Group A: 10 roots were prepared on 2/3 of the depth for the cementation of the Unimetric Post (Dentsply/Maillifer) (**UNI**) using Clearfil LinerBond 2V and Panavia F (Kuraray Co. Japan), according to manufacturers instructions; Group B: 10 roots were prepared ½ down into the root canal for cementation with the same system as Group A; Group C: 10 roots were prepared on 2/3 of the depth for the cementation of the **Aestheti-Post** (AES: RTD, St Egreve, France) /Bisco) using ALL-BOND 2 (Bisco) and Post Cement HI-X (Bisco); Group D: 10 roots were prepared ½ down into the root canal for cementation with the same system as Group C. Three mm of the post were left outside of the root canal, on the cervical portion, to allow the fixation of the core restoration with composite resin (Z250-3M/ESPE, USA). Simulating preparation for a crown. The specimens underwent compression at 450 on a universal testing machine, at a speed of 0.5 mm/min. until fracture. **Results:** The mean values of load obtained at fracture (Group A=93.4 Kgf, Group B=88.4 Kgf, Group C=95.7 Kgf, Group D=96.3 Kgf) were statistically tested using ANOVA two-way test. **Conclusions:** All groups showed statistically similar results (p>0.05).The different preparation depths of the root canals did not influence the results of the strength tests.

Cardoso, P.C., Burmann, P.A., Silveira, B., Albers, A, Soares, L.F. **Fracture strength of bovine pulpless teeth restored by post systems**. *J Dent Res. 80; AADR Abstract # 227; 2001* *(www.dentalresearch.org)*

The development of adhesive cements and prefabricated post system (PPS) provides us a conservative alternative to the traditional cast post –core in the reconstruction of endodontically treated teeth. However, the fracture strength of the core/tooth structures continues to be an object of doubts and discussions. The study aimed at evaluating the “in vitro” fracture strength of roots of restored inferior incisor bovine teeth. Thirty bovine teeth and ten human teeth were selected to constitute 4 groups (n=10); group 1) PPS Cosmopost (Ivoclar) + Syntac + Variolink II (Vivadent); group 2) PPS C-Post + All Bond 2 + Post Cement HI-X (Bisco, Inc., USA); group 3) PPS **Aestheti-Post** +All Bond 2 + Post Cement HI-X (Bisco, Inc., USA); and the group 4) (control group) human incisor teeth prepared for metal ceramic crown. The roots all the same length (15 mm), were embedded into acrylic resin blocks with a film (0.2 mm) of vinyl polysiloxane to simulate the periodontal ligament. The core was build up with composite (7.250 – 3M USA) through a custom transplant matrix. After 24 hours storage (H20/37ºC) the specimens were submitted to the comprehensive test in Richie universal testing machine. The statistical analysis of the data (ANOVA) revealed no significant difference (p>0.05) among the fracture strength averages of the four groups. The values obtained from the pre-fabricated post systems gave us results are similar to those obtained with natural teeth.

D'Arcangelo, C, De Angelis, F, Vadini, M, Zazzeroni, S, Ciampoli, C, D'Amario, M. **In vitro fracture resistance and deflection of pulpless teeth restored with fiber posts and prepared for veneers.** *J Endod. 2008 Jul;34(7):838-41. Epub 2008 May 16.*

The aim of this in vitro study was to evaluate the influence of endodontic therapy, veneer preparation, and their association on fracture resistance and deflection of pulpless anterior teeth and assess whether restoration with quartz fiber-reinforced post can influence these properties. Seventy-five freshly extracted human maxillary central incisors were selected. Teeth were randomly divided into 4 experimental groups (veneer preparation/endodontic therapy/endodontic therapy and veneer preparation/endodontic therapy, veneer preparation, and fiber post placement) and a control group (n = 15). Specimens were loaded to fracture recording crown deflection under load, and data were statistically analyzed. Veneer preparations and endodontic treatment did not significantly influence fracture resistance of maxillary incisors. On the contrary, preparation for veneer significantly increased the deflection values of the specimens. Fiber post (**Endo Light-Post,** RTD St Egreve , France) restorations seemed to significantly increase mean maximum load values for specimens prepared for veneers. A fiber-reinforced post restoration can be suggested when endodontic treatment is associated with veneer preparation. **PDF**

D'Arcangelo C, De Angelis F, Vadini M, D'Amario M, Caputi S**.** **Fracture resistance and deflection of pulpless anterior teeth restored with composite or porcelain veneers.***J Endod. 2010 Jan;36(1):153-6.*

**Introduction:** The aim of this in vitro study was to evaluate the influence that resin composite and porcelain veneer restorations, associated or not to fiber post placement, have on fracture resistance and deflection of pulpless anterior teeth. **Methods:** One hundred twenty freshly extracted human maxillary central incisors were selected. Teeth were randomly divided into 7 experimental groups (veneer preparation/resin composite veneer placement/endodontic therapy and resin composite veneer placement/endodontic therapy, fiber post and resin composite veneer placement/porcelain veneer placement/endodontic therapy and porcelain veneer placement/endodontic therapy, fiber post and porcelain veneer placement) and a control group (n = 15). Specimens were loaded to fracture recording crown deflection, and data were statistically analyzed. **Results:** Veneer preparations did not significantly influence fracture resistance of incisors. On the contrary, veneer preparation significantly increased specimen deflection values. Fiber posts seemed to significantly increase mean maximum load values for endodontically treated teeth restored with either composite or porcelain veneers. C**onclusions**: A fiber post restoration can be suggested when endodontic treatment is associated with veneer restoration. Veneer restorations seem to be an optimal choice also for endodontically treated teeth. **PDF**

Dean, J. P., Jeansonne, B. G., and Sarkar, N. **In vitro evaluation of a carbon fiber post.** *Journal of Endodontics*. *24: 807-810, 1998.*   
 **Abstract/conclusions:** The purpose of this study was to evaluate the influence of endodontic and restorative procedures on fracture resistance of teeth, and to compare the incidence of root fracture in teeth with clinical crowns removed that were restored with three different types of post and a composite core build-up. Seven groups of 10 extracted maxillary canines were used. A control group had only a crown preparation, but no endodontic treatment. Three groups had endodontic treatment, crown preparation, and the access restored. Three groups had endodontic treatment, the crown totally removed, a tapered, parallel, or carbon post (**Composipost**, RTD St Egreve, France) placed, and a composite build-up. All specimens were subjected to a 45-degree load at 0.5 mm/min until failure occurred. The force at failure and the location of fracture were recorded. The groups with post and composite build-ups failed at significantly lower force than the teeth in which the crowns had not been removed. There were no significant differences in the amount of force required to produce failure among the three groups with different posts and a composite build-up. The group restored with the Composipost had no root fractures, whereas there were five fractures (50%) in each of the parallel and tapered post groups. **PDF**

Dietschi, D, Ardu, S, Rossier-Gerber, A, Krejci, I. **Adaptation of adhesive post and cores to dentin after in vitro occlusal loading: evaluation of post material influence.** *J Adhes Dent. 2006 Dec;8(6):409-19*

**Purpose:** Fatigue resistance of post and cores is critical to the long term behavior of restored nonvital teeth. The purpose of this in vitro trial was to evaluate the influence of the post material's physical properties on the adaptation of adhesive post and core restorations after cyclic mechanical loading. **Methods:** Composite post and cores were made on endodontically treated deciduous bovine teeth using 3 anisotropic posts (made of carbon, quartz, or quartz-and-carbon fibers) and 3 isotropic posts (zirconium, stainless steel, titanium). Specimens were submitted to 3 successive loading phases--250,000 cycles at 50 N, 250,000 at 75 N, and 500,000 at 100 N--at a rate of 1.5 Hz. Restoration adaptation was evaluated under SEM, before and during loading (margins) and after test completion (margins and internal interfaces). Six additional samples were fabricated for the characterization of interface micromorphology using confocal microscopy. **Results:** Mechanical loading increased the proportion of marginal gaps in all groups; carbon fiber posts presented the lowest final gap proportion (7.11%) compared to other stiffer metal-ceramic or softer fiber posts (11.0% to 19.1%). For internal adaptation, proportions of debonding between dentin and core or cement varied from 21.69% (carbon post) to 47.37% (stainless steel post). Debonding at the post-cement interface occurred only with isotropic materials. Confocal microscopy observation revealed that gaps were generally associated with an incomplete hybrid layer and reduced resin tags. **Conclusions:** Regardless of their rigidity, metal and ceramic isotropic posts proved less effective than fiber posts at stabilizing the post and core structure in the absence of the ferrule effect, due to the development of more interfacial defects with either composite or dentin. **PDF**

Dikbas, I, Tanalp, J, Ozel, E, Koksal, T, Ersoy, M. **Evaluation of the effect of different ferrule designs on the fracture resistance of endodontically treated maxillary central incisors incorporating fiber posts, composite cores and crown restorations.** *J Contemp Dent Pract. 2007 Nov 1;8(7):62-9.*

**Aim:** The purpose of this study was to evaluate the fracture resistance of endodontically treated maxillary central incisors restored with quartz fiber posts, composite cores, and crowns when different types of ferrule designs were incorporated. **Methods:** Sixty maxillary incisors were divided into six groups: Group 1 (control): teeth with root canal treatments having a full crown prosthesis; Group 2: teeth with a 2 mm circumferential ferrule; Group 3: teeth with a 2 mm ferrule only in the vestibular region; Group 4: teeth with a 2 mm ferrule only in the palatal region; Group 5: teeth with a 2 mm ferrule in the vestibular and palatal region, having cavities in both proximal areas; and Group 6: teeth with no ferrule. The teeth in the experimental groups were restored with quartz fiber posts (**DT Light-Post, RTD**, St Egreve, France) -composite cores and full metallic crowns. All experimental teeth were subjected to an increasing compressive force with a crosshead speed of 1 mm/min, until fracture occurred. **Results:** The median fracture values of groups were as follows: Group 1: 574.4 N, Group 2: 472.4 N, Group 3: 474.3 N, Group 4: 480.7 N, Group 5: 463.1 N, and Group 6: 297.9 N. A statistically significant difference was found between Group 1 and Group 6 (p< 0.01). **Conclusions:** It was concluded different ferrule designs did not have any influence on the fracture resistance of teeth with fiber posts. The results of this study indicate fiber posts can safely be used for their reinforcing properties. Furthermore, there is no significant change in the resistance of teeth with fiber posts regardless of which ferrule design is incorporated. The property of these types of posts is an additional advantage in clinical practice. **PDF**

Dikbas I, Tanalp J, Koksal T, Yalnız A, Güngör T. **Investigation of the effect of different prefabricated intracanal posts on fracture resistance of simulated immature teeth**. *Dent Traumatol. 2013 Feb 4. doi: 10.1111/edt.12034. [Epub ahead of print]*

**Aim:** The aim of this study was to assess fracture resistances of simulated immature single-rooted teeth whose roots have been backfilled using 3 different post systems after a 4 mm apical mineral trioxide aggregate (MTA) placement. METHODS: Forty-eight maxillary anterior teeth were assigned into four groups. The lengths of each root were standardized by cutting off the coronal and apical portions to obtain 13 ± 1 mm samples and root canals were enlarged. The #6 Peeso reamers were allowed to protrude 1 mm beyond apex to simulate immature teeth. Apical 4 mm of each tooth was filled using MTA. The remaining portions were treated as follows: Group 1 (Control): AH Plus + Gutta-percha cold lateral compaction. Group 2: Glass fiber posts (FRC Postec Plus post) cemented using self-adhesive resin cement. Group 3: Quartz fiber posts (**D.T. Light -Post**) cemented using self-adhesive resin cement. Group 4: Zirconia posts (Cosmopost) were placed using self-adhesive resin cement. Specimens were embedded in self-curing acrylic. A compressive load was applied lingually at a crosshead speed of 1 mm/min at an angle of 45º until fracture in a universal testing machine. RESULTS: The mean fracture resistances were 823.17 ± 188.80, 1155.50 ± 190.37, 1208.00 ± 254.32, and 1153.25 ± 195.71 Newtons for Groups 1, 2, 3, and 4, respectively. All experimental groups had significantly higher fracture resistance compared with the control group (P < 0.01). No statistically significant difference was noted between the experimental groups (P > 0.05). **Conclusions:** All post systems exerted a similar reinforcing effect to a simulated immature tooth and may be preferred specifically in situations which require additional reinforcement.

\*Fathi, M., Mortazavi, MV, Katiraie, N.  **Fracture resistance of endodontically treated teeth restored with esthetic posts.**  *J Dent Res.Vol 87 (Spec Iss A) Abstract #1857, 2008* *(www.dentalresearch.org)*

**Objectives:** This study compared the effect of three esthetic post systems with different modulus of elasticity on the fracture resistance and fracture patterns of endodontically treated teeth with structurally compromised and normal roots. **Methods**: Forty five extracted and root canal treated central incisors were assigned to 2 main experimental groups called "narrow" and "flared" canals. Narrow-canal group divided into 2 and flared-canal group, divided into 3 experimental subgroups (n=9). For narrow-canal subgroups, post spaces were prepared with the corresponding drills to restore with quartz fiber double taper light posts (**D.T. Light-Post**; RTD St Egreve, France) [subgroup A] and zirconia posts (CosmoPost;Ivoclar) [subgroup B]. For the flared-canal subgroups, thin–walled canals were simulated, and restored with quartz fiber double taper light posts[subgroup C], quartz fiber double taper light posts inserted within the polyethylene woven fibers (Ribbond; Ribbond,Inc) [subgroup D] and zirconia posts[subgroup E]. All posts were cemented with dual–polymerizing adhesive resin cement (Panavia F; Kuraray). After restoration of access cavity with composite and thermocycling, compressive load was applied to the palatal surface of tooth until fracture. Mean failure load values were analyzed using One-way ANOVA and Tukey test (P<0.05). Mode of failure was evaluated with Fisher exact test (P<0.05). **Results:** The mean failure loads ± SD were 678.55±90.86, 603.44±68.66, 638.22±93.71, 732.44±81.78, and 573.66±91.340 N for subgroups A to E, respectively. Subgroup D exhibited significantly higher resistance to fracture compared to subgroups B, C and E (P<0.05). Subgroup E showed significantly less fracture resistance compared to subgroups A and D (P<0.05). Subgroups B and E showed more root fracture compared to subgroups A, C, and D (P=0,004). **Conclusion:** Significantly higher fracture resistance was observed in flared root canal treated teeth restored with quartz fiber double taper light posts + polyethylene woven fibers. Zirconia posts showed lower fracture resistance and significantly more root fracture compared to fiber posts.

\*Hajizadeh, H., Namazikhah, MS, Moghaddas, MJ., Ghavmnasiri, M., Majidinia, S. **Effect of posts on the fracture resistance of load cycled endodontically treated premolars restored with direct composite resin.** *J Contemp Dent Pract Vol 10, No. 3, 2009 1-10*

**Aim:** The aim of this study was to investigate the fracture resistance and failure mode of premolars restored with composite resin using various prefabricated posts. **Methods:** Sixty sound maxillary premolars were divided into four equal sized groups. All but the control group reveived endodontic treatment followed by placement of MOD composite restorations (Tetric Ceram; Ivoclar, Leichtenstein) as follows: Group T = no post, Group DT= fiber reinforced composite post (**DT Light-Post**, RTD, St Egreve, France), Group FL= prefabricated metal post (Filpost). The control group (C) had no cavity preparation. After thermal and load cycling, static load was applied at 30 degrees’ angle until fracture. Failure modes were categorized as restorable and non-restorable. Data were analyzed using the analysis of variance (ANOVA) and Duncan tests (α = 0.06). **Results:** The mean value s of fracture loads (N) for all groups were: C (880 +/-258); T (691+/- 239); DT (865+/-269); and FL(388+/-167). Statistically significant differences (P<0.05) were observed for all groups except between groups C and DT. The Chi square test showed failure modesin Groups C and DT were mostly restorable. The most non-restorable fractures were observed in Group FT. **Clinical singnificance:** The results of this study suggest that a quartz fiber post used in conjunction with an MOD composite resin restoration inproves fracture resistance in an endodontically treated pre-molar. **PDF**

\*Hayashi, M, Sugeta, A, Takahashi, Y, Imazato, S, Ebisu, S. **Static and fatigue fracture resistances of pulpless teeth restored with post-cores.** *Dent Mater. 2008 Sep;24(9):1178-86. Epub 2008 Mar 28*

**Objective:** Superior restorative methods for effectively strengthening pulpless teeth need to be identified, since vertical root fractures of pulpless teeth are still a major problem in everyday clinical practice. The present study tested the null hypothesis that there were no differences in static and fatigue fracture resistances of pulpless teeth restored with different types of post-core systems. **Methods:** Extracted human premolars were restored with a combination of either a fiber post (**DT Light-Post**, RTD, St Egreve, France), or metallic post and a composite resin core. Teeth with full crown preparations without post-core restorations served as a control. A 90 degrees vertical or 45 degrees oblique static compressive load was applied to restored teeth, and fracture loads and modes of fracture were recorded. Fatigue fracture tests were conducted by applying sinusoidal cyclic loads to restored teeth from vertical or oblique directions. Fatigue limits for each restoration were calculated using the staircase approach. **Results:** In both static and fatigue fracture testing under vertical or oblique loadings, the fracture loads of teeth restored with fiber posts were significantly greater than those of teeth restored with metallic posts. The fatigue limits of teeth restored with fiber and metallic posts were 112 kgf and 82 kgf respectively under vertical loadings and 26 kgf and 20 kgf under oblique loadings. **Significance:** The combination of a fiber post and a composite resin core showed superior fracture resistance against both static and fatigue loadings compared to restorations using a metallic post, and is therefore recommended in restoring pulpless teeth. **PDF**

Isidor, F., Odman, P., and Brondum, K. **Intermittent loading of teeth restored using prefabricated carbon fiber posts.** *International Journal of Prosthodontics*. *9: 131-136, 1996.*

**Abstract/conclusions:** This in vitro study evaluated the fracture resistance of bovine teeth with prefabricated carbon fiber posts (**Composipost,** RTD, St Egreve, France). Fourteen bovine teeth having similar lengths and dimensions were mounted in an acrylic resin block having a simulated periodontal ligament. The post space was prepared using two calibrated drills that provided an 8.5-mm post length. The prefabricated carbon fiber post was luted with a resin luting agent, and the core was made using the system's autopolymerizing resin core material. A crown was luted to each prepared tooth. Each test specimen was intermittently loaded (250 N) at an angulation of 45 degrees to the long axis of the tooth at a frequency of 2 loads per second. Four of the roots had an incomplete longitudinal fracture after loading. The results of this study were compared to a previous study by the authors that had been conducted under similar conditions. The failure rates of the two types of posts from the previous study (prefabricated parallel-sided posts (Para-Post) and tapered, individually cast posts) were significantly higher (Logrank test; *P*<.02) than those of the carbon fiber posts. **PDF**

\* Kim, YH, Lee, JH. **Influence of modification in core building procedure on fracture strength and failure patterns of premolars restored with fiber post and composite core***. J Adv Prosthodont. 2012 Feb;4(1):37-42. Epub 2012 Feb 29.*

**Purpose:** The influence of the modified process in the fiber-reinforced post and resin core foundation treatment on the fracture resistance and failure pattern of premolar was tested in this study. **Methods**: Thirty-six human mandibular premolars were divided into 4 groups (n = 9). In group DCT, the quartz fibre post (**D.T. Light-Post,** RTD St Egreve, France) was cemented with resin cement (Duo-Link) and a core foundation was formed with composite resin (Light-Core). In group DMO and DMT, resin cement (Duo-Link) was used for post (D.T. Light-Post) cementation and core foundation; in group DMO, these procedures were performed simultaneously in one step, while DMT group was accomplished in separated two steps. In group LCT, the glass fiber post (LuxaPost) cementation and core foundation was accomplished with composite resin (LuxaCore-Dual) in separated procedures. Tooth were prepared with 2 mm ferrule and restored with nickel-chromium crowns. A static loading test was carried out and loads were applied to the buccal surface of the buccal cusp at a 45 degree inclination to the long axis of the tooth until failure occurred. The data were analyzed with MANOVA (α = .05). The failure pattern was observed and classified as either favorable (allowing repair) or unfavorable (not allowing repair). **Results:** The mean fracture strength was highest in group DCT followed in descending order by groups DMO, DMT, and LCT. However, there were no significant differences in fracture strength between the groups. A higher prevalence of favorable fractures was detected in group DMT but there were no significant differences between the groups. **Conclusion:** The change of post or core foundation method does not appear to influence the fracture strength and failure patterns. **PDF**

Keçeci, AD, Heidemann, D, Kurnaz, S. **Fracture resistance and failure mode of endodontically treated teeth restored using ceramic onlays with or without fiber posts-an ex vivo study.** *Dent Traumatol. 2016 Aug;32(4):328-35. doi: 10.1111/edt.12252. Epub 2015 Dec 28*

**AIM:** This study aimed to compare the fracture resistance and fracture modes of ceramic onlay restorations with or without fiber posts in endodontically treated premolars. **Methods:** Fifty extracted human premolars with similar anatomic features were used in this study. Four groups (n = 10) were treated endodontically. Onlay cavities extended to the buccal and palatal cusps and reached out the endodontic accesses were prepared. Ceramic onlay restorations with or without fiber posts were categorized as Group CO (ceramic onlays without posts), Group COQF (ceramic onlays and **quartz fiber posts),** and Group COGF (ceramic onlays and glass fiber posts). Positive control group was left as non-restored (Group NR). Ten intact teeth were stored as negative control group (Group IT). Fracture resistance was measured using a universal load-testing machine applying compressive load at a crosshead speed of 1 mm min (-1) until fracture. Fracture resistance and modes were evaluated statistically. **Results:** Ceramic onlay restorations (Groups CO, COQF, COGF) increased the fracture resistance significantly, when compared with non-restored teeth (P < 0.05). However, no significant differences were found in the groups with fiber posts in terms of fracture resistance (P > 0.05). Negative control group (IT) had significantly higher fracture resistance than all others (P < 0.05). Fracture types had significant differences among the groups (P < 0.01). **Conclusions:** Within the limitations of this ex-vivo study, partial coverage with ceramic onlays resulted in a significant improvement of the fracture resistance of endodontically treated premolars. However, insertion of glass or quartz fibers did not increase the fracture resistance significantly.

\*Maccari, PC, Cosme, DC, Oshima, HM, Burnett, LH Jr, Shinkai, RS **Fracture strength of endodontically treated teeth with flared root canals and restored with different post systems.** *J Esthet Restor Dent. 2007;19(1):30-6;*

**Background:** Many post systems are available to clinicians, yet no consensus exists about which one is better in restoring endodontically treated teeth. **Purpose:** This study evaluated the fracture strength of teeth with flared canals and restored with two fiber-reinforced resin systems (glass fiber: FRC Postec [Ivoclar Vivadent, Schaan, Liechtenstein]; quartz fiber: **D.T. Light-Post** (RTD, St Egreve, France/ Bisco Dental Products), and one custom cast base metal (Ni-Cr) post and core system. **Methods:** Thirty anterior teeth had their crowns removed below the cemento-enamel junction and were endodontically treated. The canals were prepared for post fixation, and the canal walls were flared using a taper diamond bur. The prepared roots were randomly divided into three groups according to the post system. All posts were cemented with an adhesive resin cement. For the fiber-reinforced resin posts, cores were built up using microhybrid composite. Metallic crowns were luted using zinc phosphate cement. Specimens were loaded at 45 degrees in a universal testing machine at a crosshead speed of 0.5 mm/min until failure. The mode of failure was classified as repairable or nonrepairable. **Results:** Teeth restored with cast posts had fracture strength twice that of teeth restored with resin posts. Fiber-reinforced resin posts failed at a compressive force comparable to clinical conditions, but all failures were repairable. **Conclusions:** Fracture strength and mode of failure in anterior teeth with flared canals varied according to the type of post used to support a crown. **PDF**

Martinez-Insua, A., DaSilva, L., Rilo, B., and Santana, U. **Comparison of the fracture resistances of pulpless teeth restored with a cast post and core or carbon-fiber post with a composite core.** *Journal of Prosthetic Dentistry*. *80: 527-532, 1998.*  
   
**Statement of problem:** The survival of pulpless teeth restored with a post and core system is a controversial issue. **Purpose:** This study compared the fracture resistance of 2 types of restorations: teeth restored with prefabricated carbon-fiber (**Composipost (**RTD St Egreve, France) posts and composite cores to cast dowel-core restored teeth. **Methods:** A total of 44 recently extracted sound premolars were randomly distributed into 2 equal groups: group I, restored with prefabricated carbon-fiber post and a composite core; and group II, with custom-cast type III gold alloy post and cores. The size and shape of the posts were identical in the 2 groups. All teeth were fully covered with a nonprecious cast crown. Fracture resistance was measured by applying a point force at 45 degrees to the long angle of the tooth. **Results:** Mean fracture threshold was 103.7 + 53.1 kg for group I versus 202.7 + 125.0 kg for group II (differences significant with *P* = .003). In group II, however, fracture nearly always affected the tooth itself, whereas in group I, the post-core nearly always failed first. **Conclusions:** Significantly higher fracture thresholds were recorded for the cast post and core group. Teeth restored with cast posts typically showed fracture of the tooth, although at loads rarely occurring clinically. **PDF**

\*Mekayarajjananonth, T., Chitcharus, N., Winkler, S., Bogert, M.C. **The effect of fiber dowel heights in resin composite cores on restoration failures of endodontically treated teeth**. *J Oral Implantol. 2009;35(2):63-9.*

In vitro and in vivo testing suggest that fiber posts may reduce the incidence of root fractures of endodontically treated teeth. The purpose of this in vitro study was to compare the effect of fiber post height in resin composite cores on the **fracture resistance** of endodontically treated teeth. Forty maxillary central incisors were randomly divided into 2 control groups (Groups 1 and 2) of 5 teeth each, and 3 experimental groups (Groups 3, 4, and 5) of 10 teeth each. The teeth in Group 1 had their opening restored with composite resin, the teeth in Group 2 were restored with quartz fiber posts (**D,T. Light-Post**, RTD, St Egreve, France) without resin composite cores, and the teeth in Groups 3, 4, and 5 were restored with quartz fiber posts of 2, 4, and 6 mm high, respectively, in 6-mm resin composite cores. Ceramic crowns were fabricated for the specimens. Specimens were positioned in a mounting device and aligned at a 130-degree angle to the long axis of each tooth. A universal testing machine was used to apply constant load at a crosshead speed of 0.5 mm/min until failure occurred. The highest fracture load and mode of failure of each specimen was recorded. The highest fracture resistance force was observed in Group 2 (290.38 +/- 48.45 N) and decreased, respectively, in Group 1 (238.98 +/-26.26 N), Group 5 (228.35 +/-58.79 N), Group 4 (221.43 +/-38.74 N), and Group 3 (199.05 +/-58.00 N). According to one-way analysis of variance (ANOVA) and Duncan's test (P < or = .05), there was no statistically significant increase in the force from Group 3 to Group 5, and the force in Group 2 was significantly higher than that of the experimental groups. There was no statistical significance difference in force among the experimental groups, and the amount of residual tooth structure was found to be the critical factor in fracture resistance. The results suggest that endodontically treated teeth should be restored with the longest possible post height while preserving maximum tooth structure. **PDF**

Meng, QF, Chen, YM, Guang, HB, et al. **Effect of a ferrule and increased clinical crown length on the in vitro fracture resistance of premolars restored using two dowel and core systems**. *Oper Dent, 2007 32-6, 595-601*

**Summary:** This study investigated the effect of a crown-lengthening ferrule on the fracture resistance of endodontically-treated teeth restored with two dowel-core systems. Thirty-two extracted mandibular first premolars were sectioned perpendicular to the long axis at a point 1.0 mm occlusal to the buccal cementoenamel junction. Following endodontic treatment, the teeth were randomly assigned to four groups: cast Ni-Cr alloy dowel-core with no ferrule (Group A1), cast Ni-Cr alloy dowel-core with 2.0 mm ferrule (Group A2), prefabricated carbon fiber-reinforced dowel-resin core with no ferrule (Group B1) and carbon fiber-reinforced dowel-resin core with 2.0 mm ferrule (Group B2). Each specimen was embedded in a self-cured acrylic resin block from 2.0 mm apical to the margins of a cast Ni-Cr alloy crown, then loaded at 150 degrees from the long axis in a universal testing machine at a crosshead speed of 1.0 mm/minute until fracture. The data were recorded and analyzed using ANOVA and Fisher's exact tests, with alpha = 0.05. Mean failure loads (kN) for the A1, A2, B1 and B2 Groups (**ComposiPost**-RTD, St Egreve, France / C-POST/ Bisco Dental) were: 1.46 (S.D. 0.45), 1.07 (0.21), 1.13 (0.30) and 1.02 (0.27). The teeth restored with cast Ni-Cr dowel-cores and 2.0 mm ferrules demonstrated significantly lower fracture strengths, p = 0.04. There were significant differences in the root fracture patterns between the two dowel systems, with the carbon fiber-reinforced dowel-resin core system, being the less severe p < 0.05. Crown lengthening with a 2.0 mm apical extended ferrule resulted in reduced fracture strengths for endodontically-treated teeth restored using two dowel-core systems and cast metal crowns. The carbon fiber-reinforced dowel-resin core system reduced the severity of the root fractures. **PDF**

\*Mortazavi, V, [Fathi, M](http://www.ncbi.nlm.nih.gov/pubmed?term=fathi%25252520m%2525255bauthor%2525255d&cauthor=true&cauthor_uid=22623936), Katiraei, N, Shahnaseri, S, Badria,n H, Khalighinejad, N. **Fracture resistance of structurally compromised and normal endodontically treated teeth restored with different post systems: An in vitro study**. *Dent Res J (Isfahan). 2012 Mar;9(2):185-91*.

**Background**: With the aim of developing methods that could increase the fracture resistance of structurally compromised endodontically treated teeth, this study was conducted to compare the effect of three esthetic post systems on the fracture resistance and failure modes of structurally compromised and normal roots. **Methods:** Forty five extracted and endodontically treated maxillary central teeth were assigned to 5 experimental groups (n=9). In two groups, the post spaces were prepared with the corresponding drills of the post systems to be restored with double taper light posts (**D. T. Light-Post**) (group DT.N) and zirconia posts (Cosmopost) (group Zr.N). In other 3 groups thin wall canals were simulated to be restored with Double taper Light posts (DT.W), double taper Light posts and Ribbond fibers (DT+R.W) and Zirconia posts (Zr.W). After access cavity restoration and thermocycling, compressive load was applied and the fracture strength values and failure modes were evaluated. Data were analyzed using two-way ANOVA, Tukey and Fisher exact tests (P<0.05). **Results:** The mean failure loads (N) were 678.56, 638.22, 732.44, 603.44 and 573.67 for groups DT.N, Zr.N, DT.W, DT+R.W and Zr.w respectively. Group DT+R.W exhibited significantly higher resistance to fracture compared to groups Zr.N, DT.W and Zr.w (P<0.05). A significant difference was detected between groups DT.N and Zr.W (P=0.027). Zirconia posts showed significantly higher root fracture compared to fiber posts (P=0.004). **Conclusion:** The structurally compromised teeth restored with double taper light posts and Ribbond fibers showed the most fracture resistance and their strengths were comparable to those of normal roots restored with double taper light posts. More desirable fracture patterns were observed in teeth restored with fiber posts.

\*Nothdurft, FP, et al **The fracture behavior of premolar teeth with class II cavities restored by both direct composite restorations and endodontic post systems**. *Journal of dentistry (2008) doi:10 1016/j.jdent.2008.03.004*

**Purpose:** The aim of this study was to evaluate the influence of different posts on the fracture load and fracture resistance of endodontically treated premolars with class II cavities and direct composite restorations in an ex vivo setting. **Methods:** Forthy eight single rooted premolars were endodontically treated and prepared with standardized M-O (mesio-occlusal) cavities. Eight teeth each received either no posts or were restored with Titanium Screws (BKS), glass fiber posts (DentinPost), quartz fiber posts (**DT Light-Post SL,** RTD/ VDW, Munich, Germany). Sixteen teeth were restored with Zirconium Dioxide posts (CeraPost). BKS screws and eight Zirconium Dioxide posts were cemented conventionally with glass ionomer cement; Panavia F resin cement was used for all others. The specimens were restored with direct composite restorations. Eight sound premolars served as the controls. After thermomechanical fatigue testing, the samples were loaded until fracture occurred at an angle of 450. All specimens were evaluated for fracture lines. **Results:** The sound (control group) teeth showed the significan highest fracture load (792.5 +/- 210.1), but the group restored with quartz fiber posts differed not significantly from the control group. In the groups restored with the glass fiber posts and titanium screws significant higher fracture load values occurred as in the group with direct composite restorations without posts. The groups with the fiber posts did not show a more favorable fracture mode than the other groups. **Clinical significance**: The use of an intraradicular post in premolars with class II cavities can significantly increase the resistance towards extra-axial forces. **PDF**

\*Nothdurft,, FP , Schmitt, T., Motter, PJ, Pospiech, PR.**Fatigue testing of crowned incisors restored with FRC-posts***J Dent Res.Vol 87 (Spec Iss A) Abstract #1864, 2008* *(www.dentalresearch.org)*

**Objectives:** The aim of the study was to evaluate the influence of fatigue and cementation mode on the fracture behaviour of endodontically-treated bovine incisors restored with crowns and fiber reincorced composite (FRC) posts. **Methods:** Forty-eight endodontically-treated bovine incisors were restored with FRC-posts (**D.T. Light-Post,** VDW/RTD, St Egreve, France), composite build-ups, and full-cast crowns. In 16 teeth, each of the posts were cemented conventionally with KetacCem (3M Espe) or adhesively with Panavia F (Kuraray) or RelyXUniCem (3M Espe). One-half of the specimens in each group were subjected to thermocycling (5–55°C, x10,000) and mechanical aging (50 N, x1,200,000). Fracture resistance was determined by loading the specimens until fracture at an angle of 45 ° to the long axis of the teeth. The mean fracture loads were analysed applying the non-parametric Kruskal-Wallis test. All samples were assessed for failure modes by visual inspection in combination with ink staining. “Favorable failures” were defined as repairable failures as fractures of the root on or above the level of bone simulation. The results were reported as descriptive. **Results:** Specimens fractured at failure loads of 371 N (Panavia F, Fatigue Testing) to 494 N (KetacCem, Fatique Testing). Comparing the different modes of cementation similar values for fracture load could be found, before fatigue testing as well as afterwards. The roots restored with conventionally-cemented posts revealed no decrease in fracture resistance after fatigue loading; but the difference between fracture loads before and after artificial aging was not statistically significant for any group. Most specimens fractured in a favorable way; only the groups with KetacCem and RelyX UniCem showed an even distribution of fracture modes after simulated aging. **Conclusions:** The loading test showed that neither cementation mode nor fatigue testing had an influence on the load bearing capability of crowned endodontically-treated incisors with FRC posts.

\*Pongpatarin, A., Salimee, P.**Effect of furrule and FRC-post diameter in restoring endodontically-treated teeth.** *J Dent Res. Vol 89 (Spec. Iss. B) Abstract #2190, 2010 (www.dentalresearch.org)*

**Objectives:** To evaluate the effect of furrule and FRC post diameter in restoring endodontically-treated teeth using fracture resistance test. **Methods:** Thirty-two extracted human maxillary central incisors were randomly divided for 4 groups (n=8); group 1: ferrule+post fit, group 2: ferrule+smaller post, group 3: no ferrule+post fit and group 4: no ferrule+smaller post. Teeth were cut horizontally for root length 15 mm. Root canal treatment were performed and post space were prepared using **DT Light-Post** drill no.2. In group 1 and 3, teeth were restored with DT Light-Post no.2, while in group 2 and 4 using DT Light-Post no.1. posts (RTD, St Egreve France) were cemented with resin cement (Panavia F 2.0), core built-up were made with resin composite (Tetric N ceram). Chamfer preparation were performed around the teeth with furrule of 2 mm. in group 1 and 2, but not in group 3 and 4. Ni-Cr crowns were made to fit and cemented with resin cement. Restored teeth were embedded in resin blocks with stimulated PDL. Specimens were loaded on a universal testing machine with crosshead speed 1 mm/min on palatal surfaces, 135 degree to long axis of the tooth until failure occurred. **Results:** The fracture resistance of group 1, 2, 3 and 4 were 1474.7±285.5 N, 1339.4±120.6 N, 811.7±155.7 N and 668.5±170.2 N, respectively. Two-way ANOVA and Tukey HSD post-hoc analysis revealed that fracture resistance of group 1 and 2 were significantly higher than group 3 and 4 (p<0.05). Significant difference was not found between group 1 and 2 or between group 3 and 4 (p>0.05). **Conclusions:** Present of ferrule significantly affect the fracture resistance of endodontically-treated teeth restored with FRC post. While using post with smaller diameter did not significantly affect the fracture resistance compared with using post that properly fit to the canal.

Salameh, Z, Sorrentino, R, Papacchini, F., Ounsi, HF, Tashkandi, E, Goracci, C, Ferrari, M**. Fracture resistance and failure patterns of endodontically treated mandibular molars restored using resin composite with or without translucent glass fiber posts.** *J Endod. 2006 Aug;32(8):752-5.*

The elastic modulus of the restorative material is important in restoring endodontically treated teeth. This study aimed to compare the fracture resistance and failure patterns of 90 mandibular molars restored using resin composites with or without fiber posts, with respect to the number of residual cavity walls. Five restoration types were performed corresponding to different wall defects (groups 1-5). Groups were divided in two subgroups corresponding to the use or absence of fiber posts (**DT Light-Post**, RTD, St Evreve, France). Teeth were loaded and resistance of specimens was measured as the axial compressive load to cause fracture and macroscopic fracture patterns were observed. One-way ANOVA revealed a significant difference in fracture resistance (p < 0.001). Tukey post hoc test also revealed significant differences between groups as samples restored with fiber posts exhibited mostly restorable fractures. It was concluded that the resistance of endodontically treated mandibular molars restored with composite resins is mainly affected by the number of residual walls. Using fiber-reinforced posts optimized fracture patterns. **PDF**

Schiavetti, R. , Sannino, G. **In vitro evaluation of ferrule effect and depth of post insertion on fracture resistance of fiber posts.** *Computational and Mathematical Methods in Medicine Volume 2012, Article ID 816481, 6 pages doi:10.1155/2012/816481*

**Purpose:** The analysis of the complex model of fiber post and ferrule is given and studied in this paper. A novel approach and a solution to the evaluation of stress of post and core system within the ferrule effect are proposed. **Methods:** Sixty freshly extracted premolars were selected for the study. The following experimental groups were therefore defined (n = 10): (1) 5 mm, (2) 7 mm, (3) 9 mm, (4) ferrule-5 mm, (5) ferrule-7 mm, and (6) ferrule-9 mm. Pre-shaping drills (C) were used to prepare the root canals at 5, 7, and 9 mm in depth. In specimens of groups 3–6 a circumferential collar of tooth structure of 2 mm in height. Fluorocore 2 core build-up material (I) was used for fiber post (**Endo Light-Post** RTD, St Egreve, France)luting. With the same material, a buildup of 2 mm in height was created. A controlled compressive load (crosshead speed: 0.75 mm/min) was applied by means of a stainless steel stylus (Ø 1 mm) at the coronal end of the post extruding out of the root. **Results:** In all the tests the level of significance was set at P < 0.05. Significantly higher fracture strengths were measured in the presence of a ferrule effect. In groups 1, 2, and 3 (ferrule group), the mean fracture values were, respectively, 163,8 N, 270,9 N, and 254,7 N. These data are higher and statistically significantly different when compared with the three groups 4, 5, and 6 (no-ferrule group), in which the values obtained were, respectively, 40,5 N, 41,7 N, and 44,9 N. **Conclusion:** The ferrule effect in the endodontically treated teeth positively affects the fracture strength of the fiber post. Conversely, post depth insertion did not affect the resistance to fracture.

\*Seraj, B, Ghadimi, S, Estaki, Z, Fatemi, M. **Fracture resistance of three different posts in restoration of severely damaged primary anterior teeth: An in vitro study.***Dent Res J (Isfahan). 2015 Jul-Aug;12(4):372-8. doi: 10.4103/1735-3327.161461*

**Background:** Restoration of anterior primary teeth with severe caries lesion is a big challenge. The aim of this study was to compare the fracture resistance of three types of post, including composite resin, customized quartz fiber and prefabricated glass fiber in restoration of severely damaged primary anterior teeth. **Methods:** Sixty extracted human primary maxillary incisors were randomly divided into three groups: Group 1: Customized quartz fiber post, Group 2: Composite post and Group 3: Prefabricated glass fiber post. Due to the effect of bonded area on the fracture resistance, the bonded surface of each sample was measured 1 mm above cemento-enamel junction. An increasing force was subjected with a crosshead speed of 0.5 mm/min by a universal testing machine until fracture occurred, and the failure mode was assessed afterwards. Data were analyzed using One-way analysis of variance and Kruskal-Wallis tests. The level of significance was considered at P < 0.05. **Results:** The mean fracture resistance values of three groups were 343.28 N, 278.70 N and 284.76 N, respectively. Although customized quartz fiber post showed the greatest fracture resistance, statistical analysis revealed no significant difference between groups (P = 0.21). The mean fracture strength values of three groups were 12.82 N/mm(-2), 11.93 N/mm(-2) and 11.31 N/mm(-2), respectively; however, the differences were not statistically significant (P = 0.72). Favorable failure mode was more frequent in all groups (P = 0.12). **Conclusion:** Within the limitations of this study, it can be concluded that all three types of studied posts can be successfully used to restore badly destructed primary anterior teeth. **PDF**

\*Seto, B., Chung, KH, Johnson, J., Paranjpe, A**. Fracture resistance of simulated immature maxillary anterior teeth restored with fiber posts and composite to varying depth.** *Dental Traumatology 2012; doi: 10.1111/edt.12020*

**Background:** Traumatized immature teeth present a unique challenge during treatment, both endodontically as well as restoratively. Hence, the purpose of this study is to evaluate the type and depth of restoration that would be effective in simulated immature maxillary anterior teeth in terms of fracture resistance and mode of failure. **Methods:** Seventy-five extracted human maxillary anterior teeth were used in this study that was standardized to a length of 13 mm. Instrumentation of the canals was performed after which a Peezo no. 6 was taken 1 mm past the apex to simulate an incompletely formed root. MTA apexification was simulated after which all the teeth were mounted and a 3-mm-diameter engineering twist drill extended the preparation 3 and 7 mm below the facial cemento–enamel junction (CEJ) to simulate Cvek’s stage 3. These teeth were divided into seven different groups: Group 1: Negative control: intact teeth; Group 2: Positive control: 3 mm, no restoration; Group 3: Positive control: 7 mm, no restoration; Group 4: 3-mm composite; Group 5: 3-mm quartz fiber post (**D,T. Light-Post**, RTD, St Egreve, France); Group 6: 7-mm composite; Group 7: 7-mm quartz fiber pos (**D,T. Light-Post**, RTD, St Egreve, France t. Fracture resistance was performed at 130° to the long axis of the tooth with a chisel-shaped tip at the cingulum with a cross-head speed of 5 mm min, and the maximum load at which the fracture occurred was recorded. **Results:** Group 1 that was the negative control showed the highest fracture resistance. Among the experimental groups, 4 and 5 showed the highest fracture resistance, which were significantly different from groups 6 and 7, respectively. **Conclusions:** Within the limitations of this in vitro study, it can be concluded that using either dual-cure composite or a quartz fiber post with composite resin to a depth of 3 mm would significantly strengthen the roots in immature teeth.

\*Shirani, F., Malekipour, M.**, Effects of non-metallic posts on fracture resistance of weakened teeth.** *J Dent Res. Vol 86 (Spec. Iss. A) Abstract #1619, 2007* *(www.dentalresearch.org)*

**Objectives:** The restoration of severely damaged teeth that have lost support at the coronal portion of the root canal is very difficult. The aim of this study was the evaluation of different methods of root reinforcement by dual-cure composite and various types of non-metallic posts. **Methods:** We performed root canal therapy on 60 maxillary central incisors. The teeth were divided into five groups, and specimens from three groups were prepared to simulate the teeth with flared canals. In the 1st group, no weakening was done. In the 2nd group, the compromised area of the root canal was obturated with gutta percha. In the 3rd group, universal **D.T. Light-Posts** (RTD, St Egreve, France) were used in the root canal to 8 mm below the margin of the palatal wall, after which the height of the DT post was regulated in the canal pulp chamber space so that it would not be under direct load. The post was then cemented with dual-cure composite. In the 4th and 5th groups, the same procedures were done; however, clear and opaque posts, with shapes and dimensions similar to those of D.T. Light-Posts, were used. In all groups, the access cavity was restored with light-curing composite resin to 0.5 mm under the margins. After being mounted, all specimens were pressed in an Instron machine. At fracture, the amount of force was recorded. **Results:** The highest resistance to fracture belonged to group 1 and the lowest to group 2. The results showed that there was a significant statistical difference, and a Duncan analysis showed that the differences of resistance to fracture were significant in all groups except among groups 3, 4, and 5. **Conclusion:** The use of dual-cure composite resin and non-metallic D.T. Light-Posts can significantly increase the resistance-to-fracture of root-treated maxillary central incisors with thin root walls.

\*Shirani, F., Malekipour, M**. In-vitro study of different reinforcement methods of anterior weakened teeth.** *J Dent Res. Vol 84 (Spec. Iss. A) Abstract #1732 2005* *(www.dentalresearch.org)*

**Objectives**: The purpose of study was to evaluate the potential of intraradicular reinforcement of layered adhesion technique and two different types of post in structurally compromised roots. **Methods:** Root canal therapies were done on 48 extracted similar maxillary incisors. The samples were divided to 4 groups. In three groups for simulation of specimens to weakened teeth, instrumentation was done 5mm apical to CEJ from access cavity. In positive control group that weakening was not done, restoration of access cavity was done with composite resin (Z100, 3M dental product, USA) and dentin bonding agent (Single bond, 3M dental product, USA). In second group access cavity of the weakened teeth was restored only with composite resin and dentin bonding agent to the level of CEJ. In third group weakened cervical area were reinforced with a dual cure composite (Bis-Core, Bisco, Inc, USA) and translucent quartz fiber post (**Light-Post**, RTD, St Egreve, France) In the fourth group, the weakened cervical area was reinforced with dual cure composite and cast post with similar morphologic properties. Access cavity in the last two groups were restored with composite resin, then all specimens were tested in an instron machine. **Results:** The mean fracture load for the 4 groups were 170.12, 71.40, 129.36, and 116.6 kgf respectively. The differences between first group and others (P value=0), second group and others (P value=0) were significant. There was no significant differences between third and forth group (P value =0.103), but the rate of restorable fractures (pattern of fracture) was significantly different between these two groups. **Conclusions:** It is concluded that the use of post, dentin bonding agent and a composite resin in a root with thin walls will reinforce the weakened tooth but the type of the post will influence on the final result.

Torabi, K, Fattahi, F. **Fracture resistance of endodontically treated teeth restored by different FRC posts: an in vitro study.** *Indian J Dent Res. 2009 Jul-Sep;20(3):282-7.*

**Background:** Posts and cores are often required for restoration of pulpless teeth and to provide retention and resistance for a complete crown, but conventional posts may increase the root fracture. **Objective:** This study was performed to compare the root fracture resistance of extracted teeth treated with different fibers reinforced with composite posts and treated teeth with conventional post and core systems. **Methods:** Root canal therapy was performed for 50 mandibular first premolars. The coronal portion of each tooth was amputated, and five post and core systems (cast, polyethylene woven, glass, carbon, and quartz fiber posts) were compared. Acrylic resin blocks were used for mounting, using a layer of elastomeric impression material covering the roots. The load was applied axially and measured with a universal testing machine. **Conclusions**: Significantly, cast posts and cores had a higher failure threshold including teeth fracture; whereas, fiber posts failure was due to core fracture, with or without fractures in coronal portion of posts. Difference in FRC posts did not provide any significant difference in the load failure and the mode of fracture. **PDF**

\*Zicari F, [Coutinho E](http://www.ncbi.nlm.nih.gov/pubmed?term=Coutinho%2520E%255BAuthor%255D&cauthor=true&cauthor_uid=23395426), [Scotti R](http://www.ncbi.nlm.nih.gov/pubmed?term=Scotti%2520R%255BAuthor%255D&cauthor=true&cauthor_uid=23395426), [Van Meerbeek B](http://www.ncbi.nlm.nih.gov/pubmed?term=Van%2520Meerbeek%2520B%255BAuthor%255D&cauthor=true&cauthor_uid=23395426), [Naert I](http://www.ncbi.nlm.nih.gov/pubmed?term=Naert%2520I%255BAuthor%255D&cauthor=true&cauthor_uid=23395426). **Mechanical properties and micro-morphology of fiber posts**. *Dent Mater. 2013 Apr;29(4):e45-52. doi: 10.1016/j.dental.2012.11.001. Epub 2013 Feb 5.*

**Objectives:** To evaluate flexural properties of different fiber posts systems and to morphologically characterize their micro-structure. **Methods**: Six types of translucent fiber posts were selected: RelyX Post (3M ESPE), ParaPost Taper Lux (Colthéne-Whaledent), GC Fiber Post (GC), LuxaPost (DMG), FRC Postec Plus (Ivoclar-Vivadent), **D.T. Light-Post** (RTD). For each post system and size, ten specimens were subjected to a three-points bending test. Maximum fracture load, flexural strength and flexural modulus were determined using a universal loading device (5848 MicroTester(®), Instron). Besides, for each system, three intact posts of similar dimensions were processed for scanning electron microscopy to morphologically characterize the micro-structure. The following structural characteristics were analyzed: fibers/matrix ratio, density of fibers, diameter of fibers and distribution of fibers. Data were statistically analyzed with ANOVA. **Results**: Type and diameter of posts were found to significantly affect the fracture load, flexural strength and flexural modulus (p<0.05). Regarding maximum fracture load, it was found to increase with post diameter, in each post system (p<0.001). Regarding flexural strength and flexural modulus, the highest values were recorded for posts with the smallest diameter (p<0.001). Finally, structural characteristics significantly varied among the post systems tested. However, any correlation has been found between flexural strength and structural characteristics. **Signifigance:** Flexural strength appeared not to be correlated to structural characteristics of fiber posts, but it may rather be affected by mechanical properties of the resin matrix and the interfacial adhesion between fibers and resin matrix.

**B. Photoelastic measurements**

\*Cifuentes, I., Fernandez, A., Petrasic, L. et al **Photoelastic stress distribution for four endodontic post sytems.** *J Dent Res. Vol 84 (Spec. Iss. A) Abstract #2934, 2005* *(www.dentalresearch.org)*

**Objectives:** Determine if the fabrication and technology of four post systems modify the stress distribution to canals. **Methods:** The stress distributing characteristics associated `with the installation and function of **D. T. Light-Post** (Quartz fiber, RTD, St Egreve, France)), EasyPost (Glass fiber, Dentsply), Reforpost (Angelus) and Unimetric Post (Steel post, Dentsply) as a control group were determined with a 2-dimensional photoelastic stress analysis using a circular polariscope. Standardized 11 mm in length canals were prepared in PSM-5 (Measurements Group, Raleigh ;N.C) photoelastic sheets material with increasing sizes acrylic drills. All the posts were cemented with resin cement (Bifix QM, Voco, Germany). Then the posts were loaded vertically and with a 26 degrees inclined load at 20, 30,40,50 and 60 kilograms. The posts were photographed (Olympus 5050 Digital Camera) by use of the circular polariscope in the loaded and unloaded state. Qualitative measurement of the number (magnitude) and the closeness (concentrate) of the fringes were made. **Results:** The steel preformed post showed the higher stress magnitudes at the vertical and lateral loading. It showed stress concentration at the apical and at each post thread. The pre-stressed fiber post at the vertical load showed the least magnitude and concentration of stress in the surrounding photoelastic material. At lateral loads fiber-glass EasyPost and pre-stressed quartz fiber post showed similar behaviors. **Conclusions:** Stress distribution surrounding post cemented in canals, done in photoelastic material, is related with the fabrication material and with the fabrication technology of the posts.

\*Cifuentes, I., Fernandez, A., Sanchez, A. and Pavlov. P.. **Stress distribution surrounding five endodontic posts** *J Dent Res, Vol 83 (Spec. Iss. A) Abstract #4084, 2004* *(www.dentalresearch.org)*

**Objectives:** Determine if the cement interface thickness and fabrication material of five post system modify the stress distribution to flared canals. **Methods:** The stress distributing characteristics associated with installation and function of Cast Post (Ni-Cr), Para-Post (Steel post, Coltene-Whaladent), Integrapost (Titanium post, Premier), Mooser Post (Steel-post, Maillefer) and **D.T. Light-Post** (RTD, St Egreve, France) were determined with a two-dimentional photoelastic stress analysis using a circular polariscope ( Photoelastic Inc ).Standardized enlarged canals were prepared in PSM-5 ( Measurements Group, Raleigh ;N.C) photoelastic sheets material with increasing sizes acrylic drills (Orico,Germany). All the posts were cemented with resin cement (Duo-Link, Bisco Inc).The cast post was made closely adapted to the canal walls and cemented with the same cement .Then the posts were loaded vertically and with a 35 degrees inclined load at 10,20 and 30 kilograms. Then the posts were photographed (Olympus 5050 Digital Camera) by use of the circular polariscope in the loaded and unloaded state. Qualitative measurement of the number (magnitude) and the closeness (concentrate) of the fringes were made. **Results:** The cast post with thinner cement interface showed the higher stress magnitudes at the vertical and lateral loading. All the metallic preformed post showed high stress concentration at the apical and cervical zones for the loads respectively .The fiber post at the vertical and lateral load showed the least magnitude and concentration of stress in the surrounding photoelastic material. **Conclusions:** The stress distribution surrounding posts cemented in flared canals, done in photoelastic material, is related with the fabrication material of the post and with the thickness of the cement interface.

1. **Stress Distribution F. E. A.**

Adanir, N., Belli, S. **Stress analysis of a maxillary central incisor restored with different posts.** *Eur J Dent 2007; 2:67-71*

**Objectives:** To evaluate the effects of different post materials on the stress distribution in an endodontically treated maxillary incisor. **Methods:** a pseudo 3-dimensional finite element model was created in a labiolingual cross-sectional view of a maxillary central incisor and modified according to five posts with different physical properties consisting of stainless steel, titanium, gold alloy, glass fiber (SnowPost/ Carbotech) and carbon fiber post (**Composipost**/RTD, St Egreve, France). A 200 newton force was then applied from 2 different directions; a) a vertical load on the incisal edge, and b) 45 degreee diagonal load above the cingulum location. Stress distribution and values were then calculated by considering the pseudo 3 dimensional von Mises stress criteria. **Results:** Under the 2 loading conditions, post made of steel showed greatest stress concentration at the post/dentin interface, followed by titanium, gold alloy, SnowPost and Composipost. However, Composipost, which elastic modulus was closer to dentin, produced higher rate of stress values at the cervical 1/3. **Conclusions:** Within the limitations of this simulated mechanical analysis, we can conclude that the physical characteristics of posts were important on stress distributions in post and core applications. Fiber posts revealed more balanced stress under functional forces. **PDF**

\*Aggarwal, S, Garg, V. **Finite element analysis of stress concentration in three popular brands of fiber posts systems used for maxillary central incisor teeth***.* [J Conserv Dent.](http://www.ncbi.nlm.nih.gov/pubmed/22025836)*2011 Jul;14(3):293-6.\*

#### Objectives:: To study the stress concentrations in endodontically treated maxillary central incisor teeth restored with 3 different fiberpost systems subjected to various oblique occlusal loads. Methods: FEM analysis was used to analyze stress concentrations generated in maxillary anterior teeth. Computer aided designing was used to create a 2-D model of an upper central incisor. Post systems analyzed were the DT Light-Post (RTD, St Egreve France, Bisco, Inc), Luscent Anchor (Dentatus) & RelyX (3M-ESPE). The entire design assembly was subjected to analysis by ANSYS for oblique loading forces of 25N, 80N & 125 N. Results:: The resultant data showed that the RelyX generated the least amount of stress concentration. Conclusions: Minimal stress buildups contribute to the longevity of the restorations. Thus, RelyX by virtue of judicious stress distribution*,* is the better option for restoration of grossly decayed teeth. PDF

Bolla, M., Laplanche, O. et al. **Elastic modulus and stress distribution: finite element analysis.** *J Dent Res. Vol 84 (Spec. Iss. A) Abstract #2933, 2005* *(www.dentalresearch.org)*

**Objective:** Fractures of restored pulpless teeth can be influenced by many factors, including type or design of the post, or the occlusal load and its direction. The purpose of this study is to use finite element analysis to investigate the effect of different posts used for restoring endodontically treated teeth, according to different elastic moduli and the direction of occlusal load. **Methods:** a 3-dimensional finite element model, including the periodontal ligament, was constructed in a mesio-distal cross-sectional view of a mandibular premolar. The tooth was fully restored with a cast crown, as occurs in clinical practice. The standard model was composed of 80000 elements and 130000 nodes. Elastic modulus and Poisson’s ratio of different the components, along with the coordinate and geometry of each node and element were entered into a computer. Four different posts (length: 14mm, diameter: 1.2mm) 3 metallic (stainless, titanium gold) and one non-metallic (carbon fiber (**Composipost**, RTD, St Egreve, France) were investigated according to three different composite core materials. The effect of a 300MPa load on vertical, 30 degrees and 45 degrees oblique was tested. Analysis program (IDEAS, Version 6) was used to organize the stress analysis data. **Results:** Stress distribution in the root depends on the elastic modulus and the direction of the occlusal load. Elastic modulus of the core is less significant than the elastic modulus of the post. **Conclusions:** The effect of the post on stress distribution varies according to the direction of the load. In a vertical load, gold and carbon fiber posts generate lower stresses in the root than other metallic posts. In a 30 or 45 degree oblique load, the best results are obtained with a Carbon fiber post.

Duret, B., Duret, F., and Reynaud, M. **Long-life physical property preservation and postendodontic rehabilitation with the Composipost.** *Compendium*. *17: S50-S56, 1996.*   
   
**Abstract/conclusions:** Most coronal radicular reconstructions are made of cast inlay core metals or prefabricated metal posts covered in composite. The differences in the mechanical properties of these elements create a heterogeneous mass with inconsistent mechanical behavior. Studies using the Finite Element Method have shown the biomechanical disturbances casued by the inclusion of materials with a modulus of elasticity that is superior to that of dentine (ie, nickel, chrome, zircon, etc). The use of materials with a modulus of elasticity close to that of dentine does not disturb the flow of stress inside the root. To our knowledge, only a composite material structured with programmable mechanical properties would be capable of producing both high mechanical performance and a modulus of elasticity adapted to dentine values. The Composi-POST, made of carbon epoxy, accommodates the demands of the dentine, as well as the in vitro stress linked to the prosthesis. The internal structure, consisting of long high-performance carbon fibers, unidirectionally and equally stretched, confers a totally original behavior that is adapted to clinical objectives. In addition, the **C-POST/Composipost** (RTD, St Egreve, France) has a fracture resistance superior to most metals. **PDF**

Lanza,, A., Aversa, R.,, Rengo, S., Davide, Apicella, D., Apicella, A**.**. **3D FEA of cemented steel, glass and carbon posts in a maxillary incisor** *Dent Mater. 2005 Aug; 21(8):709-15*

**Objectives:** A comparative study on the stress distribution in the dentine and cement layer of an endodontically treated maxillary incisor has been carried out by using Finite Element Analysis (FEA). The role of post and cement rigidity on reliability of endodontic restorations is discussed. **Methods:**  A 3D FEM model (13,272 elements and 15,152 nodes) of a central maxillary incisor is presented. A chewing static force of 10 N was applied at 125° angle with the tooth longitudinal axis at the palatal surface of the crown. Steel, carbon and glass fiber posts have been considered. The differences in occlusal load transfer ability when steel, carbon and glass posts, fixed to root canal using luting cements of different elastic moduli (7.0 and 18.7 GPa) are discussed. **Results and significance:** The more stiff systems (steel and carbon posts) have been evaluated to work against the natural function of the tooth. Maximum Von Mises equivalent stress values ranging from 7.5 (steel) to 5.4 and 3.6 MPa (respectively, for carbon posts fixed with high and low cement moduli) and to 2.2 MPa (either for glass posts fixed with high and low cement moduli) have been observed under a static masticatory load of 10 N. A very stiff post works against the natural function of the tooth creating zones of tension and shear both in the dentine and at the interfaces of the luting cement and the post. Stresses in static loading do not reach material (dentine and cement) failure limits, however, they significantly differ leading to different abilities of the restored systems to sustain fatigue loading. The influence of the cement layer elasticity in redistributing the stresses has been observed to be less relevant as the post flexibility is increased. **PDF**

\*Nothdurft, FP, Seidel, E, Gebhart, F, Naumann, M, Motter, PJ, Pospiech, PR., **Influence of endodontic posts on the fracture behavior of crowned premolars with class II cavities**. *J Dent. 2008 Apr;36(4):287-93. Epub 2008 Feb 21.*

**Aim:** The aim of the study was to evaluate the influence of different posts and types of cementation on the fracture load and fracture mode of crowned, endodontically treated premolars with class II cavities in an ex vivo setting. **Methods:** Forty-eight single-rooted human premolars were endodontically treated and prepared with standardized MO (mesio-occlusal) cavities and a circular chamfer preparation. Eight teeth each received either no posts or were restored with screws (BKS), glass fiber posts (DentinPost), or quartz fiber posts (**D.T. Light-Post SL**; RTD, St Egreve, France). Sixteen teeth were restored with zirconium dioxide posts (CeraPost). BKS-screws and eight zirconium dioxide posts were cemented conventionally with glass ionomer cement; Panavia F was used for all others. The specimens were restored with composite cores and crowns cast from a non-precious metal. Eight sound premolars served as the controls. After thermomechanical fatigue testing, the samples were loaded until fracture occurred at an angle of 45 degrees. All specimens were evaluated for fracture lines. **Results:** The sound teeth showed the significant highest fracture load (792.50+/-210.01N). Conventionally cemented zirconium dioxide posts showed the lowest fracture load (327.00+/-45.84N); the highest fracture load occurred with quartz fiber posts (421.75+/-90.19N). Only the difference between these two groups was statistically significant. With glass fiber posts and conventionally cemented zirconia posts, restored teeth failed mostly in an "unfavourable" mode. **Conclusions:** With respect to the fracture load, there was no statistical difference between the restoration of non-vital premolars with class II cavities with crowns and posts or crowns alone. **PDF**

Samilee, P., Arunpraditkul, S., Dechaumphai, P. **Finite element analysis of various post and core restorations in teeth with flared root canal.** *J Dent Res. Vol 82 IADR Abstract #1936, 2003* *(www.dentalresearch.org)*

**Objectives**: Endodontically treated teeth with flared root canal are frequently found for many reasons and the prognosis of post and core restoration are also unpredictable. Reinforcing techniques that weaken the tooth had been introduced, however, the suitable methods are still questioning. The aim of this study is to investigate the stress distribution in root dentin and restorative materials. **Methods:** The 2 –dimensional Finite Element models of flared root canals (Maxillary central incisors) with ten restorative techniques were performed, using MSC/Nastran for Windows. Three evaluated parameters: reinforcing or non-reinforcing the flared root canal, reinforcing materials (composite resin and reinforced glass ionomer) and the post materials (gold alloy type III, Ni-Cr alloy, stainless steel, and carbon fiber) were investigated. All materials were assumed to be homogeneous, isotropic, linearly elastic. The load (150N) was applied on the lingual surface of metal-ceramic crown; 130 degrees to the tooth axis. **Results:** The results showed that maximal tensile stress in dentin were reduced in the reinforcing models. Reinforcement with composite resin provided less maximum tensile strength than that with reinforced glass ionomer. Higher elastic modulus of posts, such as Ni-Cr alloy showed more maximum tensile stress at post apex, but less stress concentration at flared dentin compared with posts with lower elastic modulus. **Conclusions:** From this FEA study, reinforcement of flared root canal with composite resin and carbon fiber post showed favorable stress distribution in restoring the teeth with flared root canal.

1. **Microleakage**

\*Dasch, W., El-aryan, M., Roggendorf, MJ., Ebert, JA. Petschelt, Frankenberger, R. **Leakage of different luting cements for quartz-fiber post cementation**., *J Dent Res.Vol 87 (Spec Iss A) Abstract #3141, 2008* *(www.dentalresearch.org)*

**Objectives:** Assessment of coronal leakage after quartz-fiber post cementation using adhesive and non-adhesive luting cements. **Methods:** Fourty root canals were prepared to apical size .02/#70 with K-reamers (Dentsply-Maillefer, Ballaigues/Switzerland). Root canals were obturated with AH-Plus sealer (DeTrey-Dentsply, Konstanz/Germany) and gutta-percha (Coltene-Whaledent, Langenau/Germany) and stored for 1 week under moist conditions at 37°C. Post preparation was performed with **DT Light- Post** burs #3 (VDW-Dentsply, Munich/Germany). Teeth were randomly assigned to 5 groups (grp1-5, n=8) and **DT White Posts** (VDW-Dentsply) were luted with adhesive resp. non-adhesive cement: grp1: Harvard Cement (Richter & Hoffmann, Berlin/Germany); grp2: Ketac-Cem Aplicap (3M Espe, Seefeld/Germany); grp3: RelyX Unicem (3M Espe); grp4: Panavia-F 2.0/ED-Primer II (Kuraray-Dental, Kurashiki/Japan); grp5: Variolink II/Excite DSC (Ivoclar Vivadent, Schaan/Liechtenstein). Teeth were stored for 1 week under moist condition (100% rel. humidity) at 37°C. Leakage analysis was performed by a dye penetration test (5% aqueous methylene-blue solution/3min centrifugation time at 30g). Serial cross sections were investigated for dye penetration by means of a stereo microscope (magnification: x40). **Results:** The following mean leakage values were found (in mm+S.D.): grp1: 8.3+2.2; grp2: 6.9+2.6; grp3: 3.4+1.9; grp4: 5.6+3.2; grp5: 6.1+2.9. Kolmogorov-Smirnov test displayed normal distribution (p>0.05) for each group. Significant differences were detected between groups (ANOVA; p<0.05). RelyX Unicem and Panavia-F 2.0 revealed significantly less leakage compared to the other cements tested (t-test; p<0.05). **Conclusion:** Within the limits of this study, two adhesive cements revealed better results for cementation of quartz fiber posts showing less leakage in comparison to other cement systems tested.

Kazemi, R. B., Reid, L.C., Meiers, J. C**., A new test system for measuring concurrently fatigue and microleakage**, *J Dent Res. 81 (Spec. Iss. A) Abstract # 3130; 2002* *(www.dentalresearch.org)*

**Objectives:** The purpose of this study was to develop and evaluate a non-destructive test system that could test concurrently fatigue and microleakage. **Methods:** A new multi-purpose computer-operated impact machine was designed and used in combination with a modified fluid filtration apparatus to evaluate concurrently both core integrity and post microleakage in the same sample. Crowns of single rooted teeth were removed and the roots were randomly assigned to five groups (n=10) and restored with the following post systems: one metallic group-Titanium ParaPost (TP) cemented with zinc phosphate, and four non-metallic groups- CosmoPost (CO), **C-Post /Composipost** (CP), Esthetic C-Post (EC), and FibreKor Posts (FK). All non-metallic posts were cemented with resin cement. Tetric Ceram was used for composite core for all groups. Samples were imbedded in an acrylic resin mold, connected to the filtration system and the baseline/control microleakage was measured. Samples were then placed in a positioning jig in the fatigue testing machine and subjected to 100,000 impacts at 45 degrees to the long axis of the root with a force of 55N at a frequency of 3HZ. After 60,000 impacts, the samples were subjected to 1,000 thermocycles (60KT) between 50C and 550C. Microleakage of the post systems was measured at 30K, 60K, 60KT and 100K cycles. **Results:** All samples showed no detectable displacement of any core. Mean +/-SD microleakage in microliters significantly increased in all groups as samples were subjected to increased impacts and thermocycling. The metallic group (TP) showed a statistically significant increase in microleakage (p<0.05) when compared to the non-metallic groups (CO, CP, EC and FK) at the conclusion of the study. **Conclusions:** The test design was successful in performing both fatigue loadings and microleakage measurements in the same sample using core integrity and prefabricated post microleakage as test parameters.

Reid, LC, Kazemi, RB, Meiers, JC. **Effect of fatigue testing on core integrity and post microleakage of teeth restored with different post systems.** *J Endod. 2003 Feb;29(2):125-31*.

The purpose of this study was to evaluate a new nondestructive test system, which could test concurrently fatigue and microleakage. Fifty, single-rooted teeth were restored with one of the following posts systems and a composite core: titanium ParaPost cemented with zinc phosphate cement; CosmoPost; **C-Post/Composipost**; Esthetic C-Post; and FibreKor post, all cemented with resin cement. Samples were embedded and placed in a positioning jig. They were impacted at 45 degrees to the long axis of the tooth with a force of 55 N at a frequency of 3 Hz for a total of 100,000 impacts. After 60,000 impacts, samples were thermocycled. Core integrity and post microleakage were evaluated periodically throughout the 100,000 impacts. Samples showed no detectable displacement of any of the cores, but the metallic group showed a statistically significant increase in microleakage (p < 0.05) at the conclusion of the study compared with the nonmetallic groups. **PDF**

1. **Failure mode**

Bae, J-M., Park, J-S, Kim, Y-J, et al**. Effect of component and shape of posts on fracture aspects.** *J Dent Res. Vol 83 (Spec. Iss. A) Abstract #3135, 2004* *(www.dentalresearch.org)*

**Objectives:** This study was to compare the fracture resistance and failure mode of natural teeth with endodontically treated teeth, with and without post systems that have different shapes and components. **Methods:** Total 45 human mandibular incisors were divided into 9 groups; natural teeth (A), root canal treated teeth without post (B), and teeth with their crowns removed and restored with seven kinds of post systems. Each post was cemented with dual-cured resin cement, Duo-Link (Bisco) and core build-up was done with light-cured composite, Light-Core(Bisco), except cast posts. Each specimen was embedded in acrylic resin with periodontal ligament simulation and shear load was applied using universal testing machine (Z020, Zwick) at a crosshead speed of 5 mm/min. After test, the fracture aspects were evaluated by naked eye and SEM. **Results:** The data of fracture resistance were analyzed by Kruskal-Wallis test and Duncan's multiple range test at *P*=0.01 (unit: N). The highest fracture resistance was recorded for Cast post and Para post (*P*<0.01). In failure mode, **C-Post / Composipost** and FRC Postec showed favorable aspects with few cracks around apical third. **Conclusions:** The carbon and glass fiber posts with tapered shape resulted in good failure mode, in spite of their lower strength than metal post, meaning the possibility of re-treatment.

Cormier, C., Burns, D., Moon, P., **In vitro comparison of the fracture resistance and failure mode of fiber, ceramic, and conventional post systems at various stages of restoration**. *J Prosthodont 2001; 10:26-36*

**Purpose:** This in vitro study evaluated 6 post systems over 4 simulated clinical stages of tooth restoration to (1) determine quantitatively the fracture resistance strength at each stage when a static loading force is applied to cause fracture (2) determine the failure mode for each post system at each simulated stage and (3) determne the feasibility of removing failed post systems. **Methods:** Ten post systems made with various materials and designs were tested at the following 4 stages of simulated clinical treatment: Stage 1: post only, loaded using a 3-point loading model to failure to determine transverse strengths and failure modes for each post system, Stage 2: Posts alone bonded into teeth, Stage 3: posts bonded into teeth with core build-up, Stage 4: post and core build-ups with full veneer restorations.For stages 2 through 4, the coronal portion of 60 mandibular premolars were amputated at the cemento-enamel junction (CEJ), the canals were treated enddodontically, and the specimens were mounted in acrylic blocks. A testing force was applied to the posts at 90 degrees to the long axis of the tooth, 4mm from the CEJ.The O’Brien test for constant variance was performed over the treatment groups. For non-constant variance, the Welch analysis of variance was used to test for equalities of treatment means. The Tukey Kramer procedure determined which treatment procedures differed. **Results:** The failure thresholds for each post system were significantly different at each stage of testing, but the order of test results remained generally consistent from one stage to the next. ParaPosts (Coltene Whaledent) and and core build-up resulted in higher failyre thresholds through all 4 stages of testing. This post system also displayed a high number of nonfavorable tooth fractures. FibreKor Posts (Jeneric-Pentron) resulted in significantly lower failure threshold values, in stages 2 through 4. This post system displayed no tooth fractures in stages 2 and 3, and a similar number of nonfavorable tooth fractures in stage 4, when compared with the other systems. **C-Post / Composipost** (Bisco Dental / RTD, St Egreve, France), Cosmopost (Ivoclar/Vivadent) and **Aestheti-Post** (Bisco Dental / RTD, St Egreve, France) grouped in descending order through stages 2 to 4. These systems displayed intermediate fracture resistance strengths, as well as a moderate number of non-favorable tooth fractures. Cosmopost displayed a significant number of brittle post fractures with fragments left in the root canal at all stages. The fracture resitance of the cast metal posts varied from stage to stage. No teeth fractured at stage 2. At stage 3, 9 of 10 teeth fractured non-favorably, and all teeth fractured nonfavorably in stage 4. **Conclusions:** The fiber posts evaluated provided an advantage over a conventional post that showed a higher number of irretrievable posts and unrestorable root fractures. At the stage of final restoration insertion, there was no difference in force to failure for all but the FibreKor material, which continued to be weaker than all the other tested materials. The fiber posts were readily retrievable after failure, whereas the remaining post systems tested were non-retreivable. **PDF**

Fokkinga, W**.** A., Creugers, N. H., Kreulen, C. M. **In vitro failure mode of fiber-reinforced post-core systems: A systematic review**. *J Dent Res. Vol. 82 IADR Abstract #2563, 2003* *(www.dentalresearch.org)*

**Objectives:** To compare in vitro failure modes of fiber reinforced post systems with prefab metal and cast post systems. **Methods:** The literature was searched using MEDLINE, with the year limits 1984-2002/6 for dental articles written in English, German or Dutch. Key words: (post or core or build-up or dowel) and (teeth or tooth) not (implant or orthodontic or periodontal or primary teeth). The following steps were conducted: 1) Inclusion of abstracts describing post-core techniques to reconstruct endodontically treated teeth and their mechanical characteristics (strength, fracture, failure, resistance, survival, retention, leakage, seal). Descriptive studies or reviews were excluded. 2) Inclusion if in vitro studies on fracture resistance of single rooted human teeth restored with prefab fiber posts and composite cores. 3) Failure mode categorization. Favorable failures were defined as repairable failures including adhesive failures, and fractures above bone simulation. Unfavorable were non-repairable, vertical root fractures. Steps 2) and 3) were conducted using the Aim, Materials and Methods and Results of the articles. All assessments were done by 2 operators. Consensus was reached in case of disagreement. Kappa’s were used for observer agreement. Percentages of favorable failures of the post systems were compared using Wilcoxon Signed Rank Test. **Results:** MEDLINE identified 1237 articles. Results of each step: inclusion of 203 articles (Kappa=0.86) of which 21 dealt with fibers, 2) inclusion of 8 articles (Kappa=0.62) of which 6 dealt with failure mode of carbon fibers, 3) failure mode categorization per system (Kappa=0.99). Favorable failures occurred significantly more with the carbon fiber reinforced posts than with the prefab metal (n=11, p=0.05, z=1.96) and respectively, the cast post groups (n=8, p=0.02, z=2.39). **Conclusions:** These results suggest a more favorable failure mode of the Carbon fiber post systems compared with prefab metal and cast post systems. Comparative studies of the different post systems are scarce

\*Hegde, J., Ramakrishna, T., Bashetty K, Srirekha, Lekha, Champa. **An in vitro evaluation of fracture strength of endodontically treated teeth with simulated flared root canals restored with different post and core systems**. *J Conserv Dent. 2012 Jul;15(3):223-7*.

**Purpose**: The objective of this study is to evaluate the fracture strength and mode of failure of endodontically treated teeth with flared canals restored with two fiber reinforced systems -glass fiber and quartz fiber -(**D,T. Light-Post**, RTD, St Egreve, France) and one base metal cast post and core system. **Methods:** Forty-five anterior teeth were de-coronated at cemento-enamel junction and were endodontically treated. Post space was prepared and randomly divided into three groups according to post system. Specimens were loaded at 45° in a universal testing machine at a cross head speed of 0.5 mm/min until failure. The mode of failure was classified as repairable or non-repairable. **Results:** Teeth restored with cast posts have fracture strength twice that of teeth restored with fiber posts. Fiber-reinforced posts failed at a certain compressive force but they were repairable unlike the non-repairable fracture seen with cast posts. **Conclusion:** The results of this study showed that, fracture strength and mode of failure in anterior teeth with flared canals varied according to the type of post used to support a crown. **PDF**

\*Hou, QQ, Gao, YM, Lei Sun, L. **Influence of fiber posts on the fracture resistance of endodontically treated premolars with different dental defects**. *International Journal of Oral Science* *advance online publication, 2 August 2013; doi:10.1038/ijos.2013.52*

This study aimed to evaluate the influence of quartz fiber post (**D,T. Light-Post**, RTD, St Egreve, France) placement on the fracture resistance of endodontically treated premolars with different dental defects under dynamic loading. Fifty extracted single-rooted mandibular premolars were randomized into five groups. Each group was prepared according to numbers of residual walls ranged from 0 to 4. Then each group was divided into two subgroups with one restored with quartz fiber posts and the other without posts. In no-post groups, gutta percha point 2 mm below cemento-enamel junction was removed. Composite resin was adapted to the well and used to shape the core directly. Each tooth was restored with a complete metal crown. Dynamic loading was carried out in a masticatory simulator with a nominal load of 50 N at 2 Hz for 300,000 loading cycles. Then a quasi-statically load was applied in a universal testing machine 306 to the long axis with a crosshead speed of 1 mm/min until fracture. Data were analyzed with one-way analysis of variance and pairwise comparison (P,0.05). No specimens failed during dynamic loading. The fracture resistance enhanced with the increase of numbers of coronal walls and the differences were significant (P,0.05). Placement of fiber posts had a significant effect when fewer than two walls remained (P,0.05), but it had no significant influence in groups with two, three or four walls (P.0.05). Fiber post did not change failure mode, and the fracture pattern was mainly favorable. More dentin walls need to be retained in clinic. When no less than two walls remained, a fiber post is not always necessary. **PDF**

Krug, KP, Otter SE, Knauber AW, Erdelt KJ, Nothdurft FP. **Influence of proximal contacts and FRC posts on the fracture behavior of premolars with class II composite restorations: an in-vitro study**. *Dent Mater J. 2013 Nov 30;32(6):952-8. Epub 2013 Nov 15.*

The purpose of this study was to evaluate the influence of the number of proximal contacts and fiber-reinforced composite (FRC) post insertion on the fracture behavior of endodontically treated premolars with class II (MOD) cavities and direct composite restorations. Forty-eight single-rooted human premolars were endodontically treated and prepared with standardized MOD (mesio-occluso-distal) cavities. One-half of the teeth additionally received FRC-posts (**DT Light-Post SL**; RTD/VDW) luted with Panavia F resin cement. All of the specimens were restored with direct composite restorations, and the teeth were embedded in proximal contact with either zero, one or two adjacent tooth-replicas. Eight sound premolars served as control. After thermo-mechanical aging, the samples were loaded until fracture at an angle of 30°. The sound teeth showed the highest mean fracture load. Teeth with one or two proximal contacts and FRC-posts showed only statistically insignificantly lower values. All of the other groups had significantly lower values.

\*Latta, ,M. A., Barkmeier,W. W. , Kimmes,,N. S. , O'Meara, J. D. **Failure resistance of post-core assemblies**. *J Dent Res 85, (Special Issue A) #0377, 2006* *(www.dentalresearch.org)*

Resistance to lateral loading is critical for clinical success of the post/core assembly. **Objective:** The purpose of this in-vitro study was to evaluate the load resistance and failure mechanism of glass fiber and metal retained core build-ups. **Methods:** Following the removal of the clinical crown, gutta percha was used to restore canals prepared to size 40 in 60 extracted human anterior teeth. After storage in water for 1 week at 370C, post preparations were made to a depth of 9mm and parallel ParaPost, FibreKleer and FibreKor posts and tapered FibreKleer and (**D,T. Light-Post**, RTD, St Egreve, France were cemented using Bond-1 adhesive and Lute-It cement. Using a gelatin capsule matrix, a core was fabricated using Build-It resin. A flat area was prepared on the core at a 45º angle to the lingual/occlusal aspect of the post/core/tooth assembly. The specimens were stored in water for 24 hours at 370C, thermocycled and loaded to failure at a crosshead speed of 1mm/min in an Instron testing machine. **Results:** Mean load at failure (in Newtons) and failure pattern for each group are presented. ANOVA and post hoc LSD tests revealed significant differences in load failure (p<0.05). Groups with a similar letter are statistically similar (p>0.05). **Conclusion:** Metal posts generated the highest resistance to failure of the post/core assembly but also the highest root fracture.

Le Bell-Rönnlöf AM, Lassila LV, Kangasniemi I, Vallittu PK. **Load-bearing capacity of human incisor restored with various fiber-reinforced composite posts.** *Dent Mater. 2011 Jun;27(6):e107-15. Epub 2011 Mar 27.*

**Objectives:** The aim of this study was to evaluate the load-bearing capacity and microstrain of incisors restored with posts of various kinds. Both prefabricated titanium posts and different fiber-reinforced composite posts were tested. **Methods:** The crowns of human incisors were cut and post preparation was carried out. The roots were divided into groups: (1) prefabricated serrated titanium posts, (2) prefabricated carbon fiber-reinforced composite posts (**C-Post /** **Composipost**, RTD, St Egreve, France, (3) individually formed glass fiber-reinforced composite posts with the canal full of fibers, and (4) individually formed "split" glass fiber-reinforced composite posts. The posts were cemented and composite crowns were made. Intact human incisors were used as reference. All roots were embedded in acrylic resin cylinders and stored at room temperature in water. Static load was applied under a loading angle of 45° using a universal testing machine. On half of the specimens microstrain was measured with strain gages and an acoustic emission analysis was carried out. Failure mode assessment was also made. **Results:** The group with titanium posts showed highest number of unfavorable failures compared to the groups with fiber-reinforced composite posts. **Conclusions:** fiber-reinforced composite posts the failures may more often be favorable compared to titanium posts, which clinically means repairable failures. **PDF**

McLaren, J.D., McLaren, C.I., Yaman, P., Bin-Shuwaish, M.S., Dennison, J.D., McDonald, N.J. **The effect of post type and length on the fracture resistance of endodontically treated teeth.** *J Prosthet Dent. 2009 Mar;101(3):174-82.*

**Statement of problem:** Few studies have been conducted to determine a correlation between the flexural modulus of metal and fiber-reinforced posts and the fracture resistance and failure mode of teeth restored with posts. Questions remain as to whether a longer post length or a post with a higher flexural modulus will significantly improve the fracture resistance of a tooth restored with a prefabricated post and core. **Purpose:** The purpose of this study was to compare the fracture resistance and mode of failure of endodontically treated teeth restored with 3 different post systems, including 2 fiber-reinforced posts (**Light-Post** and Snowlight) and a stainless steel post (ParaPost XP). **Methods:** Seventy single-rooted premolars were sectioned at the cemento-enamel junction and then endodontically treated. Teeth were distributed into 7 groups. Three different prefabricated posts were cemented into a post space either 5 or 10 mm in depth, and composite resin (ParaPost ParaCore automix) cores were fabricated. A composite resin core group without a post served as a negative control. Specimens were loaded at 90 degrees to the longitudinal axis until ultimate failure occurred. An initial failure load and mode of failure were also recorded. Statistical analysis was performed for initial and ultimate failure loads of groups by using 2-way ANOVA (P=.05). **Results:** The groups with ParaPost XP posts demonstrated significantly higher initial and ultimate mean failure loads when compared with the fiber-reinforced post groups. The highest mean (SD) initial failure load was with the ParaPost XP group with a 10-mm post length (170.05 (60.08) N), and the lowest was with the Snowlight group with the 5-mm post length (62.85 (18.47) N). **Conclusions:** The stiffness and the load to initial fracture of the teeth restored with ParaPost XP posts were higher compared with the fiber-reinforced post groups. The stainless steel posts had an incidence of **25% root fractures,** while no root fractureas were observed with the fiber posts. Clinical Implications: The results of this study suggest that a stainless steel post may provide better support for a composite core than a fiber –reinforced post when a 90 degree load is applied. **PDF**

Mannocci, F., Ferrari, M., and Watson, T. F. **Intermittent loading of teeth restored using quartz fiber, carbon-quartz fiber, and zirconium dioxide ceramic root canal posts**. *Journal of Adhesive Dentistry*. *1: 153-158, 1999.*   
   
**Purpose:** The purpose of the investigation was to compare the performances of teeth restored with quartz-fiber, carbon-quartz fiber, and zirconium-dioxide posts covered with all-ceramic crowns when subjected to a cyclic loading tests performed in a wet environment. **Methods:** Forty single-rooted human lower premolars having similar dimensions were endodontically treated and mounted in acrylic resin blocks with a simulated periodontal ligament. The teeth were divided into three experimental groups and one control group. Post holes 8 mm long were prepared in the roots of the experimental groups in which quartz fiber (**Aestheti-Plus,** RTD, St Egreve, France), carbon-quartz fiber (**Aestheti-Post**; RTD, St Egreve, France), and zirconium dioxide (Cerapost) posts were cemented. In the control group, no posts were used. The crown buildup was made with composite resin. The teeth were covered with all-ceramic crowns and intermittently loaded an at angle of 45 degrees to the long axis of the tooth at a frequency of two loads per second. **Results:** Only one failure (root fracture + post fracture), was observed in each of the fiber post groups, while in the zirconium dioxide post group, six failures were observed (one crown fracture and 5 root fracture + post fractures). The Kaplan-Meier analysis of the three experimental groups showed that the survival rate of zirconium dioxide posts was significantly lower than that of both types of fiber post. All the experimental groups showed a survival rate higher than that of the control group. **Conclusions:** Fiber posts reduced to a minimum the risk of root fractures of teeth restored with composite cores and Empress crowns under the present experimental conditions (intermittent loading in a wet environment). **PDF**

Maroulakos G., Nagy, WW, Kontogiorgos, ED,. **Fracture resistance of compromised endodontically treated teeth restored with bonded post and cores: An in vitro study.** *J Prosthet Dent. 2015 Sep;114(3):390-7. doi: 10.1016/j.prosdent.2015.03.017. Epub 2015 Jun 2.*

**Statement of problem:** It is unclear which post and core system performs best when bonded to severely compromised endodontically treated teeth. **Purpose:** The purpose of this study was to investigate the fracture resistance and mode of failure of severely compromised teeth restored with 3 different adhesively bonded post and core systems. **Methods:** Thirty extracted endodontically treated maxillary anterior teeth were randomly divided into 3 groups, CPC, gold cast post and core; TPC, titanium prefabricated post/composite resin core; and FPC, quartz fiber reinforced post (**D,T. Light-Post**, RTD, St Egreve, France) /composite resin core. All posts were adhesively cemented. All cores resembled a central incisor preparation with no remaining tooth structure above the finish line. Cast gold crowns were fabricated and cemented adhesively. The specimens were aged with thermocycling and cyclic loading. Two specimens per group were randomly selected for micro-computed tomographic imaging before and after aging. Failure was induced with a universal testing machine. The mode of failure was characterized by the interface separation. Data were analyzed with 1-way ANOVA (α=.05) followed by post hoc tests (Bonferroni). **Results:** A statistically significant difference was found among the 3 groups (P=.002). CPC was significantly different than TPC (P=.008) or FPC (P=.003). The primary mode of failure for CPC and TPC was root fracture, and for FPC post debonding. **Conclusions:** Severely compromised endodontically treated teeth restored with bonded gold cast post and cores showed significantly higher fracture resistance. **PDF**

\*Muangamphan, P, Sattapan, B, Kukiattrakoon, B, Thammasitboon, K. **The effect of incomplete crown ferrules on fracture resistance and failure modes of endodontically treated maxillary incisors restored with quartz fiber post, composite core, and crowns*.*** *J Conserv Dent. 2015 May-Jun;18(3):187-91. doi: 10.4103/0972-0707.157239.*

**Aim:** To investigate the fracture resistance of restored endodontically treated teeth (RETT) with fiber posts, cores, and crowns with limited ferrules. **Methods:** Sixty maxillary anterior teeth were endodontically treated and de-coronated 2 mm above the cemento-enamel junction, and then divided into 6 groups of 10 teeth each; Group circumferential ferrule (2FR), Group ferrule in the labial, mesial, and palatal region (2FR-LaMPa), Group ferrule in the labial, and palatal region (2FR-LaPa), Group 2FR-Pa and 2FR-La respectively, and Group 0FR (no ferrule). All 60 prepared teeth were then restored with quartz fiber posts (**DT Light-Post**, RTD/ St Egreve, France), resin composite cores, and metal crowns. The specimens were subjected to load until failure occurred. Data were analyzed using one-way analysis of variance and Tukey's tests (α = 0.05). The mode of failure was determined under a stereoscope. **Results:** A statistical significant difference was found among groups 2FR-LaMPa, 2FR-Pa, 2FR-LaPa, and 2FR from the group 2FR-La, and from the group 0FR (P < 0.01). The predominant mode of failure was an oblique palatal to labial root fracture for the groups with remaining ferrules. **Conclusion:** For RETT that have incomplete crown ferrules, the location of the ferrules may affect their fracture resistance. **PDF**

\*Ng, C., Dumbrigue, H., Al-Bayat, M., Griggs, J., Wakefield, C. **Influence of remaining coronal tooth structure location on the fracture resitance of restored endodontically treated anterior teeth.** *J Prosthet Dent 2006;95:290-6.*

**Statement of problem:** a restored endodontically treated tooth is less likely to fracture when there is axial tooth structure between the core base and preparation finish line. However an accurate prognosis requires knowing whether fracture resistance depends on a complete circumferential distribution of tooth structure or tooth structure in a specific location to the applied force. **Purpose:** This in vitro study investigated the fracture resistance of restored endodontically treated teeth when residual axial tooth structure was limited to one half of the circumference of the crown preparation. **Methods:** Fifty extracted maxillary anterior teeth were sectioned 18mm from ther apices, endodontically treated and divided into 5 groups of 10 teeth each. Four groups were prepared with full shoulder crown preparations having axial wall heights of 2mm around the preparation circumferences. In three of the groups with axial tooth structure, one half of the axial tooth structure was removed. Palatally, labially, or proximally and groups were identified according to the site of retained coronal tooth structure. For the fifth group, all axial tooth structure was removed to the level of the preparation shoulder. Thus, in one group the axial walls were circumferential, 360 degrees around the preparations (Complete group), in 3 groups the axial walls were continuous for 180 degrees (palatal, labial and proximal groups) and the last groups had no retained coronal tooth structure incisal to the finish line (Level Group). All 50 prepared teeth were then restored with quartz fiber posts (**D.T. Light-Post**; RTD, St Egreve, France/ Bisco Dental), composite cores (Bisco Dental) and metal crowns. A universal testing machine compressively loaded the tooth specimens at a crosshead speed of 0.5cm/minute at an angle of 135 desh line, the location degrees to the long axis of the teeth until failure occurred. A survival analysis was conducted using a log rank test followed by Holm-Sidak pairwise test (α=0.05) to detect significant differences in median failure load between groups. The mode of failure was determined by visual inspection of all specimens. **Results:** The median failure load (P<.001) was 607 N, 782N, 358N, 375N, and 172N for the Complete, Palatal, Labial, Proximal and Level groups, respectively. The predominant mode of failure was an oblique palatal to facial root fracture for the groups with remaining coronal tooth structure. In the Level group, post debonding was the predominant mode of failure. **Conclusion:** For restored endodontically treated teeth that do not have complete circumferential tooth structure between the core and preparation finish line, the location of the remaining coronal tooth structure may affect their fracture resistance. **PDF**

Salameh, Z, Ounsi, HF, Aboushelib, MN, Sadig, W, Ferrari, M. **Fracture resistance and failure patterns of endodontically treated mandibular molars with and without glass fiber post in combination with a zirconia-ceramic crown.** *J Dent. 2008 Jul;36(7):513-9. Epub 2008 May 13*

**Objective:** The aim of this study was to investigate the influence of a fiber post on the fracture mechanics of zirconia crowns inserted over endodontically treated teeth with different extent of coronal damage. **Methods:** Endodontically treated human molars with three types of coronal damage received fiber posts (**D,T. Light-Post**, RTD, St Egreve, France before cementation of zirconia-veneered crowns. Controls received composite resin cores without fiber posts. The specimens were loaded to failure and fractographically examined using a scanning electron microscope (SEM). **Results:** Statistical analysis revealed that specimens with fiber posts demonstrated significantly higher failure loads and favorable fracture pattern compared to the controls. At fractographic analysis, specimens with fiber posts demonstrated delamination of the veneer ceramic from intact zirconia under structure. Meanwhile, the specimens that were restored without a fiber post demonstrated micro-cracking of the composite core build-up resulting in loss of the support under the zirconia crowns which was responsible for the initiation of radial crack and catastrophic damage. **Conclusions:** Within the limitation of this study, the insertion of fiber post improved the support under zirconia crowns which resulted in higher fracture loads and favorable failure type compared to composite core build-up. **PDF**

Sharma, S, Attokaran, G, Singh, KS, Jerry, JJ, Ahmed, N, Mitra, N. **Comparative evaluation of fracture resistance of glass fiber reinforced, carbon, and quartz post in endodontically treated teeth: An in-vitro study.** *J Int Soc Prev Community Dent. 2016 Jul-Aug;6(4):373-6. doi: 10.4103/2231-0762.186801*.

**Aim and objectives:** Use of posts improves the physical properties of endodontically-treated teeth. Different post types are developed such as metal, custom-made, carbon, and quartz. The present study was conducted to evaluate the fracture resistance of glass fiber-reinforced, carbon, and quartz post in endodontically-treated teeth. **Methods:** Forty extracted human maxillary incisor teeth were decoronated and endodontically treated and equally divided into 4 groups; control, glass fiber-reinforced, carbon, and quartz posts. No post was used in the control group. Post space was prepared and cemented with different posts and subjected to universal testing machine to check fracture resistance. The data were statistically analyzed using t-test and analysis of variance to compare the mean difference between groups (SPSS version 20, IBM). **Results:** Quartz type of endodontic post showed good fracture resistance compared to carbon and resin-reinforced post. Least resistance was observed in the control group without post. **Conclusion:** Quartz, carbon, and glass fiber-reinforced posts show good resistance to fracture, and hence can be used in endodontically-treated teeth to enhance their strength.  **PDF**

\*Sorrentino, R., Monticelli, F., Goracci, C., Zarone, F., Tay, F., Garcia-Godoy, Ferrari, M. **Effect of post –retained composite restorations and amount of coronal residual structure on the fracture resistance of endodontically treated teeth.** *Am J Dent2007;20:269-274*

**Purpose:** To compare the fracture resistance and failure patterns of endodontically treated teethwith a progressively reduced number of residual walls , restored using resin composites, with or without translucent fiber posts. **Methods:** Ninety extracted human single-rooted maxillary premolars were used. After endodontic treatment, the following groups were created: Group 1 (control group): endodontically treated single-rooted maxillary premolars with four residual walls, Group 2: three residual walls, Group 3: two residual walls, Group 4: one residual wall, Group 5: no residual wall. Groups 2-5 were each divided into two subgroups: subgroups “a” were restored with resin composites, while subgroups “b” were restored with translucent fiber posts (**D.T. Light-Post**; RTD St Egreve, France) AND resin composites. Static fracture tests and statistica analyses were performed. **Results:** The mean failure loads (N) were: Group 1=502.4 +/-152.5, Group 2a= 416.4 +/- 122.2, Group 2b= 423.0 +/- 103.3, Group3a= 422.1+/-138.9, Group 3b= 513.2+/-121.7, Group 4a=488.7+/-153.7, Group 4b= 573.4+/-169.2, Group 5a=856.7+/-112.2 and Group 5b= 649.5+/-163.5, respectively. The samples restored with the fiber posts exhibited predominately restorable fractures. The number of residual cavity walls influenced the mechanical resistance of endodontically treated teeth. **PDF**

Sorrentino, R, Salameh, Z, Zarone F, Tay, FR, Ferrari M. **Effect of post-retained composite restoration of MOD preparations on the fracture resistance of endodontically treated teeth***. J Adhes Dent. 2007 Feb;9(1):49-56*

**Purpose:** The present study aimed to compare the fracture resistance and failure patterns of endodontically treated premolars with MOD preparations restored using different material combinations. The null hypothesis postulated that there was no association between the fracture resistance of endodontically treated premolars and the resin composite materials or the post-and-core system used to build up the restorations. **Methods:** Eighty single-rooted maxillary premolars were used. After endodontic treatment and preparation of MOD preparations, 8 groups of 10 samples each were created, using the following material combinations: group 1 (control), flowable and microhybrid resin composites; group 2, flowable A; group 3, flowable B; group 4, microhybrid resin A; group 5, microhybrid resin B; group 6, flowable B + microhybrid resin B; group 7, flowable A + microhybrid resin A + post A; group 8, flowable B + microhybrid resin B + post B. Mechanical static fracture tests were performed loading the specimens till fracture. **Results:** The mean failure loads (N) were 502 (control), 470 (group 7), 445 (group 8), 441 (group 6), 405 (group 5), 364 (group 4), 317 (group 2), and 302 (group 3). Statistically significant differences were found between groups 1 vs 2, 1 vs 3, and 3 vs 7 (p < 0.05). **Conclusions:** The fracture resistance of endodontically treated premolars with MOD preparations was enhanced by the use of the sandwich technique. The samples restored with posts predominantly showed restorable fractures, while teeth restored without posts mostly displayed unrestorable failures. **PDF**

**F. FATIGUE RESISTANCE**

\*Baldissara, P., Zicari, F., Melilli, D., Monaco, C. **Effect of endodontic treatment on fatigue resistance of fiber post bonding**. *J Dent Res. Vol 82 (Special Issue A) Abstract # 2565, 2003* *(www.dentalresearch.org)*

**Objectives:** The aim of this study is to evaluate the effect of the endodontic treatment on the fatigue resistance of endodontic post adhesive interfaces. **Methods:** FIFTY single-rooted human teeth have been severed at the CEJ and randomly assigned to 5 groups receiving different endodontic treatments as follows: 1) distilled water + gutta percha (control); 2) NaOCl 5% + gutta percha + Pulp Canal Sealer EWT (Kerr); 3) NaOCl 5% + gutta percha + TopSeal (Dentsply-Maillefer); 4) NaOCl 5% and EDTA 10% (alternatively) + gutta percha + Pulp Canal Sealer EWT; 5) NaOCl 5% and EDTA 10% (alternatively) + gutta percha + TopSeal. Subsequently, #2 **DT Light-Post** (RTD, St Egreve, France /Bisco) quartz fiber posts have been placed in the root canal using All-Bond 2 adhesive (Bisco) and Bis-Fil 2B composite (Bisco). Five specimens from each group have been subjected to 2,000,000 fatigue cycles ranging from 0 to 37.5N at 8Hz frequency and 370C water irrigation, whereas the remaining specimens were stored in distilled water at room temp. After the fatigue cycles, all of the specimens were severed obtaining 4 sections from each tooth, which were then evaluated with the push-out test at a constant speed of 1mm/min. Stereomicroscope and SEM observations were done to evaluate the interface failures. **Results:** no statistically significant differences were observed between the 5 groups in both fatigue stressed (p=0.298) and water stored specimens (p=0.093). Also, the microscope analysis of interface failures showed that the post-cement interface is weaker than the cement-dentin one. The difference was significant with P=0.001. **Conclusions:** the results suggest that the interface resistance is not influenced by the canal treatments adopted in this study. Probably the hard tissue removal necessary for post placement eliminated contaminated or altered dentin that may affect the bonding with the luting cement. High resistance of the cement-dentin interface strongly supports this last hypothesis.

\*Baldissara, P, Pieri, F, Arcidiacono, A**, Fatigue resistance of fiber posts: a comparative study.** *J Dent Res.Vol. 80 (Special Issue A) Abstract #1434, 2001* *(www.dentalresearch.org)*

Fiber posts are commonly used to restore endodontically treated teeth prepared for fixed partial dentures. Their mechanical properties and the use of adhesive cements seem to allow higher survival rates when compared to traditional cast or metal posts. The aim of this study was to compare the fatigue resistance of five different types of fiber posts. Fifty sound incisors, bicuspids and canines have been selected and endodontically treated. The crown was removed and they were randomly divided into five groups. Each group received 10 fiber posts inserted 9mm into the root. The posts were cemented using the dentin adhesive and the cement suggested by the manufacturer: 1) Carbon fiber (**Composipost**, RTD; St Egreve , France / Bisco C-Post); All-Bond 2 / C&B Cement (Bisco), 2) Quartz fiber post **Aestheti-Post** (RTD; St Egreve , France / Bisco); All-Bond 2 / C&B Cement (Bisco), 3) Quartz fiber **Light-Post** (RTD, St Egreve , France / Bisco); One -Step (Bisco) and Duo-Link cement (Bisco), 4) Glass fiber FibreKor (Jeneric Pentron) Post; BOND-1 (Jeneric Pentron) and Cement-It! (Jeneric Pentron) , 5) Quartz fiber D T Light-Post (RTD / Bisco); One-Step (Bisco) and Duo-Link cement (Bisco). Post diameter was 1.4mm for groups 1 – 4 and 1.5mm for group 5. Each group was subdivided into a control group and an experimental one. Specimens from the experimental groups underwent 2 million 8Hz frequency load cycles in distilled water at 370C. During each cycle, the load ranged from 3 to 21 Newtons and was applied directly one the post in 450 direction. The controls were stored in water at 270C. After the tests, all the specimens were imbedded in epoxy resin and sectioned transversely, obtaining 1mm thick sections. The sections were observed under the stereomicroscope and the post/cement (PC) and (CD) cement/dentin interfaces were evaluated using an ordinal scale. One post (Aestheti-Post) fractured after 1.5 million cycles. Light-Post and D. T. Light-Post gave the better results (P<0.009) at both interfaces. The PC interface appeared significantly stronger (P<0.05) than CD when tested with Kruskal-Wallis test. Significant differences (P<0.05) were found between controls and experimentals in groups 4 & 5. It was concluded that Quartz fiber posts are very resistant to fatigue stress and the adhesion at CD interface could be improved.

\*Hayashi, M, et al. **Static and fatigue fracture resistance of pulpless teeth restored with post-cores**, *Dent Mater (2008), doj:10.1016/jdental 2008.01.009*

**Objectives:** Superior restorative methods for effectively strengthening pulpless teeth need to be identified, since vertical root fractures of pulpless teeth are still a major problem in everyday clinical practice. The present study tested the null hypothesis that there were no differences in static and fatigue fracture resistance of pulpless teeth restored with different types of post-core systems. **Methods**: Extracted human premolars were restored with a combination of either a fiber post (**D.T. Light-Post** #3, RTD, St Egreve, France / Bisco USA) or metallic post and a composite resin core. Teeth with full crown preparations without post-core restorations served as the control. A 900 vertical or 450 oblique static compressive load was applied to the restored teeth, and (static) fracture loads-and modes of fracture-were recorded. Fatigue fracture tests were conducted by applying sinusoidal cyclic loads to restored teeth from vertical or oblique directions. Fatigue limits for each restoration were calculated using the staircase approach. **Results:** In both static and fatigue fracture testing under vertical or oblique loadings, the fracture loads of the teeth restored with fiber posts were significantly greater thanthose of teeth restored with metallic posts. The fatigue limits of teeth restored with fiber and metallic posts were 112 kgf and 82kgf respectively under vertical loadings, and 26kgf and 20kgf under oblique loadings. **Significance:** the combination of a fiber post and a composite resin core showed superior fracture resistance against both static and fatigue loadings compared to restoration using a metal post and is therefore recommended in restoring pulpless teeth. **PDF**

\*Kumar, J., Ng, J.Griggs, Y. Duan, Y. Nagy, W.,**Ferrule Effect on Preliminary Cyclic Fatigue of Endodontically Treated Teeth** . *J Dent Res. Vol 89 (Spec. Iss. A) Abstract #657, 2010 (www.dentalresearch.org).*

**Objective:** Determine the effect of axial tooth structure location on fracture resistance of restored endodontically treated teeth subject to cyclic loading. **Methods:** Fifty extracted maxillary anterior teeth subject to endodontic treatment were divided into five groups. In the complete ferrule group, axial tooth structures were circumferential and complete around the preparation shoulder line. In the palatal, labial and proximal groups, half of the axial tooth structure was removed. These groups were identified by the remaining coronal tooth structures. For the level group, all axial tooth structures were removed to the level of preparation shoulder. All teeth were restored with quartz fiber posts (Bisco/ RTD), composite resin cores (Bisco/ RTD) and metal crowns (Dentsply Ceramco). Teeth were embedded in the acrylic holders, thermally cycled, and then aged for two years in DI water. An electrical circuit was placed across the margin to detect preliminary failure as might lead to microleakage clinically. Specimens were subjected to cyclic fatigue (2Hz, R=0.1) using a servohydraulic load frame under ambient conditions immediately after connecting the circuits. Loading was applied at a 135-degree angle to the long axis of the tooth using step-stress technique. The initial load of 1N was increased by 0.00505N per cycle, and the numbers of cycles at preliminary and ultimate failure were recorded. Results were analyzed by ALTA Pro7 (Reliasoft). **Results:** The statistical analysis indicated that the lifetime data fitted an inverse power law-exponential model, and the cumulative probability of failure was not significantly different among all the five groups (p=0.076 preliminary; p=0.063 ultimate). The model parameters K and n are summarized in the following table. **Conclusions:** The location of the remaining coronal tooth structure does not affect fatigue resistance. NIH-NIDCR grants DE017991 and DE013358.

Nie, EM, Chen, XY, Zhang, CY, Qi, LL, Huang, YH. **Influence of masticatory fatigue on the fracture resistance of the pulpless teeth restored with quartz-fiber post-core and crown***. Int J Oral Sci. 2012 Dec;4(4):218-20. doi: 10.1038/ijos.2012.78. Epub 2013 Jan 10.*

To investigate whether masticatory fatigue affects the fracture resistance and pattern of lower premolars restored with quartz-fiber post-core and full crown, 44 single rooted lower premolars recently extracted from orthodontic patients were divided into two groups of 22 each. The crowns of all teeth were removed and endodontically treated and then restored with quartz-fiber post-core and full crown. Twenty-two teeth in one group were selected randomly and circularly loaded at 45° to the long axis of the teeth of 127.4 N at a 6 Hz frequency, and the other group was not delivered to cyclic loading and considered as control. Subsequently, all teeth in two groups were continually loaded to fail at 45° to the long axis of the teeth at a crosshead speed of 1 mm/min. (-1). The mean destructive force values were (733.88±254.99) and (869.14±280.26) N for the experimental and the control group, respectively, and no statistically significant differences were found between two groups (P>0.05). Bevel fracture and horizontal fracture in the neck of root were the major fracture mode of the specimens. **Under the circumstances of this study, it seems that cyclic loading does not affect the fracture strength and pattern of the quartz-fiber post-core-crown complex.**

\*Wiskott, HWA, et al**. Rotational fatigue-resistance of seven post types anchored on natural teeth. :***Dent Mater. 2007 Nov;23(11):1412-9. Epub 2007 Jan 30.*

**Purpose:** To develop a laboratory model aimed at duplicating the failure process of post and core restorations. The load pattern applied was to be repetitive (fatigue) and multivectorial. To determine and compare the resistance under fatigue loading of seven endodontic post/natural root combinations: stainless steel, titanium, ceramic, composite-fiber/epoxy, two glass-fiber/epoxy and glass-fiber/acrylic posts. **Methods:** The repetitive, alternating and multivectorial intraoral force pattern was reproduced by subjecting the specimens to the rotating cantilever beam test. To this end, the samples were designed as rotation-symmetric structures comprising a root, a post, periodontal ligament- and bone analogs and a restoration analog. The following posts were tested: Unimetric-Ti, Unimetric-SS, Biopost, Composipost, Easypost, **DT Light-Post**, Everstick post. The samples were spun around their long axes while being clamped into a revolving collet on one end and loaded normal to their long axis on the other end. The aim was to determine the load level at which 50% of the specimens survived- and 50% fractured before 10E6 cycles. The 50% means were determined using the staircase procedure. **Results:** In increasing order of magnitude, the resistances to fatigue loading were as follows: Biopost, Unimetric-Ti, Unimetric-SS, Composipost, Easypost, Everstick post, D.T. Light-Post. **Significance:** The fatigue resistance of the two fibrous posts with the highest fatigue resistance (Everstickpost, D. T. Light-Post ) was twice that of any of the ceramic or metal posts. **PDF**

\*Zamboni, SC, Baldissara, P, Pelogia, F, Bottino, MA, Scotti, R, Valandro, LF**. Fatigue resistance of bovine teeth restored with resin-bonded fiber posts: effect of post surface conditioning.** *Gen Dent. 2008 Jan-Feb;56(1):56-9*

This study evaluated the effect of post surface conditioning on the fatigue resistance of bovine teeth restored with resin-bonded fiber-reinforced composite (FRC). Root canals of 20 single-rooted bovine teeth (16 mm long) were prepared to 12 mm using a preparation drill of a double-tapered fiber post system (**D.T. Light-Post**; RTD, St Egreve France). Using acrylic resin, each specimen was embedded (up to 3.0 mm from the cervical part of the specimen) in a PVC cylinder and allocated into one of two groups (n = 10) based on the post surface conditioning method: acid etching plus silanization or tribochemical silica coating (30 pm SiO(x) + silanization). The root canal dentin was etched (H2PO3 for 30 seconds), rinsed, and dried. A multi-step adhesive system was applied to the root dentin and the fiber posts were cemented with resin cement. The specimens were submitted to one million fatigue cycles. After fatigue testing, a score was given based on the number of fatigue cycles until fracture. All of the specimens were resistant to fatigue. No fracture of the root or the post and no loss of retention of the post were observed. The methodology and the results of this study indicate that tribochemical silica coating and acid etching performed equally well when dynamic mechanical loading was used.

#### IV. Adhesion / Retention Testing

**A. POST TO ROOT**

\*Akgungor, G, Akkayan, B. **Influence of dentin bonding agents and polymerization modes on the bond strength between translucent fiber posts and three dentin regions within a post space.** *J Prosthet Dent. 2006 May;95(5):368-78*

**Statement of problem:** Debonding is the most frequent failure encountered with translucent fiber posts and usually occurs along the post space dentin-adhesive interface. **Purpose:** The purpose of this study was to evaluate the effect of different dentin bonding agents and polymerization modes on the bond strength between translucent fiber posts and root dentin in different regions of the post space. **Methods:** Forty maxillary canines with similar root lengths were selected, sectioned at the cemento-enamel junction, and the roots were endodontically treated. Following post space preparation, the roots were divided into 4 groups of 10 specimens each, and the post spaces were treated with 1 of 4 different dentin bonding agents: light-polymerized, single-bottle bonding agent Excite (Group EX); dual-polymerized, single-bottle bonding agent Excite DSC (Group EX-DSC); self-etching primer Clearfil Liner Bond 2V with a light-polymerized bonding agent, Bond A (Group CL-LC); or self-etching primer Clearfil Liner Bond 2V with a dual-polymerized bonding agent, Bond A+B (Group CL-DC). Translucent fiber posts(**D.T. Light-Post,** RTD, St Egreve, France), 2.2 mm in diameter, were luted (Panavia F) in each specimen after respective dentin bonding procedures. The roots were cut into 3-mm-thick sections, perpendicular to the long-axis in cervical, middle, and apical post space dentin. Push-out tests were performed with a universal testing machine at a crosshead speed of 0.5 mm/min, and bond strength values (MPa) were calculated by dividing the force at which bond failure occurred by the bonded area of the post. The data were analyzed with 1- and 2-way analysis of variance and Tukey multiple comparison tests (alpha=.05). Dentin adhesive bonding mechanisms in different regions of the post spaces were evaluated with a scanning electron microscope. **Results:** The highest mean bond strength values were obtained for Group CL-LC (18.3 +/- 4.1 MPa). The dual-polymerized bonding agent resulted in significantly lower bond strength (P<.001) in combination with self-etching primer (Group CL-DC) (13.2 +/- 2.5 MPa). The light-polymerized and dual-polymerized single-bottle bonding agents provided similar bond strengths (12.7 +/- 5.0 for EX; 13.5 +/- 5.3 for EX-DSC). The regional bond strength values of single-bottle bonding agents were reduced significantly in apical post space dentin (P<.001). Self-etching primers did not demonstrate regional differences in post space dentin bonding and dense resin tags were apparent. **Conclusions:** Data suggests that the self-etching primer system used in this study was unaffected by the morphological variations in the post space dentin compared to the single-bottle bonding agents. Dual polymerization did not improve the bond strength values of the bonding agents tested. **PDF**

\*Aksornmuang, J, Nakajima, M, Foxton, RM, Panyayong, W, Tagami, J. **Regional bond strengths and failure analysis of fiber posts bonded to root canal dentin.** *Oper Dent. 2008 Nov-Dec;33(6):636-43.*

This study evaluated the regional bond strengths of fiber posts to root canal dentin luted with dual-cure resin composite. Twelve extracted human premolars were decoronated and post spaces prepared to a depth of 8 mm. The root canal dentin was treated with Clearfil SE Bond and light-cured for 20 seconds. Three posts from each of the following four types of fiber posts; Snowlight, FibreKor, **DT Light-Post** and GC Fiber Post-were surface-treated with a mixture of Porcelain Bond Activator and Photobond, then luted into the post spaces with Clearfil DC Core Automix and light-cured for 60 seconds. After 24-hour water storage, each specimen was serially sliced into eight 0.6 x 0.6 mm-thick beams for the microtensile bond strength (microTBS) test. Failure modes were observed using SEM. The microTBS data were divided into coronal and apical regions and statistically analyzed. The highest bond strengths were obtained from FibreKor posts. Regional factors had no effect on bond strength. FibreKor and DT Light-Post specimens primarily failed at the post-resin composite interface, whereas Snowlight and GC Post cohesively failed within the post.

\*\*Ariki, E.K, , Gonçalves, M, Souza, ROA, Z , S.C.,Gia, PEL, Takahashi, F.E., Bottino, M.A, **Resin bond to root dentin: Accessory posts and dentin hybridization effect**. *J Dent Res. Vol 87 (Spec. Iss. A) Abstract 1748 (www.dentalresearch.org)*

**Objective:** To evaluate the influence of accessory fiber posts (AFP) and intraradicular dentin hybridization (IDH) on the push-out bond strength of fiber post luted with resin cement to bovine root dentin. The null hypotheses were that the AFP using and IDH do not affect the push-out bond strength. **Methods:** The canals of forty single-root bovine roots (16mm in length) were prepared at 12mm using the preparation drill (N0 3, RTD, France). With an assistance of a modifier parallelometer, each root had your apical region (4 mm length) embedded in acrylic resin and the roots were randomically divided into four groups, according the luting procedures (N=10): Gr1- IDH + fiber post n0 3; Gr2- IDH + fiber post n0 1; Gr3- IDH + fiber post n0 1 + AFP; Gr4- Fiber post n0 3 without IDH. Except for the group Gr4, the specimens (sps) were treated with the adhesive system (All Bond 2) and the fiber posts (**Macro- Lock Illusion)** were luted (Duolink) and after stored in distilled water prior the mechanical test (24 h, 37°C). Each specimen was cut in 4 disc samples (1.8 mm in thickness), which were submitted to the push-out test on a universal test machine (EMIC, model DL-1000) at a speed of 1mm/min. The data (MPa) were analyzed statistically by one-way analysis of variance (ANOVA). **Results:** The means (± standard deviation) values obtained after push out test were: Gr1- 5.4±1.3 MPa; Gr2- 4.2±2.4 MPa; Gr3- 4.6±1.5 MPa; Gr4- 3.3±1.7 MPa. The statistical analysis didn't observe influence among the groups (p=0.0966> 0.05). The null hypotheses were accepted. **Conclusion:** The AFP and the IDH do not improve nor diminish the bond strength of fiber post luted to bovine root dentin.

\*\*Baldissara, P. Monaco , C., Valandro, L.F., . Scotti, R*.***Retention of quartz fiber posts using different luting cements** *J Dent Res. Vol 88 (Spec. Iss. A) Abstract # 976, 2009. (www.dentalresearch.org)*

Objectives: To determine the effect on the pull-out strength of threads cut into the surface of quartz fiber post cemented with three luting materials. Methods: 42 human single-rooted, crownless teeth were treated endodontically and randomly assigned to six fiber posts groups: 1) to 3) were restored with **Macro-Lock** #3 posts (RTD); 4) to 6) with control posts made of the same material but lacking threads (RTD). The posts were cemented 12mm deep using Panavia(Kuraray), RelyX Unicem (3M ESPE), and Fuji Plus (GC) following the manufacturer instructions. The specimens were subjected to 5000 thermal cycles at 5 and 55°C and wet stored. Retentions were made on the emerging portion of the controls using a diamod bur, then a composite core was made using a mold. A pull-out stress was applied by clamping the core with an Instron machine (2mm/min speed). The pull-out strength was recorded for each group and compared (alpha=0.05). After the test, the specimens were observed under the stereomicroscope to determine failure patterns. Results: The Macro-Lock demonstrated higher retention with all the luting materials employed, statistically significant when RelyX and Fuji were used (P<.05), suggesting that the threads on their surface are effective to improve the pull-out strength. The highest retention of Macro-Locks was obtained using the Fuji GIC and the self-adherent cement (RelyX). The resin cement coupled with an adhesive system (Panavia) showed lower retention forces, probably caused by the “C” factor dynamics. Conclusion: The grooves on Macro-Lock surface are effective to improve the retention; these posts could be used safely with low cost, easy to use materials such as resin modified GIC. Control posts were less retentive, particularly when RelyX Unicem was used. This could be explained by the smooth surface and lack of any thread.

\*Baldissara, P., Zicari, F., Melilli, D., Monaco, C. **Effect of endodontic treatment on fatigue resistance of fiber post bonding**. *J Dent Res. Vol 82 (Special Issue A) Abstract # 2565, 2003* *(www.dentalresearch.org)*

**Objectives:** The aim of this study is to evaluate the effect of the endodontic treatment on the fatigue resistance of endodontic post adhesive interfaces. **Methods:** FIFTY single-rooted human teeth have been severed at the CEJ and randomly assigned to 5 groups receiving different endodontic treatments as follows: 1) distilled water + gutta percha (control); 2) NaOCl 5% + gutta percha + Pulp Canal Sealer EWT (Kerr); 3) NaOCl 5% + gutta percha + TopSeal (Dentsply-Maillefer); 4) NaOCl 5% and EDTA 10% (alternatively) + gutta percha + Pulp Canal Sealer EWT; 5) NaOCl 5% and EDTA 10% (alternatively) + gutta percha + TopSeal. Subsequently, #2 **D.T. Light-Post** (RTD; St Egreve, France /Bisco) quartz fiber posts have been placed in the root canal using All-Bond 2 adhesive (Bisco) and Bis-Fil 2B composite (Bisco). Five specimens from each group have been subjected to 2,000,000 fatigue cycles ranging from 0 to 37.5N at 8Hz frequency and 370C water irrigation, whereas the remaining specimens were stored in distilled water at room temp. After the fatigue cycles, all of the specimens were severed obtaining 4 sections from each tooth, which were then evaluated with the push-out test at a constant speed of 1mm/min. Stereomicroscope and SEM observations were done to evaluate the interface failures. **Results:** no statistically significant differences were observed between the 5 groups in both fatigue stressed (p=0.298) and water stored specimens (p=0.093). Also, the microscope analysis of interface failures showed that the post-cement interface is weaker than the cement-dentin one. The difference was significant with P=0.001. **Conclusions:** the results suggest that the interface resistance is not influenced by the canal treatments adopted in this study. Probably the hard tissue removal necessary for post placement eliminated contaminated or altered dentin that may affect the bonding with the luting cement. High resistance of the cement-dentin interface strongly supports this last hypothesis.

\*Beriat, N.C., Gülay, G., Yilmaz ,Z., Ertan, A.A*.* **Bond Strength of fiber posts luted with self etch adhesive.** *J Dent Res. Vol 88 (Spec. Iss. A) Abstract # 970, 2009. (www.dentalresearch.org)*

**Objectives:** To evaluate the push-out bond strengths of fiber posts luted with self etch self adhesive luting agent. **Methods:** Twenty six extracted single-rooted teeth were randomly divided in two groups and restored using **D.T. Light-Post** and the following luting agents: Variolink II/ExciteDSC/37% phosphoric acid (Ivoclar-Vivadent) and Maxcem (Kerr). For push-out bond strength measurements, thirteen roots per group were tested. Each posted root was cut horizontally into 1mm-thick slices at coronal and apical portions. On every slice the post was loaded by means of an adequately sized punch that pushed the post segment in an apical-coronal direction until the post-root bond failed. This was manifested by the extrusion of the post segment from the root slice, and the load recorded at this time was divided by the area of the post-root interface, in order to express the bond strength in MPa. **Results:** The mean bond strength achieved by Variolink at apical portion (14.77 ± 4.31 MPa), Variolink coronal portion (14.60 ± 4.09 MPa) and Maxcem apical (13.98 ± 4.58 MPa), Maxcem coronal (13.58 ± 4.93 MPa). **Conclusion:** The push-out bond strength was not statistically significantly different between the coronal and apical sections for each luting agent (p>0,005). The highest push-out bond strength was measured for Variolink however it was not statistically significant from Maxcem (p<0,005).

\*Beriat, N.C., Ertan, A.A., Yilmaz, Z., Gulay, G., **Effects of different luting cements and light curing units on the sealing ability and bond strength of fiber posts.** *Dent Mater J. 2012;31(4):575-82.*

This study evaluated the sealing ability and push-out bond strength of two luting cements cured with two different types of light curing units (LCU): light-emitting diode (LED) versus quartz tungsten halogen (QTH). Forty teeth were divided into four groups (n=10/group). Quartz fiber posts (**D. T. Light-Post**, RTD St Egreve, France) were luted to coronal or apical section of root canals using two types of resin cements (Panavia F or RelyX) cured with either LED LCU (Elipar FreeLight II) or QTH LCU (Optilux 501). Highest push-out bond strength was exhibited by QTH-cured RelyX, which was not significantly different from LED-cured RelyX but was higher than QTH cured Panavia F. The push-out bond strength of Panavia F did not differ with LCU type (p>0.05), but exhibited lower values than both QTH- and LED-cured RelyX. Fluid filtration test revealed that sealing ability was not influenced by luting cement type, but was significantly influenced by LCU type in favor of QTH light source: QTH-cured specimens displayed better seal than LED-cured ones (p<0.05).

Boff, LL, Grossi, ML, Prates, LH, Burnett ,LH, Shinkai ,RS. **Effect of the activation mode of post adhesive cementation on push-out bond strength to root canal dentin**. *Quintessence Int. 2007 May;38(5):387-94*

**Objective:** To evaluate the effect of the activation mode of adhesive cementation on push-out bond strength of fiber-reinforced resin posts to root canal dentin. **Methods:** Forty mandibular premolars were endodontically treated and randomly divided into 4 equal groups. In groups G-1, G-2, and G-3, Single Bond (3M Espe) was applied and light polymerized for 20 seconds; in group G-4, Scotchbond Multi-Purpose Plus (3M Espe) was used as an autopolymerized adhesive. The dual-cure resin cement Rely X ARC (3M Espe) was light polymerized in G-2 and G-3 but not in G-1 and G-4. The translucent post **Light-Post** (RTD, St Egreve, France) was used in G-3 and the opaque post **Aestheti-Plus** (RTD, St Egreve, France) in the other groups. The roots were sectioned in 3 parts (cervical, middle, apical); each slice was submitted to the push-out test at a crosshead speed of 0.5 mm/min. Data were analyzed by analysis of variance and Tukey test (a = .05). **Results:** Light polymerization of both the adhesive and resin cement in G-2 led to significantly higher bond strength than in G-1, where only the adhesive was light polymerized. No difference was found between G-2 (opaque post) and G-3 (translucent post). The autopolymerized adhesive showed the highest bond strength in all root regions. The middle and apical post/root regions had similar bond strength, but it was significantly lower than that in the cervical region (P <.001). **Conclusion:** Bond strength to root dentin varied as a function of the activation mode of post adhesive cementation and post/root regions

Bolhuis P, de Gee A, Feilzer A**. Influence of fatigue loading on four post-and-core systems in maxillary premolars.** Q*uintessence Int. 2004 Sep;35(8):657-67.*

**Objective:** Clinical studies show a high failure incidence after years of service of endodontically treated premolars, when restored with post-core crowns, especially those with short posts or deficient ferrules. The reason for this can be a deterioration of the luting cement around the post by fatigue from functional loading. In particular, the anatomy of premolars may frequently be incompatible with the application of long endodontic posts. The aim of this study was to evaluate the influence of fatigue loading on the quality of the cement layer between posts with restricted lengths and the root canal wall in premolars. As the stiffness of posts may affect the outcome, post-and-core systems with varying post stiffness were selected. **Methods:** Four types of post-and-core systems were selected for this study: three prefabricated post systems combined with a resin composite core material and one cast post and core. The three prefabricated posts were titanium posts (Tenax), quartz-fiber posts (**Aestheti-Post,** RTD, St Egreve, France), and quartz-coated-carbon-fiber posts (**Aestheti-Plus**, RTD, St Egreve, France). The post-and-core restorations were made on single-rooted, human, maxillary premolars from which the coronal sections were removed at the level of the proximal cementoenamel junction. Following endodontic treatment, a cast post and core (post length 6 mm) was prepared for each tooth individually (direct method) and cemented into the root canal with chemical cure Panavia 21 TC. The prefabricated posts were directly cemented in the root canal and then, after applying a dual-cure adhesive (Clearfil Photobond), built up with a core build-up composite (Clearfil Photocore). For each group (n = 8), half of the specimens were exposed to fatigue loading (10(6) load cycles) almost perpendicular to the axial axis (85 degrees), while the other half was used as the control. Three parallel, transverse root sections of 1.5-mm thickness, were cut from each specimen. These sections were examined by scanning electron microscopy (SEM) to evaluate the cement integrity, while the retention strength of the cemented post sections was determined with a push-out test. **Results:** Fatigue loading did not cause separation of the buildups from the roots or affect the push-out strength. On a univariate level, only SEM evaluation showed significant differences between the types of post, fatigue loading, and between the levels of root sections. The cement integrity with the titanium post was significantly less than with the other three systems, which did not differ among themselves. **Conclusions:** A composite core build-up material bonded to the dentin and supported by quartz-fiber posts or quartz-coated-carbon-fiber posts, cemented with adhesive cement may be a viable alternative for the conventional cast core.

\*Borer, R., Leandro, R and Haddix, J. **Effect of dowel length on the retention of two different prefabricated posts.** *Quintessence Int. 2007;38:173.e164-168*

**Objectives:** to compare the in vitro retentive values of stainless steel, parallel sided posts to quartz fiber tapered posts for two different dowel lengths (5mm and 10mm). **Methods:** Both post systems were cemented with a dual-cure adhesive resin cement. Single rooted extracted human teeth (n-40) were de-coronated and randomly divided into 4 groups of 10 samples each. Posts of 5 and 10mm in length were luted with the resin cement. Each sample was placed on a universal testing machine, and using a push-out method, a vertical load was applied at a crosshead speed of 2mm/min. The amount of force required to dislodge the post was recorded. The effect of post type and length was evaluated using a 2-way analysis of variance. **Results:** A statistically significant main effect was found for post length (P<.001) with the 10mm posts of both post systems requiring greater force to dislodge than the 5mm posts. There was no interaction between post length and post type (P>.05). **Conclusions**: It is concluded from this study that there is no statistical difference in retention between quartz fiber tapered posts (**D. T. Light-Post**; RTD, St Egreve, France) and stainless steel parallel-sided posts (ParaPost, Coltene Whaledent, Cuyahoga Falls, OH USA) when they are cemented with the same resin cement (P> .05). The study also concludes that adequate retentive values are achieved with both systems at the shorter, 5mm post length. **PDF**

\*[Bottino, MA](http://www.ncbi.nlm.nih.gov/sites/entrez?db=pubmed&cmd=search&term=%25252522bottino%25252520ma%25252522%2525255bauthor%2525255d&itool=entrezsystem2.pentrez.pubmed.pubmed_resultspanel.pubmed_rvabstractplusdrugs1), [Baldissara, P](http://www.ncbi.nlm.nih.gov/sites/entrez?db=pubmed&cmd=search&term=%25252522baldissara%25252520p%25252522%2525255bauthor%2525255d&itool=entrezsystem2.pentrez.pubmed.pubmed_resultspanel.pubmed_rvabstractplusdrugs1), [Valandro, LF](http://www.ncbi.nlm.nih.gov/sites/entrez?db=pubmed&cmd=search&term=%25252522valandro%25252520lf%25252522%2525255bauthor%2525255d&itool=entrezsystem2.pentrez.pubmed.pubmed_resultspanel.pubmed_rvabstractplusdrugs1), Galhano, GA, Scotti, R. **Effects of mechanical cycling on the bonding of zirconia and fiber posts to human root dentin.** *J Adhes Dent. 2007 Jun;9(3):327-31.*

**Purpose:** To evaluate the effect of cyclical mechanical loading on the bond strength of a fiber and a zirconia post bonded to root dentin. **Methods:** Forty single-rooted human teeth (maxillary incisors and canines) were sectioned, and the root canals were prepared at 12 mm. Twenty randomly selected specimens received a quartz fiber post (FRC) (**D.T. Light-Post**; RTD, St Egreve, France) and 20 others received a zirconia post (ZR) (Cosmopost). The posts were resin luted (All Bond 2 + resin cement Duo-link) and each specimen was embedded in epoxy resin inside a PVC cylinder. Ten specimens with FRC post and 10 specimens with ZR post were submitted to fatigue testing (2,000,000 cycles; load: 50 N; angle of 45 degrees; frequency: 8 Hz), while the other 20 specimens were not fatigued. Thus, 4 groups were formed: G1: FRC+O cycles; G2: FRC+2,000,000 cycles; G3: ZR+O cycles; G4: ZR+2,000,000 cycles. Later, the specimens were cut perpendicular to their long axis to form 2-mm-thick disk-shaped samples (4 sections/specimen), which were submitted to the push-out test (1 mm/min). The mean bond strength values (MPa) were calculated for each tooth (n = 10) and data were submitted to statistical analysis (alpha = 0.05). **Results:** Two-way ANOVA revealed that the bond strength was significantly affected by mechanical cycling (p = 0.0014) and root post (p = 0.0325). The interaction was also statistically significant (p = 0.0010). Tukey's test showed that the mechanical cycling did not affect the bonding of FRC to root dentin, while fatigue impaired the bonding of zirconium to root dentin. **Conclusion:** (1) The bond strength of the FRC post to root dentin was not reduced after fatigue testing, whereas the bonding of the zirconia post was significantly affected by the fatigue. (2) Cyclical mechanical loading appears to damage the bond strength of the rigid post only.

\*[Coniglio, I](http://www.ncbi.nlm.nih.gov/pubmed?term=%25252522coniglio%25252520i%25252522%2525255bauthor%2525255d), [Magni, E](http://www.ncbi.nlm.nih.gov/pubmed?term=%25252522magni%25252520e%25252522%2525255bauthor%2525255d), [Cantoro, A](http://www.ncbi.nlm.nih.gov/pubmed?term=%25252522cantoro%25252520a%25252522%2525255bauthor%2525255d), Goracci C, Ferrari M. **Push-out bond strength of circular and oval-shaped fiber posts.***Clin Oral Investig. 2010 Jul 27. [Epub ahead of print]*

This study aimed at evaluating the post-root dentin push-out bond strength of circular and oval posts luted in oval-shaped canals with two different resin cements. Twenty extracted premolars with oval-shaped canals were selected, endodontically instrumented and obturated. The teeth were divided into two groups according to the drill used for post-space preparation and to the post shape (**Ellipson** oval tip + post and MTwoPF + **DT Light-Post**). Each group was then subdivided into two subgroups according to the cement (Gradia Core and Corecem Automix). The post-dentin bond strength was evaluated with the thin-slice push-out test. The bonded surface area was calculated for each post shape with an appropriate geometric formula in order to express the retentive strength in megapascal. Push-out strength data were analyzed with the Kruskal-Wallis ANOVA. The results showed that neither the drill-post system nor the cement significantly affected the push-out strength. The means (SD) of the push-out bond strengths in the experimental subgroups were the following: 11.79 MPa (4.77) for Gradia Core/Ellipson tip and post, 13.36 MPa (5.16) for Gradia Core/MtwoPF and DT Light-Post, 11.18 MPa (2.58) for Corecem Automix/Ellipson tip and post, and 10.91 MPa (3.89) for Corecem Automix/MtwoPF and DT Light-Post. In conclusion, circular and oval posts achieved similar retentive strengths in oval canals.

Dallari, A, Rovatti, L, Dallari, B, Mason, PN, Suh, BI. **Translucent quartz-fiber post luted in vivo with self-curing composite cement: case report and microscopic examination at a two-year clinical follow-up.** *J Adhes Dent. 2006 Jun;8(3):189-95*

A maxillary central incisor with mild periodontitis and extensive loss of coronal tooth structure was endodontically treated and restored with a translucent quartz-fiber post and a composite core. Treatment was completed with the cementation of full-ceramic crowns on teeth 11 and 21. Informed consent was obtained from the patient. Due to the extent of the periodontal disease, tooth 11 was extracted two years later. With the patient's consent, the tooth was used for research. The tooth was sectioned at 11 levels perpendicularly to the long axis and investigated by means of optical microscopy and scanning electron microscope (SEM). The visual examination showed perfect adhesion between the various interfaces (restoration-dentin-post) at both the coronal and root levels. The adhesion between the post and dentin appeared to be free of gaps, and even where the composite cement showed a nonhomogeneous thickness, voids were not apparent. The tooth under examination allowed the authors to check the effectiveness of the adhesion and the integrity of the hybrid layer after exposure to the oral cavity for two years. The results of this investigation show that there were no gaps between the adhesive resin and dentin and no hydrolysis of the adhesive bond. This case suggests that it is possible to obtain good results in the short term from the cementation of quartz-fiber posts with composite resin cements. **PDF**

\*\*Dallari, A., Mason, P., Rovatti, L., Dallari, B. **Effect of surface treatments on retention of quartz- fiber posts.** *J Dent Res. Vol 87 (Spec. Iss. C) Abstract #0383, PEF Division 2008 (www.dentalresearch.org)*

The use of quartz fiber-reinforced posts, adhesively luted into root canal, has increased in popularity for the post-endodontic restorations. Objectives: The aim of this in vitro study is to verify the influence of different surface pre-treatments on micro-tensile bond strength between quartz posts and composite luting cement. Methods: 50 quartz fibers posts (40 **DT Light-Post**, RTD, France + 10 **Macro-Lock Post**, RTD, France) have been subdivided into 5 groups: 1) 10 DT Light-Post with no surface treatment ( as control ). 2) 10 DT Light-Post pre-treated with hydrofluoric acid 9.6 % for 15 sec. 3) 10 DT Light-Post coated with industrial procedure by the factory. 4) 10 DT Light-Post pre-treated with methyl-methacrylate for 1 minute. 5) 10 Macro-Lock Post, with carved surface and not subjected to chemical pre-treatments. Posts have been luted using the same composite cement ( BisCem, Bisco, USA ) in plastic cylinders ( Endo Trainers, Frasaco, USA ), and slices 2.0 mm thick have been obtained with a diamond wheel ( Leitz 1600 ). Slices have been subjected to pull-out test with Instron Machine. Results: Group 1: 13.28 MPa; Group 2: 24.60 MPa; Group 3: 26.90 MPa; Group 4: 34.20 MPa; Group 5: 32.05 MPa. Conclusions: All the post-surface pre-treatments lead to a real (double or more) improvement of tensile bond strength values. Macro-retention provided by carving of the surface (Macro-Lock Post) and micro-retention obtained with methyl-methacrylate pre-treatment reached the highest results.

\*Dimitrouli, M, Geurtsen W, Lührs AK. **Comparison of the push-out strength of two fiber post systems dependent on different types of resin cements.** *Clin Oral Investig. 2011 Jun 7. [Epub ahead of print]*

The purpose of this study was to compare the push-out strength of glass fiber posts dependent on the resin cement. One hundred human teeth were divided into five groups (n = 20). Two glass fiber post systems (**DT Light-Post SL** (DTSL) and Rely-X Fiber Post (RF)) were used. DTSL posts were cemented with one "etch & rinse" system (ER) or one of three self-adhesive resin cements (SA). The RF posts were cemented with Rely-X Unicem. Afterwards, half of the specimens were thermocycled (TC; 5°C/55°C, 5,000 cycles). All specimens were cut into disks (thickness, 2 mm). The push-out test was performed (crosshead speed, 1 mm/min), fracture types were determined (×25 and ×40 magnification), and statistical analysis was performed (one-way analysis of variance (ANOVA), Scheffe test, p < 0.05). One-way ANOVA showed a significant influence of the resin cement on the push-out strength of the glass fiber posts before thermocycling (p < 0.001). After TC, no significant differences were detected. Microscopic evaluation showed mainly adhesive failures between post and cement for ER or mixed fractures for SA. The bond strength of adhesively cemented glass fiber posts is not dependent on the type of resin cement after TC. The use of SA can lead to bond strength values comparable to ER. Self-adhesive resin cements could be used just as well as resin cements with "etch & rinse" adhesive systems for the cementation of glass fiber posts.

\*Dulla, M., Lussi, A., Zimmerli, B*.* **Influence of root-canal sealer and luting-cement on fibre-post adhesion.** *J Dent Res. Vol 89 (Spec. Iss. B) Abstract #3980, 2010 (www.dentalresearch.org)*

**Objectives:** To investigate the effects of three different luting-cements and two root-canal sealers on bond strength of fibre-posts. **Methods:** Sixty extracted maxillary molars were divided into two groups (n=30). The teeth were endodontically treated and filled with Gutta-percha and root-canal sealer (group 1: AHplus,  group 2 : EndoREZ). Only the palatinal roots were treated, whereas the other roots were removed. The specimens were thermocycled (5000x; 5-55°C) and each group was divided into three subgroups A-C (A: RelyX Unicem, B: Multilink Automix, C: Calibra and XP Bond) (n=10). Quartz fiber-posts  (**D.T. Light-Post**) were cemented. A standardized composite build-up was placed (Core-Xflow). All specimens were fatigue-cycled (1'200'000x; 49N; 1.6Hz), thermocycled (5000x; 5-55°C) and subsequently stored for one year.  Push-out bond-strength was measured on four 1mm slices per specimen (coronal and apical root region) at a crosshead speed of 1mm/min. Fracture analysis was performed by light-microscopy. Statistical differences were analyzed with ANOVA and pairwise Wilcoxon signed rank test (a=0.05). Groups with the same superscript are not statistically significant different. Bond-strengths values were significantly affected by luting-cement and root-canal sealer (p<0.05). Additionally, there was a significant interaction between luting-cement and root-canal sealer (p<0.05). RelyX Unicem showed significantly higher bond-strengths compared with all other materials. EndoREZ showed significant higher bond-strengths in all groups compared with AHplus. Root region had no significant effect (p>0.05). Microscopical analysis revealed a prevalence of adhesive failures at the post-cement interface, except for groups 2A and 2C whereas mainly cohesive failures within the post occured. **Conclusion:** Resin-based root-canal sealers can increase bond-strengths of fibre-posts. The self-adhesive luting-cement showed good performance after artificial aging procedure.

\*Ertan, A.A., Beriat, N. C., Yilmaz, Z.**Push-out bond strength of a novel fiber metal post.***J Dent Res. Vol 89(Spec. Iss. B) Abstract #4495, 2010 (www.dentalresearch.org)*

**Objectives:** The aim of this study was to evaluate the regional push-out bond strengths for two post types using two different resin cements. **Methods:** Twenty-four single-rooted, extracted human teeth were selected and the crowns were sectioned off to obtain roots with standardized length (18mm). The roots were obturated with gutta-percha using lateral condensation. The teeth were randomly divided into four experimental groups (n=6/group). Roots were restored with a quartz fiber post (**D.T. Light-Post**) and fiber metal posts (Spirapost), which were cemented with two different resin cements. After 1 week of water storage at 37º C, 1mm-thick sections were prepared from each specimen for push-out bond strength testing. Push-out tests were performed at a crosshead speed of 0.5 mm/min. The data were analyzed with ANOVA. Results: Quartz fiber posts demonstrated significantly higher push-out bond strengths than fiber metal posts (p < 0.001). Bond strength values decreased significantly from the cervical to the apical root canal regions (p < 0.001). **Conclusion:** In conclusion, in all root segments, the quartz fiber posts provided significantly increased post retention than the fiber-metal post, regardless of the adhesive used.

\*Gernhardt, CR, K. Bekes, K., Schaller, HG . **Effect of different fibre post diameters on retentive strength**. *J Dent Res (Special Issue A) #1586, 2006* *(www.dentalresearch.org)*

**Objectives:** The retention of endodontic posts is believed to be a major factor in restoration survival. The purpose of this study was to evaluate the effect of post diameter on the bond strength of the fiber post **D.T. Light-Post** using two different cements. **Methods**: Sixty caries free human incisors were selected for standardized size and quality, endodontically treated and coronally reduced to the cemento-enamel junction. The specimens were randomly assigned to three experimental groups: (I): canal preparation with DT drill #1, insertion of DT Light Post #1, (II): canal preparation with DT drill #2, insertion of DT Light Post #2; (III) canal DT drill #3, insertion of DT Light Post #3. The fibre posts were cemented using either Calibra (subgroup C) or Panavia F (subgroup P). Retentive strength was measured 24 hours after cementation using a universal testing machine. Data were analyzed with SPSS 10.0. **Results:** The following mean retentive strengths were evaluated. Statistical analysis showed that the post diameter did not affect the bond strengths the fibre posts of the D.T. Light Post system (p< 0.05, Tukey test). Posts cemented with Panavia showed higher bond strengths. In the case of size 3 posts this difference was significant (p< 0.05, Tukeyxs test). **Conclusions:** The reconstruction of endodontically treated single rooted teeth with fibre posts showed acceptable retentive values for both cements used in this in vitro study. The post diameter did not affect the bond strengths of the D.T. Light-Post system (RTD, St Egreve, France).

\*Giovannetti, A, Goracci, C, Vichi, A, Chieffi, N, Polimeni A, Ferrari, M. **Post retentive ability of a new resin composite with low stress behaviour.** *J Dent. 2012 Apr;40(4):322-8. Epub 2012 Jan 25.*

**Objectives:** To assess by means of push-out test the post retentive potential of a new flowable resin composite with low polymerization stress. **Methods:** SureFil(®) SDR™ (Dentsply, S) was compared with the resin cement Calibra (Dentsply, C). S and C were used in combination with the adhesive XP Bond (Dentsply, XPB). In C group the Self-Cure Activator was mixed with XPB. The following types of fibre posts were luted into 30 extracted premolars: Radix Fiber Post (Dentsply, R), DT Light-Post (RTD, LP), ER Dentin Post (Komet, ER), **DT Light-Post SL** (VDW, SL), FibreKleer (Jeneric Pentron, F). Six posted roots per group were tested. Each root provided three to five 1mm-thick slices. Measured push-out strengths were differentiated by post space level and statistically analysed (p<0.05). The failure mode of each debonded specimen was assessed. **Results:** Cement type did not have a significant effect on post retention (p=0.54). Post type was a significant factor for push-out strength (p<0.001). LP exhibited significantly higher retentive strength than SL and F; push-out strengths of ER and R were significantly higher than those of F. Postretention was significantly influenced by post space level (p<0.001). Significantly higher push-out strengths were recorded at the coronal third than at the middle and apical levels. The post-cement interaction was significant (p=0.002). Posts luted with S most often failed at the cement-post interface. **Conclusions:** When the new flowable low-stress composite was used to lute fibre posts, similar retentive strengths to those of a marketed cement from the same manufacturer were achieved. SureFil(®) SDR™, a flowable composite originally proposed for bulk filling of posterior restorations, exhibited postretentive strengths similar to those of a cement by the same manufacturer. With a relatively high filler load, yet a low curing stress, SureFil(®) SDR™ may be adequate for both post cementation and core build-up.

Hedlund, S-O, Johanson, N. G., Sjogren, G. **Retention of prefabricated and individually cast posts in vitro**. *British Dental Journal Vol 195, No. 3. Aug 9, 2003 155-158*.

**Objectives:** The aim of the study was to evaluate the retention of prefabricated root canal posts made of a variety of materials that have recently been introduced to dentistry. **Methods**: The posts studied were Cosmopost (ceramic), **Composipost** / C-Post (Carbon fibres), **Aestheti-Plus** post (Quartz Fibres), **Light-Post** (Quartz fibres) and ParaPost White (glass fibres). The posts were luted in extracted human pre-molars and the cores were built up with the resin composites recommended by the (post) manufacturers. The retention of individually cast gold alloy posts luted with zinc phosphate cement were used as reference. A universal testing machine was used to determine the retention of each cemented post. Data were compared using ANOVA supplemented with Fisher’s PLSD at a significance level of p<0.05. **Results:** Only the Cosmopost system exhibited retention values that were significantly lower than for the conventional cast gold alloy posts luted with zinc phosphate cement. The force necessary to loosen the Cosmopost specimens was significantly less than that needed to loosen the Aestheti-Plus post (p<0.05) and the Light-Post systems (p<0.01). The force necessary to loosen the ParaPost White specimens was significantly less than for the Light-Post system (p<0.01). Other combinations did not differ significantly (p<0.05). **PDF**

\*Kadam, A, Pujar, M, Patil, C. **Evaluation of push-out bond strength of two fiber-reinforced composite posts systems using two luting cements in vitro.** J Conserv Dent. 2013 Sep;16(5):444-8. doi: 10.4103/0972-0707.117522

**Introduction:** The concept of using a "post" for the restoration of teeth has been practiced to restore the endodontically treated tooth. Metallic posts have been commonly used, but their delirious effects have led to the development of fiber-reinforced materials that have overcome the limitations of metallic posts. The use of glass and quartz fibers was proposed as an alternative to the dark color of carbon fiber posts as far as esthetics was concerned. "De-bonding" is the most common failure in fiber-reinforced composite type of posts. This study was aimed to compare the push-out bond strength of a self-adhesive dual-cured luting agent (RelyX U100) with a total etch resin luting agent (Variolink II) used to cement two different FRC posts. **Methods:** Eighty human maxillary anterior single-rooted teeth were de-coronated, endodontically treated, post space prepared and divided into four groups (n = 20); Group I: D.T. Light -Post (RTD) and Variolink II (Ivoclare vivadent), Group II: **D.T. Light-Post** (RTD, St Egreve, France) and RelyX U100 (3M ESPE), Group III: Glassix post (Nordin) and Variolink II (Ivoclar vivadent) and Group IV: Glassix post (Nordin) and RelyX U100 (3M ESPE). Each root was sectioned to get slices of 2 ± 0.05-mm thickness. Push-out tests were performed using a triaxial loading frame. To express bond strength in megapascals (Mpa), load value recorded in Newton (N) was divided by the area of the bonded interface. After testing the push-out strengths, the samples were analyzed under a stereomicroscope. **Results:** The mean values of the push-out bond strength show that Group I and Group III had significantly higher values than Group II and Group IV. The most common mode of failure observed was adhesive between dentin and luting material and between post and luting material. **Conclusions:** The mean push-out bond strengths were higher for Groups I and III where Variolink II resin cement was used for luting the fiber post, which is based on the total etch adhesive approach. In most of the samples, failure was observed between cement-dentine interface, followed by post-cement interface, which shows difficulty in bonding between post-cement-dentine interface. **PDF**

\*Khamverdi, Z, Damavandi, LY, Kasraei, S. **Effect of cyclic loading on bond strength of fiber posts to root canal dentin.** J Dent (Tehran). 2014 Jan;11(1):85-92. Epub 2014 Jan 31.

**Objective:** The aim of this study was to evaluate the effect of cyclic loading on the bond strength of quartz fiber posts to root canal dentin after different surface treatments of different regions of root canal dentin. **Methods:** Forty-eight single-rooted human teeth were selected. Post spaces were prepared and then the teeth were divided into four groups: G1: no treatment (control); G2: irrigation with a chemical solvent; G3: etching with 37% phosphoric acid; G4: treatment with ultrasonic file. The fiber posts (**DT Light-Post** RTD, St Egreve, France) were cemented using dual-cured resin cement. Half of the specimens were load-cycled (10000 cycles, 3 cycles/s) and the others did not undergo any load cycling. From each root, two slides measuring 1 mm in thickness were obtained from the apical and cervical regions. The push-out bond strength test was performed for each slice. Data were analyzed by using 3-way ANOVA and Tukey HSD tests. The fracture modes were evaluated under a stereomicroscope at ×20. **Results:** The effect of load cycling and surface treatment as the main factors and the interaction of main factors were not significant (P=0.734, P=0.180, and P=0.539, respectively). The most frequent failure mode under the stereomicroscope was adhesive. **Conclusion:** It appears that load cycling and surface treatment methods had no effect on the bond strength of fiber posts to root canal dentin, but it depended on the region of the root canal dentin. **PDF**

\*Kremeier, K, Fasen, L, Klaiber, B, Hofmann, N. **Influence of endodontic post type (glass fiber, quartz fiber or gold) and luting material on push-out bond strength to dentin in vitro.** *Dent Mater. 2008 May;24(5):660-6. Epub 2007 Aug 23.*

**Objectives:** To determine the influence of post type and luting material on bond strength to dentin. **Methods:** The root canals of extracted human upper central incisors were instrumented and post space was prepared using the respective drills for each post system. Glass fiber posts (Luscent Anchor, Dentatus [LA]) were luted using three dual-curing adhesive systems (Excite DSC/Variolink II, Vivadent [VL2]; EnaBond/EnaCem, Micerium [ENA]; Prime & Bond NT/Calibra, DentSply DeTrey [CAL]). A different brand of glass fiber post (EasyPost, DentSply Maillefer [EP]) and quartz fiber post (**DT Light- Post**,RTD, St Egreve, France [DT]) were luted using CAL. Gold posts (Perma-dor, VDW) were luted either adhesively following tribo-chemical silicate coating (Rocatec, ESPE-Sil, 3M ESPE; CAL) or conventionally using glass ionomer cement (Ketac Cem, 3M ESPE). Three slices of 2mm height were cut perpendicular to the post from each restored root. Bond strength was determined by pushing out the post using a universal testing machine (/1449, Zwick**). Results:** For all experimental groups combined, bond strength increased from the coronal to the apical section (Friedman test: P<0.001). Significant differences were observed among the fiber posts (DT/CAL>LA/CAL; Mann-Whitney U-test with Bonferroni-Holm adjustment: P<0.05; EP/CAL ranging in between) but not among luting materials (LA/VL2, LA/ENA, LA/CAL: n.s.). The gold posts were equivalent to DT/CAL with both luting procedures. **Significance:** Selection of post type may be more important for bond strength than luting material. Bond strength of fiber posts was equivalent but not superior to adhesively or conventionally luted gold posts. **PDF**

\*Mallmann, A, Jacques, LB, Valandro, LF, Mathias, P, Muench, A. **Microtensile bond strength of light- and self-cured adhesive systems to intraradicular dentin using a translucent fiber post.** *Oper Dent. 2005 Jul-Aug;30(4):500-6*

This study evaluated the bond strength of a light- and self-cured adhesive system to different intra-radicular dentin areas (cervical, middle and apical thirds). Twenty single-rooted teeth were instrumented and their roots were prepared to receive a #2 translucent fiber post (**Light- Post** RTD: St Egreve, France). The root canals were irrigated with 0.5% sodium hypochlorite for one minute, rinsed with water and dried using paper tips. The teeth were divided into two groups (n=10): Single Bond [SB] (light-cured) and Scotchbond Multi-Purpose Plus [SBMP] (self-cured). To avoid polymerization of the materials through the root lateral walls, the teeth were placed in a silicone mold and the adhesives applied with a thin microbrush according to manufacturer's instructions. The resin cement, Rely X ARC, was inserted into the root canals using Lentulo burs. The post was then placed and the light-curing procedure was carried out for 40 seconds (+/-500 mW/cm2). The roots were kept in a 100% relative moisture environment for 24 hours and stored in distilled water for an additional 24 hours. Each root was perpendicularly sectioned into 1-mm thick sections, resulting in approximately four slices per region. Dumbbell-shaped slices were obtained by trimming the proximal surfaces of each slice using a diamond bur until it touched the post. The bonded area was calculated, slices were attached to a special device and submitted to micro-tensile testing at 1 mm/minute crosshead speed. Data were analyzed using ANOVA and Tukey's test. The mean bond strength values (MPa) were: SBMP: cervical=10.8a, middle=7.9b%, apical=7.1bc; SB: cervical=8.1b, middle=6.0c, apical=6.9b. Significant differences were found between adhesive systems only for the cervical third. The cervical region showed higher mean bond strength values than the middle and apical regions (p<0.0001). **PDF**

Mallmann, A, Jacques, LB, Valandro, LF, Muench, A**. Microtensile bond strength of photoactivated and autopolymerized adhesive systems to root dentin using translucent and opaque fiber-reinforced composite posts**. *J Prosthet Dent. 2007 Mar;97(3):165-72*

**Statement of Problem:** The use of fiber-reinforced composite resin posts in endodontically treated teeth has increased. However, selecting an adhesive system that provides reliable and long-lasting bonding to root canal dentin remains difficult. **Purpose:** This study evaluated the microtensile bond strength of 2 adhesive systems to root dentin and 2 different fiber-reinforced composite resin posts. **Methods:** Forty single-rooted teeth were instrumented, and root canals were prepared for translucent (Light Post [LP]) RTD: St Egreve, France or opaque (Aestheti Post [AP]) RTD: St Egreve, France quartz fiber-reinforced composite resin posts. Two adhesive systems were used: Scotchbond Multi-Purpose Plus (SBMP) (autopolymerized) as a control group, and Single Bond (SB) (photoactivated). Teeth were assigned to 4 groups (n=10): SBMP+LP, SBMP+AP, SB+LP, SB+AP. After post cementation, roots were perpendicularly sectioned into 1-mm-thick slices, which were trimmed to obtain dumbbell-shaped specimens. The specimens were divided into 3 regions: cervical (C), middle (M), and apical (A). To determine the bond strength, the bonding area of each specimen was calculated, and specimens were attached to a device to test microtensile strength at a crosshead speed of 1 mm/min. Data were analyzed using 3-way analysis of variance and the Tukey test (alpha=.05). Fractured specimens were examined under a x 25 stereomicroscope to determine the mode of fracture. **Results:** There were significant differences only among root dentin regions (P<.001). The cervical third (9.16 +/- 1.18 MPa) presented higher mean bond strength values, especially for SBMP. Middle and apical regions demonstrated lower values (7.08 +/- 0.92 and 7.31 +/- 0.60 MPa, respectively). Adhesive and post main factors did not demonstrate significance. Also, no interaction was significant. No cohesive fractures within resin cement, fiber-reinforced composite resin post, or root dentin were identified. **Conclusions:** Both adhesive systems tested demonstrated reliable bonding when used with translucent and opaque fiber-reinforced composite posts. **PDF**

\*Mazzoni, A., Marchesi, G., Cadenaro, M., Mazzotti, G., Di Lenarda, R., Ferrari, M., Breschi, L. **Push-out stress for fibre posts luted using different adhesive strategies**. *Eur J Oral Sci. 2009 Aug;117(4):447-53.*

The influence of thermocycling on the bond strength of fibre posts cemented with different luting approaches was investigated. A total of 84 human incisors were selected for the study. Sixty teeth were assigned to one of the following adhesive/cement combinations for push-out bond-strength evaluation: group 1, XP Bond/CoreXFlow + **DT Light-Post** (RTD: St Egreve, France); group 2, Panavia F 2.0 + Tech 21; or group 3, RelyX Unicem + RelyX. Bonded specimens were cut into 1-mm-thick slabs and either thermocycled (40,000 cycles) or stored in artificial saliva (control specimens) before push-out bond-strength testing. Additional specimens were processed for quantitative interfacial nanoleakage analysis. Thermocycling decreased the bond strength in specimens of groups 2 and 3, but did not affect the specimens from group 1. No difference was observed among luting approaches in control specimens. Thermocycling resulted in increased silver nitrate deposition (i.e. interfacial nanoleakage) in all groups. Within the limitations of the study, the use of an etch-and-rinse adhesive in combination with a dual-cure cement to lute fiber posts is the most stable luting procedure if compared with a self-etch resin-based cement or a self-adhesive cement, as assayed by thermocycling of the bonded specimens. **PDF**

Michida, SMA, Souza, ROA, Passos, SP, Mesquita, AMM. Pereira, PC, Valandro, LF, Takahashi, FE, Bottino MA. **Influence of cement insertion technique on fiber post bond strength**, *J Dent Res.Vol 87 (Spec Iss A) Abstract #1745, 2008* *(www.dentalresearch.org)*

**Objective:** this study evaluated the influence of different methods of resin cement insertion on the bond strength between bovine root dentine and fiber posts (null hypothesis: the insertion methods do not influence the bond strength). **Methods:** forty bovine roots (16mm) (single-root) were prepared to 12 mm with custom drill of the fiber post system (FRC Postec Plus). The roots were embedded in chemically cured acrylic resin using a surveyor. The specimens were divided into 4 groups, according to the methods of resin cement insertion: G1- Lentulo drill, G2- Centrix syringe, G3- Explorer #5, G4- with the aid of the post. The root canals were rinsed with 20 mL of distilled water, and dried with paper points. The root dentine was etched with H2PO3 37%/15s + washing/drying and the adhesive system All-Bond 2 was applied, and right away the cylinder quartz fiber posts (**Aestheti-Plus**) were cemented (RelyX). The samples were kept in distilled water 370 C for 24 h, then, each specimen was cut into 4 slices of ±1.8 mm of thickness, and the samples were submitted to push-out test (Emic DL-1000) (1mm/min). **Results:** ANOVA (a=0.05) showed that the bond strength (MPa) was not affected by resin cement insertion methods (P>0.05). G1 (4.21±1.27a), G2 (3.17±1.79a), G3 (4.46±0.95a), G4 (3.12±1.28a), (null hypothesis was accepted). **Conclusion:** the resin bond strength between the bovine root dentin and the fiber posts are not influenced by the resin cement insertion methods.

\*Mazzitelli, C, Ferrari, M, Toledano, M, Osorio, E, Monticelli, F, Osorio, R. **Surface roughness analysis of fiber post conditioning processes.** *J Dent Res. 2008 Feb;87(2):186-90.*

The chemo-mechanical surface treatment of fiber posts increases their bonding properties. The combined use of atomic force and confocal microscopy allows for the assessment and quantification of the changes on surface roughness that justify this behavior. Quartz fiber posts were conditioned with different chemicals, as well as by sandblasting, and by an industrial silicate/silane coating. We analyzed post surfaces by atomic force microscopy, recording average roughness (R(a)) measurements of fibers and resin matrix. A confocal image profiler allowed for the quantitative assessment of the average superficial roughness (R(a)). Hydrofluoric acid, potassium permanganate, sodium ethoxide, and sandblasting increased post surface roughness. Modifications of the epoxy resin matrix occurred after the surface pre-treatments. Hydrofluoric acid affected the superficial texture of quartz fibers. Surface-conditioning procedures that selectively react with the epoxy-resin matrix of the fiber post enhance roughness and improve the surface area available for adhesion by creating micro-retentive spaces without affecting the post's inner structure.

\*[Monticelli, F](http://www.ncbi.nlm.nih.gov/sites/entrez?db=pubmed&cmd=search&term=%25252522monticelli%25252520f%25252522%2525255bauthor%2525255d&itool=entrezsystem2.pentrez.pubmed.pubmed_resultspanel.pubmed_rvabstractplusdrugs1), [Osorio, R](http://www.ncbi.nlm.nih.gov/sites/entrez?db=pubmed&cmd=search&term=%25252522osorio%25252520r%25252522%2525255bauthor%2525255d&itool=entrezsystem2.pentrez.pubmed.pubmed_resultspanel.pubmed_rvabstractplusdrugs1), Tay, FR, Sadek, FT, Ferrari, M, Toledano M. **Resistance to thermo-mechanical stress of different coupling agents used as intermediate layer in resin-fiber post bonds.** *Am J Dent. 2007 Dec;20(6):416-20.*

**Purpose:** To evaluate the microtensile bond strength (MTBS) of different coupling agents used in fiber post-composite bonds to withstand different in vitro challenging procedures. **Methods:** 63 fiber posts (**D.T. Light-Post**: RTD, St Egreve, France) etched with 10% hydrogen peroxide were divided into three groups according to the silane/adhesive system applied: (1) Porcelain Bond Activator (PBA) + Clearfil SE Bond; (2) PBA + Clearfil Tri S Bond; (3) Monobond-S. A composite build-up (Clearfil AP-X) was performed around the post producing cylindrical specimens that were divided into three subgroups according to the different aging protocol: (1) 24-hour storage at room temperature; (2) Thermocycling (5000 cycles, 5 degrees/55 degrees C dwell time: 30 seconds); (3) Cyclic loading (45 degrees angle, 20,000 cycles, load 5-50 N at 3.0 Hz). Samples were then cut obtaining sticks that were loaded in tension until failure. Bond strength values were statistically analyzed with two-way ANOVA and Tukey test (alpha = 0.05). Failure mode was recorded and the morphologic aspect of post/core interface after aging was evaluated under SEM. **Results:** Both post superficial treatment, thermocycling and cyclic loading influenced bond strength. After 24 hours, samples treated with silane/adhesive couplings attained higher MTBS than those bonded with conventional silane. No significant differences in the microtensile bond strength at the post/core interface were recorded between the different silane/adhesive couplings. After challenging, no differences were found between the tested groups.

\*Perdigão J, Gomes G, Augusto V. **The effect of dowel space on the bond strengths of fiber posts**. *J Prosthodont. 2007 May-Jun;16(3):154-64*

**Purpose:** The purpose of this study was to evaluate the effect of the degree of mismatch between post space and post diameters on the bond strength of a fiber-reinforced resin post. **Methods:** Thirty-two extracted human maxillary central incisors and canines were endodontically treated and assigned to four groups: Group 1--Canal prepared with a D.T. Light -Post #1 (RTD: St Egreve, France) drill (control); Group 2--Canal prepared with a D.T. Light -Post #2 drill; Group 3--Canal prepared with a D.T. Light- Post #3 drill; Group 4--Canal prepared with a Gates Glidden #6 drill. A D.T. Light -Post size 1 was then luted into the canal using One-Step Adhesive and Post Cement Hi-X. A push-out test was performed on three sections of each root to measure push-out bond strengths. Data were analyzed with ANOVA and Bonferroni's test at p < 0.05. Two extra teeth for each group were restored in the same fashion and processed for SEM observation. **Results:** (in MPa): Group 1: 15.7 +/- 6.9; Group 2: 14.7 +/- 6.5; Group 3: 14.0 +/- 5.0; Group 4: 14.0 +/- 5.1. The variable "post space" resulted in no statistically significant difference in mean bond strengths (p > 0.05). For the variable "root region," the coronal third (17.5 +/- 6.0) resulted in statistically greater mean bond strengths than the apical third (12.3 +/- 6.0) at p < 0.008. The middle third (14.0 +/- 5.3) resulted in no statistically significant different mean bond strengths from the coronal third at p > 0.119 and from the apical third at p > 0.999. Under the SEM, some areas of the canal system still displayed residual gutta-percha, which resulted in debonding of the interface between the resin cement and dentin. Areas with incomplete dentin hybridization were observed in localized areas of all groups. **Conclusions:** The diameter of the post space did not affect the push-out bond strengths. Bonding at the coronal level of the root canal is more reliable than bonding at the apical level. The presence of residual gutta-percha and the deficient dentin hybridization may result in deficient seal of the resin-dentin interface. **PDF**

Perez, BE, Barbosa, SH, Melo, RM, Zamboni, SC, Ozcan, M, Valandro, LF, Bottino, MA.  **Does the thickness of the resin cement affect the bond strength of a fiber post to the root dentin?** *Int J Prosthodont. 2006 Nov-Dec;19(6):606-9*

This study aimed to evaluate the influence of cement thickness on the bond strength of a fiber-reinforced composite (FRC) post system (**Light-Post,** RTD, St Egreve, France) to the root dentin. Eighteen single-rooted human teeth were decoronated (length: 16 mm), the canals were prepared, and the specimens were randomly allocated to 2 groups (n = 9): group 1 (low cement thickness), in which size 3 FRC posts were cemented using adhesive plus resin cement; and group 2 (high cement thickness), in which size 1 FRC posts were cemented as in group 1. Specimens were sectioned, producing 5 samples (thickness: 1.5 mm). For cement thickness evaluation, photographs of the samples were taken using an optical microscope, and the images were analyzed. Each sample was tested in push-out, and data were statistically analyzed. Bond strengths of groups 1 and 2 did not show significant differences (P = .558), but the cement thicknesses for these groups were significantly different (P < .0001). The increase in cement thickness did not significantly affect the bond strength (r2 = 0.1389, P= .936). Increased cement thickness surrounding the FRC post did not impair the bond strength. **PDF**

\*Potesta, F., Broome, J., O’neal, S., Givan, D., Ramp, L. **The effect of etching technique on the retention of adhesively cemented prefabricated dowels.** *J Prosthodont. 2008 Aug;17(6):445-50*

**Purpose:** To determine if etching technique influences the bond strength of resin cement to root canal dentin. **Methods:** Fifty-five extracted teeth were endodontically treated, dowel space prepared, and divided into five groups. Each group was treated with different etchant consistencies: acid gel, semi-gel, low-viscosity gel, liquid, and a self-etching primer. After dowel cementation (**DT Light-Post**, RTD: St Egreve, France), four sections were removed from each root and a push-out test was performed. **Results:** Significant effects were found for etching procedure and for location within the root canal. The apical segment produced the lowest bond strength. Self-etching primer showed the highest bond strength. **Conclusions**: The consistency of etchant material influenced the bond strength of a prefabricated dowel in the canal. **PDF**

Prisco, D., De Santis, R, Mollica, F., Ambrosio, L., Rengo, S., Nocolais, L. **Fiber post adhesion to resin luting cements in the restoration of endodontically - treated teeth**. *Operative Dentistry, 2003, 28-5, 515-521.*

**Clinical Relevance:** With respect to the adhesion properties of carbon fiber posts and glass fiber posts used in the restoration of endodontically - treated teeth, they perform equally well if used in combination with chemically cured luting cements or with light- activated ones. **Summary:** Fiber posts are used widely in the restoration of endodontically - treated teeth. Scientific evidence demonstrates that the mechanical performance of teeth restored with fiber posts in combination with resin luting cements is improved with respect to metallic post restorations. The post is cemented inside the root canal using low-modulus elastic polymer resins. In this study, the mechanical resistance of four different post – cement systems (1. carbon fiber C-Post/**Composipost** (RTD, St Egreve, France/ Bisco Dental) with C&B chemically-cured cement (Bisco Dental), 2. carbon fiber/glass fiber **Aestheti-Plus** (RTD, St Egreve, France/ Bisco Dental) post with C & B cement, 3. glass fiber Aestheti-Plus Post (RTD, St Egreve, France) with C&B cement, and 4. glass fiber **Light-Post** (RTD, St Egreve, France) with dual-curing Duo-Link cement (Bisco Dental) was assessed by means of a micro-mechanical pull-out test assisted by a simulation using the Finite Element methodology. This *in vitro* test is specifically designed to accurately characterize the post/cement interface. The results show no significant difference among the adhesion of the various types of post – cement systems used. **PDF**

\*Purton, D., Chandler, N., Qualtrough, A.. **Effect of thermocycling on the retention of glass fiber root canal posts.** *Quintessence Int. 34(5): 366-9 2003*

**Objective:** this study investigated the effects of thermocycling on the retention of glass fiber and resin posts. **Methods:** Forty premolar and canine tooth roots were imbedded in acrylic blocks shaped to fit into a retention device. The roots were randomly assigned to two groups of 20 to receive either **Light-Posts** (RTD, St Egreve, France) or Lucent Anchors (Dentatus) which were cemented into 9mm deep post spaces, with Panavia F resin cement. Each group was divided into two equal subgroups; one for thermocycling and the other to serve as a control. The thermocycled specimens were cycled 300 times between water baths at 5 degrees C and 55 degrees C, with a dwell time of 60 seconds in each. Control specimens were stored at 37 degrees C. The tensile force required to dislodge each post from its root was recorded and the data analyzed using Student’s T-Tests. **Results:** There were no significant differences between the control and the thermocycled specimens. Light-Posts were significantly more retentive than the Lucent Anchor without thermocycling, but that distinction was not that apparent in the thermocycled groups. **Conclusions:** Glass-fiber-and-resin posts cemented with resin cement offer acceptable levels of retention and are not susceptible to reduced retention from thermocycling. Thermocycling should be given less emphasis in tests for the retention of root canal posts cemented with resin cements.

\*Putignano, A, Poderi, G, Cerutti, A, Cury, A, Monticelli, F, Goracci, C, Ferrari, M. **An in vitro study on the adhesion of quartz fiber posts to radicular dentin.** *J Adhes Dent. 2007 Oct;9(5):463-7*

**Purpose:** To evaluate in vitro the bond strength at the adhesive interface between a quartz fiber post, different adhesive systems, and different composite cements. **Methods:** Thirty extracted single-rooted teeth were endodontically treated and divided into three groups (n=10). Quartz fiber posts (**DT Light-Post** RTD: St Egreve, France) were cemented with the following materials: group I: Prime & Bond NT + Self Cure Activator, and Calibra as luting cement; group II: Prime & Bond NT + Self Cure Activator, and UniFil Core; group III: UniFil Bond in combination with Unifil Core. The specimens were processed for the push-out test to evaluate bond strength at the root dentin-cement-post interface. They were sectioned along the long axis of the post into 1-mm-thick slices. A total of 60 sections was obtained from group I. Group II provided 67 slices, while group III provided 69. Loading was performed at a crosshead speed of 0.5 mm/min until the post segment was dislodged from the root section. **Results:** There was no statistically significant difference between the three experimental groups. The mean bond strength obtained for group I was 9.81 +/- 5.40 MPa. For group II it was 12.06 +/- 6.25 MPa, and 9.80 +/- 5.01 MPa for group III. **Conclusions:**: All the materials tested were similar in terms of providing satisfactory bond strength when used for luting fiber posts. However, Unifil Core may be advantageous since it can also be used as a core buildup material, which simplifies the clinical procedures. **PDF**

Qualtrough, A. Chandler, N., Purton, D**. A comparison of the retention of tooth-colored posts.** *Quintessence Int 2003;34:199-201*

**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. **Methods:** 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 ten for post preparation. Post space preparation was carried out according to manufacturer’s instructions. All posts were bonded using Panavia F. A 4mm 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 crosshead speed of 5mm/min.were recorded. **Results:** It was found that the parallel-sided **Light-Post** (RTD, St Egreve, France) were significantly more retentive than all of the other posts. ParaPost Fiber White was more retentive than tapered DT Light-Posts (RTD, St Egreve, France) and Snow Posts. There was no significant difference between the retention of the stainless steel ParaPost 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. 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. **PDF**

\*[Rödig, T](http://www.ncbi.nlm.nih.gov/pubmed?term=%25252522r%252525c3%252525b6dig%25252520t%25252522%2525255bauthor%2525255d), [Nusime, AK](http://www.ncbi.nlm.nih.gov/pubmed?term=%25252522nusime%25252520ak%25252522%2525255bauthor%2525255d), [Konietschke, F](http://www.ncbi.nlm.nih.gov/pubmed?term=%25252522konietschke%25252520f%25252522%2525255bauthor%2525255d), [Attin, T](http://www.ncbi.nlm.nih.gov/pubmed?term=%25252522attin%25252520t%25252522%2525255bauthor%2525255d). **Effects of different luting agents on bond strengths of fiber-reinforced composite posts to root canal dentin.** [J Adhes Dent.](http://www.ncbi.nlm.nih.gov/pubmed/20589257)*2010 Jun;12(3):197-205. doi: 10.3290/j.jad.a18441.*

**Purpose:** To evaluate the bond strength between two fiber posts (FRC Postec and **DT Light-Post-** RTD: St Egreve, France) and different composite resins following different surface treatments of the posts. **Methods:** One hundred sixty extracted teeth were divided into sixteen groups (n = 10). After pretreatment of the post surface with (1) no treatment, (2) silanization, (3) sandblasting + silanization or (4) tribochemical coating, the posts were either luted with the resin cements provided by the manufacturers of the post system or with a core buildup material. Push-out tests were performed in a universal testing machine until the post segment was dislodged from the root section. Data were analyzed using ANOVA. Multiple comparisons were performed using Tukey's test. **Results:** FRC Postec achieved significantly higher bond strengths than DT Light-Post (p < 0.0001). Cementation with the core buildup material showed significantly higher bond strengths than the resin cement provided by the post manufacturers (p < 0.0001). **Conclusions:** Post type, type of surface treatment and type of resin cement were significant factors for bond strength. Luting with a core buildup material significantly increased the bond strengths. **PDF**

\*\*Rovatti, L., Mason, P.N., Dallari, B. , Dallari, A. **Influence of carved surface on carbon and quartz posts retention** *J Dent Res. Vol 85 (Spec. Iss. C) Abstract #0554, PEF Division 2006 (www.dentalresearch.org)*

New quartz fiber endodontic posts with a carved surface have been recently marketed. Objectives: the purpose of this in vitro study is to compare the influence of different surfaces on carbon and quartz fiber posts luted into root canals. Methods: Into 20 extracted single-rooted human teeth, fiber-reinforced posts with a different surface (smooth and carved ) have been luted by using a self-etching composite cement ( All Bond II C & B, Bisco ), so obtaining 4 groups of 5 elements each: 1) **Composipost** (RTD: St Egreve, France). 2) Composipost Retentive ( RTD: St Egreve, France, with carved surface ). 3) **DT Light- Post** (RTD: St Egreve, France). 4) **DT Light-Post ‘Retentive’** ( RTD, France, with carved surface ). In a further 5th group of 5 teeth, used as control, quartz fiber posts (DT Light-Post) etched with hydrofluoric acid 9.6 % for 15 sec have been luted with the same composite cement. Roots have been sectioned perpendicularly to long axis with a diamond wheel and the slices 2.2 mm thick so obtained have been subjected to pull-out test with Instron machine. Results: group 1: 27.12 MPa. group 2: 31.7 MPa. group 3: 29.83 MPa. group 4: 41.7 MPa. group 5: 32.4 MPa. **Conclusions:** a) quartz fiber posts confirmed to be more retentive than carbon fiber posts. b) a carved surface leads to a higher retention both in carbon and in quartz fiber posts. c) by using quartz fiber posts (etching is uneffective on carbon fibers ), the carving of the surface leads to much higher values of retention than etching with hydrofluoric acid. d) all the above suggests that a macro-retention could be the right choice to increase the resistance to dislodgment of fiber-reinforced posts adhesively luted into root canals.

\*Sadek, FT, Monticelli, F, Goracci, C, Tay, FR, Cardoso, PE, Ferrari, M. **Bond strength performance of different resin composites used as core materials around fiber posts.** *Dent Mater. 2007 Jan;23(1):95-9.*

**Objectives:**: To evaluate the microtensile bond strengths of different resin composites used as core materials around fiber posts. **Methods:** Forty **D. T. Light-Post** (RTD, St Egreve, France) were randomly divided into eight groups, according to the resin composite used. They included two core materials specifically developed for core build-up--Group 1: Core-Flo (Bisco Inc.) and Group 2: UniFil Core (GC Corp.); three hybrid composites--Group 3: Tetric Ceram (Ivoclar-Vivadent), Group 4: Gradia Direct (GC Corp.), Group 5: Bisfil 2B (Bisco, Inc.); and three flowable composites--Group 6: AEliteflo (Bisco, Inc.), Group 7: Filtek Flow (3M ESPE) and Group 8: UniFil Flow (GC Corp). A cylindrical plastic matrix was placed around the silanized post and filled with the respective resin composite. Each bonded post provided five to eight sticks for microtensile testing. Each stick was loaded to failure under tension at a cross-head speed of 0.5mm/min. One-way ANOVA and Tukey's test were used for statistical analysis. Scanning electron microscopy (SEM) was used to evaluate the interface of the fractured sticks. **Results:** Resin composites exhibited a significant influence on microtensile bond strength (p<0.05). Core-Flo showed the highest bond strength (11.00+/-0.69 MPa) although it was not statistically significantly different from all groups, except from the flowable composites. Under SEM, all the composites adapted well to the fiber post, with a variable extent of voids observed along the fractured composite interfaces. **Significance:** Although good adaptation to the post surface was achieved, bond strength to fiber post remains relatively weak. Core build-up and hybrid composites are better alternatives to flowable composites as core build-up materials. **PDF**

\*Simonetti , M, Radovic, I, Vano, M, Chieffi, N, Goracci ,C, Tognini, F, Ferrari, M . **The influence of operator variability on adhesive cementation of fiber posts.**  *J Adhes Dent. 2006 Dec;8(6):421-5*

**Purpose:** The aim of this study was to evaluate the influence of the operator's experience on the outcome of fiber post cementation using an etch-and-rinse acetone-based adhesive. **Methods:** Fifteen human anterior teeth were used in the study. One trained operator performed the endodontic procedures and prepared the roots for the insertion and cementation of the posts. At this point, teeth were divided into 3 groups and distributed to 3 operators to lute the posts: an expert operator (EO), a moderately experienced operator (ME), and an operator with a low level of experience (LE). Quartz fiber posts (**D. T. Light Post** #1 or #2, (RTD, St Egreve, France) were used. Posts were cemented using Prime&Bond NT Dual Cure adhesive system (Dentsply Caulk) in combination with the dual-curing resin cement Calibra (Dentsply Caulk). The post retention was assessed with the "thin-slice" push-out test. One-way ANOVA was performed to examine the effect of the operator on push-out strength, followed by post-hoc multiple comparisons using Tukey's test, with the significance level set at alpha = 95%. **Results:** The results of push-out strength testing were as follows: EO (12.44+/-3.63 MPa), ME (11.68+/-2.64 MPa), LE (11.18+/-3.12 MPa). No statistically significant differences were determined among the three groups. **Conclusions:** There was no statistically significant difference in the retention measured for fiber posts luted by operators with different levels of clinical experience. Given the parameters of this investigation, the level of operator experience in luting fiber posts does not affect post retention under laboratory conditions. **PDF**

\*Sousa-Neto, M.D., Manicardi, C. A., Ozório, J.E.Z., Versiani, M. A., Pécora, J. D.**Influence of filling on the bond strength of fiber post.** *J Dent Res. Vol 89 (Spec. Iss. B) Abstract #3938, 2010 (www.dentalresearch.org)*

**Objectives:** To evaluate the influence of filling on the interfacial bond strength of fiber posts (**DT Light-Post**; RTD St Egreve, France) to experimentally weakened root dentin restored with composite resin (Light Core). **Methods:** Fifty 17-mm long upper canine roots were used. After root canal preparation, the specimens were randomly divided into a control (n=10) (normal post preparation with no previous filling) and an experimental group (n=40). In the experimental group, the canals were enlarged to produce a circumferential space of approximately 1mm between the fiber posts and the dentine walls, and the specimens were subdivided into four subgroups (n=10), according to the filling materials: G1=Endofill + gutta-percha; G2=AH Plus + gutta-percha; G3=Epiphany + gutta-percha; G4=Epiphany + Resilon. Twenty-four hours after obturation, the root canals were empty up to a depth of 12mm, the dentine was etched with 32% phosphoric acid (15s), rinsed with deionised water (30s) and gently dried with absorbent paper points. A 3-step adhesive system (All-Bond 2) was applied and the roots were bulk restored with a Bis-Core composite resin which was light-activated (20s) through the DT Light Post. After 24 h, the roots were sectioned transversely at the coronal, middle and apical regions producing 1-mm-thick slices. Push-out tests were performed and failure modes were observed under stereomicroscopy. Statistical analysis was performed by using ANOVA and Tukey's post-hoc tests (α=0.05). **Results:** Means in MPa (±SD) were 15.4±6.91 (control), 11.41±4.66 (G1); 9.97±3.41 (G2), 10.12±4.18 (G3), and 9.0±4.17 (G4). There was statistical difference between the control and the experimental groups(P<0.05), but not between the post regions (p>0.05). The stereomicroscopy analysis showed higher percentage of adhesive failures in all groups. **Conclusion:** Previous root canal filling has reduced the bond strength of the adhesive system in the weakened group.

\*Teixeira, CS., Silva-Sousa, YTC. Sousa-Neto, MD. **Bond strength of fiber posts to adhesively restored intracanal dentin** *J Dent Res.Vol 87 (Spec Iss A) Abstract #1744, 2008* *(*[www.dentalresearch.org](http://www.dentalresearch.org)*)*

**Objectives:** This ex vivo study evaluated the influence of different light-exposure times on the interfacial bond strength of fiber posts (**D. T. Light-Post,** RTD, St Egreve France / Bisco, Inc.) to experimentally weakened root dentin restored with composite resin (Light Core, Bisco Inc.). **Methods:** Sixty 17-mm long maxillary incisor roots were used. Twenty-four hours after obturation, the root canals were emptied up to a depth of 12 mm and 4 groups (n=15) were formed at random. In the 3 experimental groups (G1, G2 and G3), root dentin was flared to produce a 1-mm space between the fiber post and the canal walls. In the control group (G4), the roots were not experimentally weakened. The roots in the experimental groups were bulk restored with Light Core composite resin, which was light-activated through the D. T. Light-Post for either 40 s (G1), 80 s (G2) or 120 s (G3). The posts were cemented (Duo Link-Bisco Inc.) and, after 24 h, the roots were sectioned transversely at the coronal, middle and apical regions producing 1-mm-thick slices (±0.1 mm). Push-out tests were performed (0.5 mm/min, Instron 4444) and failure modes were observed under stereomicroscopy. **Results:** Means in MPa (±SD) were: GC=7.939 ±2.784; G1=10.36 ±2.99; G2=9.03 ± 2.69 and G3=10.28 ±3.16. Two-way ANOVA (a=0.05) indicated statistically significant difference among the groups (p<0.001), but not among the post regions (p>0.05). Comparing the weakened/reinforced groups, composite light-exposure time did not influence the results (p>0.05). There were a higher percentage of adhesive failures (in the post or dentin) in the control (73.33%) and experimental groups (85.18%). Cohesive failures occurred only in the weakened/reinforced roots (100%). **Conclusions:** Root reinforcement with composite resin and light transmitting posts provided higher bond strength to dentin than the control group, independently of the composite light-exposure time and analyzed region.

\*Valandro, LF, Baldissara, P, Galhano, GA, Melo, RM, Mallmann, A, Scotti, R, Bottino, MA. **Effect of mechanical cycling on the push-out bond strength of fiber posts adhesively bonded to human root dentin.** *Oper Dent. 2007 Nov-Dec;32(6):579-88.*

This study evaluated the effect of mechanical cycling on the bond strength of fiber posts bonded to root dentin. The hypotheses examined were that bond strength is not changed after fatigue testing and bond strength does not present vast variations according to the type of fiber post. Sixty crownless, single-rooted human teeth were endodontically treated, with the space prepared at 12 mm. Thirty specimens received a quartz fiber post (Q-FRC) (**D.T. Light-Post,** RTD, St Egreve, France), and the remaining 30 specimens received a glass fiber post (G-FRC) (FRC Postec Plus). All the posts were resin luted (All-Bond+Duo-link), and each specimen was embedded in a cylinder with epoxy resin. The specimens were divided into six groups: G1- Q-FRC+no cycling; G2- Q-FRC+20,000 cycles (load: 50N; angle of 450; frequency: 8Hz); G3- Q-FRC+2,000,000 cycles; G4- G-FRC+no cycling; G5- G-FRC+20,000 cycles; G6- G-FRC+2,000,000 cycles. The specimens were cut perpendicular to their long axis, forming 2-mm thick disc-samples, which were submitted to the push-out test. ANOVA (alpha = .05) revealed that: (a) Q-FRC (7.1 +/- 2.2MPa) and G-FRC (6.9 +/- 2.1MPa) were statistically similar (p = 0.665); (b) the "no cycling" groups (7.0 +/- 2.4MPa), "20,000 cycles" groups (7.0 +/- 2.1MPa) and "2,000,000 cycles" groups (7.0 +/- 2.0MPa) were statistically similar (p = 0.996). It was concluded that mechanical cycling did not affect the bond strength of two fiber posts bonded to dentin.

Wang, VJ, Chen, YM, Yip, KH, Smales, RJ, Meng, QF, Chen, L. **Effect of two fiber post types and two luting cement systems on regional post retention using the push-out test.** *Dent Mater. 2008 Mar;24(3):372-7. Epub 2007 Jul 25.*

**Objective:** To investigate regional root canal push-out bond strengths for two fiber-reinforced post types using two adhesive systems. **Methods**: The crowns of 24 recently extracted sound maxillary central incisors were sectioned transversely 2mm coronal to the labial cemento-enamel junction, and the roots treated endodontically. Following standardized post space preparations, fiber-reinforced posts (**Composipost / C-Post; Aestheti-Plus**: RTD, St Egreve, France/Bisco) were placed using two adhesive systems (acid-etch One-Step Plus /C&B Cement; self-adhesive RelyX Unicem), in four equal groups. Push-out bond strength tests were performed at four sites in each root. Results were analyzed using split-plot ANOVA, with a=0.05 for statistical significance. **Results:** Aestheti-Plus quartz fiber-reinforced posts showed significantly higher push-out strengths than C-POST carbon fiber-reinforced posts (P<0.0001). The separate acid-etch adhesive system resulted in significantly higher bond strengths than the self-etch self-adhesive system (P<0.0001). Bond strengths decreased significantly from coronal to apical root canal regions (P<0.0001). **Significance:** The quartz fiber-reinforced post placed using the separate acid-etch adhesive system provided significantly better post retention than the carbon fiber-reinforced post placed using the self-etch self-adhesive system.

\*Wrbas, KT, Kampe, MT, Schirrmeister, JF, Altenburger, MJ, Hellwig, E. **Retention of fiber posts dependent on different resin cements.** *Schweiz Monatsschr Zahnmed. 2006;116(1):18-24 (article in German)*

Tooth-coloured adhesive inserted fiber posts are used to restore endodontically treated teeth. In this investigation, the tensile bond strength of two different fiber posts systems (ER DentinPost and **D.T. Light-Post** RTD: St Egreve, France) in combination with five different resin cements was tested. The posts were inserted into artificial root canals in bovine dentin using Clearfil Core, RelyX Unicem, Panavia 21ex, Panavia F2.0 und Calibra. Titanium posts (ER-Kopfstift), inserted with zinc phosphate cement served as control group. ER DentinPost inserted with Clearfil Core had significantly higher tensile bond strengths than in combination with Panavia F2.0 (221.70 +/- 17.99 N) or Calibra (212.37 +/- 45.20 N). D.T. Light-Post in combination with Calibra (338.20 +/- 46.40 N), Panavia F2.0 (321.69 +/- 40.11 N) and Panavia 21ex (290.41 +/- 55.28 N) showed significantly higher tensile bond strengths compared to adhesive cementation with RelyX Unicem (211.57 +/- 32.35 N) and Clearfil Core (131.67 +/- 51.72 N). The tensile bond strength of the control group was in the upper third of the values (315.43 +/- 51.38 N). Optical analysis of the post surface after decementation demonstrated in all cases adhesive-cohesive mixed fractures. The adhesion of resin cement to the fiber posts and resin cement to root canal dentin is influenced by different factors. The combination of fiber post systems with the type of resin cement has a great influence on the tensile bond strength.

\*Wrbas, KT, Altenburger, MJ, Schirrmeister, F,  Bitter, K., Kielbassa, AM. **Effect of adhesive resin cements and post surface silanization on the bond strengths of adhesively inserted fiber posts** *J Endod July s2007 Volume 33, Issue 7, Pages 840-843*

Abstract: This study evaluated the tensile bond strengths and the effect of silanization of fiber posts inserted with different adhesive systems. Sixty **D.T. Light-Post** Size 1 (RTD St Egreve, France) were used. Thirty posts were pretreated with silane. The posts were cemented into form-congruent artificial root canals (12 mm) of bovine dentine. Six groups were formed: G1, Prime&Bond NT/Calibra; G2, Monobond-S+Prime&Bond NT/Calibra; G3, ED Primer/Panavia 21ex; G4, Monobond-S+ED Primer/Panavia 21ex; G5, RelyX Unicem; and G6, Monobond-S+RelyX Unicem. The mean (standard deviation) tensile bond strengths (megapascals) were 7.69 (0.85) for G1, 7.15 (1.01) for G2, 6.73 (0.85) for G3, 6.78 (0.97) for G4, 4.79 (0.58) for G5, and 4.74 (0.88) for G6. G1 achieved significantly higher bond strengths than G3 and G5; G3 had significantly higher values than G5 (*P* < .05; Scheffé procedure). Silanization had no significant effect (*P* > .05, one-way analysis of variance). Tensile bond strengths were significantly influenced by the type of resin cement. Silanization of fiber post surfaces seems to have no clinical relevance.

1. **RESIN TO POST**

\*\*Berthold, C., Holzschuh, B., Schuetz, E., Koch, AT, Powers, JM, Petschelt, A. **Bonding of frc-posts: influence of post length and surface design.** *J Dent Res.Vol 92 (Spec Iss A) Abstract #1858, 2013* *(*[www.dentalresearch.org](http://www.dentalresearch.org)*)*

**Objectives:** To evaluate the influence of post length and post surface design on pull-out force and bond strength of conventionally and adhesively luted quartz-fiber-reinforced-composite posts [QFRCP]. Methods: 360 extracted bovine teeth were randomly assigned (n=20; 16 test and 2 control groups), root canal treated, filled and post space (6mm or 10mm) prepared. Custom-made smooth-surfaced QFRCPs [PSXRO] and macro-retentive (**Macro-Lock Post,** RTD: St Egreve, France) QFRCPs [MLXRO] (both RTD, France) were luted with Fuji Plus [FP], RelyX Unicem [RXU], Multilink Primer+Multilink [MLP] and LuxaBond+LuxaCore Z [LB]. A titanium-post [TiP] (NTI, Germany) (control) was luted with Ketac Cem [KC]. After water storage (24h, 37°C), pull-out-test was performed, bond strength calculated and analyzed using Kolmogorov-Smirnov-test (p<0.05), followed by Kruskal-Wallis-test and Mann-Whitney-U-test (α=0.05). Failure mode was assessed under a stereomicroscope. Results: Bond strengths (MPa) were: KC (TiP), 4.1±0.6; FP (PSXRO+MLXRO), 6.5±2.1; RXU (PSXRO+MLXRO), 7.8±2.6; MLP\_ML (PSXRO+MLXRO), 13.2±2.0; and LB\_LCZ (PSXRO+MLXRO), 15.5±1.6. Influences of the post length on pull-out force (N) and post surface design on bond strength (MPa) were statistically significant (p<0.05). Bond strength (MPa), for the different post designs within one post length, was statistically significant different (p<0.05). Pull-out force (N), for the two post lengths within one post design, was statistically significant different (p<0.05), while the bond strength (MPa) was not (p>0.05). **Conclusion:** Post length and post surface design influenced bonding properties of conventionally and adhesively luted QFRCPs. The macro-retentive surface design and increased post length were in general beneficial to improve the bonding properties of the QFRCPs.

\*\*Berthold, C., Koch, A.T., Mitterhuber, B. Binus, S., Powers, J.M., Petschelt, A. **Bonding of frc-posts - influence of post surface roughness**. *J Dent Res.Vol 92 (Spec Iss A) Abstract #1857, 2013* *(*[www.dentalresearch.org](http://www.dentalresearch.org)*)*

**Objectives:** To evaluate the influence of post surface roughness on bond strength of conventionally and adhesively luted quartz-fiber-reinforced-composite posts [QFRCP]. Methods: 180 extracted single rooted human teeth were randomly assigned (n=20; 8 test and 1 control group), root canal treated, filled and post space (size 6, 8mm) prepared. Custom-made smooth-surfaced QFRCPs [PSXRO] (Rz=5.48µm, Ra=0.82µm) and rough-surface QFRCPs (**Macro-Lock Post,** RTD, St Egreve, France) [PRXRO] (Rz=11.58µm, Ra=2.01µm) (both RTD, France) were luted with Fuji Plus [FP], RelyX Unicem [RXU], Multilink Primer+Multilink [MLP] and LuxaBond+LuxaCore Z [LB]. As control, a titanium-post [TiP] (Rz=5.37, Ra=0.79) (NTI, Germany) was luted with Ketac Cem [KC]. After water storage (24h, 37°C), pull-out-test (N) was performed, bond strength (MPa) calculated and analyzed using Kolmogorov-Smirnov-test (p>0.05), followed by ANOVA, post-hoc-tests and t-test (α=0.05). Failure mode was assessed under a stereomicroscope. Results: The influence of the post surface roughness (p< 0.001) and the luting system selection (p<0.001) on the bond strength was statistically significant. The bond strengths for the QFRCPs with different surface roughness, within one luting system, were statistically significant different for FP and LB (p<0.001). The highest bond strength was found for PRXRO in combination with LB. **Conclusion:** In this in vitro study, post surface roughness and luting system selection significantly influenced the bond strength of conventionally and adhesively luted QFRCPs to human teeth. In general, the rough-surface design was beneficial for improving the bond strength.

\*\*Berthold,, C, Binus, S.M, Koch, A.T., Powers, L.M., Petschelt, A. **Bonding Properties of FRC-posts - Influence of Post Pre-treatment.***J Dent Res.Vol 92 (Spec Iss A) Abstract #1855, 2013* *(*[www.dentalresearch.org](http://www.dentalresearch.org)*)*

**Objectives**: To evaluate the influence of post pre-treatment by adhesive application on bond strength of adhesively luted quartz-fiber-reinforced-composite posts [QFRCP] to root canal dentin. **Methods:** 160 extracted single rooted bovine teeth were randomly assigned (n=20 per group), root canal treated, filled and post space (10mm) prepared. Size 6 custom-made smooth-surfaced QFRCPs [PSXRO] (Rz=5.5µm, Ra=0.8µm) (RTD, France) were cleaned with alcohol for pretreatment A and additionally pretreated with the respective dentin bonding system for pretreatment B. The posts were then luted with Multilink Primer\_Multilink [ML], AdheSE\_Multicore flow [MCF], SealBond Ultima (light-cured before post insertion). CoreCem [CC], and LuxaBond\_LuxaCore Z [LCZ], respectively. After water storage (24h, 37°C), pull-out-test (N) was performed, bond strength (MPa) calculated and analyzed using Kolmogorov-Smirnov-test (p>0.05), ANOVA and t-test (α=0.05). Failure mode was assessed under a stereomicroscope and data analyzed using Kolmogorov-Smirnov-test (p<0.05) and Mann-Whitney-U-test. **Results:** The influence of the post pretreatment on the bond strength (p<0.05) was statistically significant, while the luting system selection (p=0.31) was not. Within one luting system, statistically significant differences in bond strength, for the two post pretreatment techniques, were found for ML (p<0.05). Overall, the main failure occurred between the post and the luting system (86%). The failure between post and luting system was reduced when using pretreatment B (83%) compared to pretreatment A (89%), but not statistically significant (p=0.069). **Conclusion**: In this in vitro study, the post pretreatment technique using Macro-Lock significantly influenced the bond strength of adhesively luted QFRCPs to bovine teeth. This effect might be explained due to improved bonding between the post and the ML luting system.

\*\*Berthold, C., B. Mitterhuber, B., Powers, J.M., Haapasalo, M. Petschelt, A. **Bonding of FRC-posts - Influence of post size**, *J Dent Res.Vol 92 (Spec Iss A) Abstract #1856, 2013* *(*[www.dentalresearch.org](http://www.dentalresearch.org)*)*

**Objectives:** To evaluate the influence of post size on bond strength of conventionally and adhesively luted quartz-fiber-reinforced-composite posts [QFRCP]. **Methods:** 180 extracted single-rooted human teeth were randomly assigned (n=20; 8 test, 1 control group), root canal treated, filled, and post space (size 3 or 6; 8mm) prepared. Sizes 3 and 6 custom-made smooth-surfaced QFRCPs (**Macro-Lock Post**, RTD St Egreve France) [PSXRO] (Rz=5.48µm, Ra=0.82µm) (RTD, France) were luted with Fuji Plus [FP], RelyX Unicem [RXU], Multilink Primer+Multilink [MLP] and LuxaBond+LuxaCore Z [LB]. As control, a titanium-post [TiP] (Rz=5.37, Ra=0.79) (NTI, Germany) was luted with Ketac Cem [KC]. After water storage (24h, 37°C), pull-out-test (N) was performed, bond strength (MPa) calculated and analyzed using Kolmogorov-Smirnov-test (p>0.05), followed by ANOVA, post-hoc-tests and t-test (α=0.05). Failure mode was assessed under a stereomicroscope. Results: The influence of post size (p< 0.001) and luting system selection (p<0.001) on the pull-pout force (N) and the bond strength (MPa) was statistically significant. Statistically significant differences were found for the two post sizes, within one luting system, in pull-out forces for RXU and MLP and in bond strength for FP and LB (p<0.05). **Conclusion:** In this in vitro study, post size and luting system selection significantly influenced the bond strength of conventionally and adhesively luted QFRCPs to human teeth. However, bonding properties did not distinctly improve when using bigger size posts. Therefore smaller size posts may be selected with the aim to maintain valuable root structure when considering only bonding features.

\*Coelho, G., Santos, G., El-Mowafy. O., Hernique Rubo, J. **Diametral tensile strength of a resin composite core with nonmetallic prefabricated posts: an in vitro study.** *J Prosthet Dent. 2004 Apr;91(4):335-41.*

**Statement of problem**: A number of prefabricated nonmetallic posts are currently available for use in conjunction with resin composite cores before fabrication of crowns for endodontically treated teeth. Information is needed regarding the strength of the composite and the nature of attachment between its components. **Purpose:** The aim of this study was to determine the influence of different types of posts on the fracture resistance of a resin composite core material using the diametral tensile strength (DTS) test. **Methods:** Cylindrical specimens, 6 mm in diameter and 3 mm high, were prepared from resin composite (Tetric Ceram) and a group of prefabricated posts (n=10) as follows: resin composite only (control); Vectrispost (VTS); FiberKor (FKR); **Aestheti-Plus** post (ATP); **Light-Post** (LTP); Dentorama post (DRM), and Para-Post (PRP) as a second control. Specimens were stored for 7 days in water at 37 degrees C and then subjected to DTS test in a universal testing machine until failure occurred and load was recorded (N). Mean values and SD for DTS values (MPA) were calculated, and data were analyzed statistically with 1-way analysis of variance, followed by the Tukey test (alpha=.05). Representative specimens from each group were examined with SEM to determine nature of failure. **Results:** Mean values (SD) in MPa for DTS were as follow: Control group: 49.64 (3.36); VTS: 29.77 (3.36); FKR: 31.9 (2.39); ATP: 28.92 (2.2); LTP: 34.26 (3.37); DRM: 33.45 (2.46), and PRP: 27.90 (2.40). Analysis of variance indicated significant differences among the groups (P<.05). SEM examination indicated that for PRP failure was adhesive in nature, whereas with all nonmetallic posts, cohesive failure was more predominant. **Conclusions:** The use of posts did not result in reinforcement of resin composite core when diametral tensile force was applied. When used with the core material, LTP, DRM, and FKR resulted in the highest DTS values, whereas PRP resulted in the lowest values. **Clinical Implications:** Some non-metallic fiber-reinforced posts, when used with a resin composite core, resulted in significantly higher Diametral Tensile Strength (DTS) compared with metal prefabricated posts. These higher DTS values meet minimum accepted values as provided by the ADA specifications for direct Type II composite materials. **PDF**

Dallari, A., Rovatti, L., Dallari, B., Mason, P. **Adhesion of different composites to carbon and quartz fiber endodontic posts: in vitro studies and preliminary reports**. *J Dent Res. Vol 82 IADR Abstract #1952, 2003* *(www.dentalresearch.org)*

**Objectives:** Composites are used in post-endodontic core rebuildings when carbon and/or quartz fiber posts have been luted in root canals. Which composite is able to give the best clinical results in core rebuilding is still being discussed. The purpose of this study is to compare the adhesion of different composites to the surface of both carbon and quartz fiber posts. **Methods:** Two dual-curing (CoreRestore2 : Kerr & Luxacore:DMG) and two light-curing composites (Light-Core:Bisco & HelioMolar: Vivadent) were used to build a core on quartz fiber posts (**Light-Post**: RTD, St Egreve, France/Bisco). Posts were etched with Hydrofluoric acid 9.6% for 10 seconds. Two dual-curing (CoreRestore2 & BisCore: Bisco) and two light-curing composites (Renew: Bisco & Heliomolar) were used on carbon fiber posts **Composipost** (RTD). In all, 8 groups of 10 specimens each were prepared. All the cores were built by using the same form (Composipost Core Form: RTD). Three slices (2.5mm thickness) in each specimen were obtained by using Leitz 600 device, and pull-out tests with Instron machine were performed. **Results:** on quartz fiber posts, CoreRestore 2: 393.9 N-29.02 MPa, Luxacore: 347 N-25.52 MPa, Light-Core: 313.7 N-21.31 MPa, Heliomolar: 182.4 N-13.22 MPa. On carbon fiber posts CoreRestore 2: 236.3 N-216.67 MPa, Bis-Core: 235.5 N-16.66 MPa, Renew: 234.8 N-16.61 MPa, Heliomolar: 228.6 N-16.15 MPa. **Conclusions:** The above results show that 1) the adhesion of composite resins to quartz fiber posts is higher than to carbon fiber posts, 2) on quartz fiber posts, dual-curing composites lead to a stronger adhesion that light–curing composites and 3) on carbon fiber posts, only negligible differences exist between dual and light-curing composites.

\*\* Koch, AT, Binus, SM, Holzschuh, B, Petschelt, A, Powers, JM, Berthold, C. **Restoration of endodontically treated teeth with major hard tissue loss - influence of post surface design on pull-out bond strength of fiber-reinforced composite posts.** *Dent Traumatol. 2014 Aug;30(4):270-9. doi: 10.1111/edt.12089. Epub 2014 Jan 29.*

The aim was to evaluate the influence of post surface design and luting system on bond strength of quartz-fiber-reinforced composite posts (QFRCPs) luted to root canal dentin. **Methods:** Single-rooted bovine teeth (n = 650) were randomly assigned (13 groups, n = 50), sectioned, endodontically treated, filled, and post space (length 8 mm) prepared. Custom-made plain-surfaced fiber posts (PSXRO) and (both RTD) macroretentive **Macro-Lock Post** **Illusion X-RO** (MLXRO)RTD, St Egreve, France) were inserted into the post spaces using six luting systems: Ketac Cem (KC), Fuji Plus (FP), RelyX Unicem, Multilink Primer\_Multilink, Sealbond Ultima\_& CoreCem, and LuxaBond\_& LuxaCore Z. As control, a titanium post was cemented with KC. After water storage (24 h, 37°C), pull-out test was performed, followed by failure mode assessment. Bond strength was calculated in MPa and analyzed using anova, Dunnett-T3-test, and Student's t-test with Bonferroni correction. **Results:** Post design and luting system significantly influenced the bond strength [MPa] (P < 0.05). Compared with the control 4.3 (1.5), all test groups exhibited higher bond strengths (P < 0.05), except for group PSXRO/KC 4.2 (1.0). The remaining bond strengths were PSXRO: FP 8.6 (1.5), RelyX Unicem 10.4 (3.4), Multilink Primer\_Multilink 12.7 (3.0), SealBond Ultima\_CoreCem 12.7 (3.0), LuxaBond\_LuxaCore Z 15.7 (2.5), and MLXRO: KC 7.2 (2.2), FP 13.4 (2.5), RelyX Unicem 9.2 (2.9), Multilink Primer\_Multilink 12.5 (4.5), SealBond Ultima\_CoreCem 13.7 (4.6), LuxaBond\_LuxaCore Z 20.6 (2.2). The bond strengths of MLXRO were higher than those of PSXRO when luted with KC, FP, and LuxaBond\_LuxaCore Z (P < 0.05). **Conclusio**n: The post surface design and luting system selection influenced the bond strength of conventionally and adhesively luted.

\*Kim, YK, Son, JS, Kim, KH, Kwon, TY. **A simple 2-step silane treatment for improved bonding durability of resin cement to quartz fiber post.** *J Endod. 2013 Oct;39(10):1287-90. doi: 10.1016/j.joen.2013.06.010. Epub 2013 Aug 7.*

**Introduction:** This study examined a clinically feasible protocol for improving hydrolytic stability using a 2-step silanization including a nonorganofunctional silane. **Methods:** The surfaces of 24 **D.T. Light-Post** (RTD, St Egrege, France) were polished and assigned to the following 4 groups: M: 1-step silanization with Monobond-S (MS) (Ivoclar Vivadent, Schaan, Liechtenstein); BM: 2-step silanization with 5% 1,2-bis(triethoxysilyl)ethane and then MS; and HM and HBM: 1-step and 2-step silanization, respectively, after 24% H2O2 etching. Four resin composite cylinders (RelyX Unicem; 3M ESPE, St Paul, MN) were bonded on each surface according to a microshear testing protocol. All bonded samples were stored in water at 37°C for 24 hours, and half of them were then thermocycled 5000 times before microshear testing (n = 12). The failure modes were evaluated under an optical and scanning electron microscope. Water contact angles were measured on the post surfaces before and after silanization to estimate surface hydrophobicity. The results were statistically analyzed using 2-way analysis of variance and the Tukey test. **REsults:** The bond strengths for the BM and HBM groups were significantly higher than the M and HM groups at 5000 thermocycles (P < .05), whereas no significant differences were found between the 4 groups before thermocycling (P > .05). All debonded samples showed some fractured fibers. No significant difference in the hydrophobicity was found between the 1-step and 2-step silanized post surfaces (P > .05). **Conclusions:** The 2-step 1,2-bis(triethoxysilyl)ethane/MS treatment has potential as a silanization procedure for enhancing the hydrolytic stability of the fiber post/resin composite interface.

\*Leforestier, E., Ceretti, I., Darque-Ceretti E., Laplanche, O., B**olla**, M. **Silanization effect of fiber posts on adherence to dental tissues.** *J Dent Res. Vol 89 (Spec. Iss. B) Abstract #4481, 2010 (www.dentalresearch.org)*

**Objectives:** The main purpose of a post and core system is to keep a really damaged tooth in the jaw-bone, as long as it is possible. Due to the rapid progress in materials and bonding substances, the pulpless teeth treatments with quartz fiber posts, have been more and more used in daily practice. Thanks to their favorable mechanical properties, these posts give less failure than with a technique using cast metal posts. The aim of this study is to evaluate the influence of quartz fiber posts' silanization on the dental tissue's adherence. **Methods:** Eighteen extracted teeth were previously endodontically treated and randomly received a quartz fiber post without (group 1) or with silane layer on the surface (**DT Light-Post SL**® (RTD, St Egreve, France). Both posts were bonded with a composite resin (XP Bond® adhesive+ Self Cure Activator®+ Core X Flow®). The push-out method was employed to measure bond strengths of the system, more exactly of 2 mm thick transversal discs of teeth's roots. Optic and scanning electron microscope (SEM) were used for visual macroscopic and microscopic examination of the samples before and after the push-out test. An energy dispersive X-ray spectrometry (EDX) gave the opportunity to analyze present elements. **Results:** The statistical analysis revealed a significant effect of the push-out force (p<0, 05) between the two groups, in favour of posts industrially treated with a silane coupling agent (group 2). **Conclusions:** The failure mode is complex. A part of the luting agent has been found on some extracted fiber posts and samples. The silane seems to improve the composite resin with a positive incidence on the adherence to dental tissues.

\*Meador, M., Broome, J., Ramp, L. **Diametral tensile bond strength of resin composite to fiber posts***. J Dent Res. Vol 86 (Spec. Iss. A) Abstract #0867, 2007* *(www.dentalresearch.org)*

Adhesive reconstruction of endodontically treated teeth using fiber posts and resin composite materials has become increasingly popular.  Recommendations include pre-treating the post with adhesive and/or silane.  However, since the fiber post has a rough surface and is highly polymerized, it is questionable whether this step contributes to the bond.  The diametral compression test (DCT) can be used to indirectly determine he bond of composite to a post (Santos JPD 91:335-41,2004).  **Objective:** to determine the effect of various surface treatments on the bond of resin composite to fiber posts by DCT.  **Methods:** Cylinders of resin composite (Z100, 3M ESPE, St. Paul, MN), were formed around the coronal end of three different fiber posts: **D.T. Light-Post** (RTD, St Egreve, France), RelyX (3M ESPE) and UniCore (Ultradent).  Four conditions (n=5) were tested: post surface untreated (Untx); cleaned with EtOH; cleaned and primed with All-Bond 2 (AB2); post coated with Vaseline to prevent bonding (Vas). A solid cylinder of composite (Sol) was used as a control (n=5).  Samples were loaded to failure in diametral compression on an Instron Universal Testing Machine at a crosshead speed of 1 mm/min.  DTS was calculated according to the formula: 2P/π\*D\*T.  Means were compared with ANOVA and Fisher's PLSD (alpha = 0.05).  **Results:** Means in MPa (s.d) are given in the table.  Means with the same superscript are not significantly different. Due to slight variations in size, comparisons between posts were not possible. **Conclusions:** For two of the three posts there was no statistically significant difference in bond regardless of surface treatment, but treatment of the post with a dentin bonding agent resulted in the highest bond strength to resin composite in all cases.

\*\*Pallottini, S., Llukacej, A., Monaco, C. Baldissara, P*.* **Fiber post bonding using self-etching and resin cements.** *J Dent Res. Vol 89 (Spec. Iss. B) Abstract #4493, 2010 (www.dentalresearch.org)*

**Objectives:** the fiber post bonding to root dentin relies on both chemical and micro-mechanical adhesion, this latter could be the main factor to generate retention strength. The aim of this study is to evaluate the push-out strength of different fiber post types when luted with a self-etching and a resin cement. **Methods**: 3 fiber post types a) Hi-Rem POP #2 (Overfibers); b) **Macro-Lock Illusion** (RTD) #2; c) RelyX Fiber Post (3M ESPE) and 2 cements were selected (self-etching RelyX Unicem, and resin RelyX ARC, 3M ESPE). 30 human teeth having narrow canals were randomly subdivided in six groups accordingly to each post/cement combination. Post space was prepared to obtain circular section canals using the manufacturer suggested burs. The specimens were subjected to 5000 thermal cycles then embedded in resin cylinders and sectioned obtaining >1mm thick slices for the push-out test. Data were analyzed with 1-way ANOVA and multiple comparison SNK test (alpha=.05). Failure distribution was determined by stereomicroscope/SEM observations (Mann-Witney test). **Results:** push-out strength of group a) and b) was significantly higher than that of group c) using both cements. The self-etching cement gave the highest values when used with group a) and b) posts: 15.2 and 15.4MPa, respectively; posts of group c) showed significantly lower values (9.7 and 11.8MPa with the self-etching and resin cement, respectively). Failures at the post/cement interface was significantly higher in group c) posts luted with self-etching cement. **Conclusion**: self-etching cement is a promising material for fiber post cementation. Its bonding to the dentin appeared more stable and stronger than that of the resin cement; the adhesion to the fiber post seems to be improved by a micro-retentive rough surface (Hi-Rem) or by an interlocking effect due to the threaded surface pattern (Macro-Lock). Smooth surface posts showed lower push-out values.

Perdigão J, Gomes G, Lee IK. **The effect of silane on the bond strengths of fiber posts**. *Dent Mater. 2006 Aug;22(8):752-8. Epub 2006 Jan 19.*

**Objectives:** Esthetic posts have been developed to maximize the foundation of esthetic restorations. The purpose of this study was to evaluate the effect of silane on the bond strength of three fiber-reinforced resin posts (fiber posts). **Methods:** Fifty-four extracted human maxillary central incisors and canines were endodontically treated. **D.T. Light Post** (DT, Bisco), FRC Postec (FR, Ivoclar Vivadent), and ParaPost Fiber White (PP, Coltène/Whaledent) were inserted using the resin adhesive system provided by the respective manufacturer. For half of the specimens in each group, the fiber posts were treated with a silane solution (Monobond S, Ivoclar Vivadent). A push-out test was performed on three different sections of each root to measure bond strengths. Data were analyzed with ANOVA and Bonferroni's post hoc test at P<0.05. **Results:** The use of silane did not result in any statistically significant difference at any level of the root. Silane did not result in any significant different bond strengths (MPa) for each of the posts. When the data were pooled, the use of silane did not result in statistically significant different bond strengths at P>0.403: No silane=12.7+/-8.4; Silane=14.1+/-7.0. The coronal third of the root (17.5+/-6.7) resulted in statistically greater bond strengths than the medium third (12.9+/-6.8) and than the apical third (9.8+/-7.3) at P<0.002 and P<0.0001, respectively. The medium third and the apical third resulted in no statistically significant different bond strengths from each other at P>0.07. The type of post did not result in statistically significant different bond strengths at P>0.417: DT=14.7+/-6.8 MPa; FR=13.3+/-6.6 MPa; PP=12.2+/-6.6 MPa. **Significance**: The use of a silane coupling agent did not increase the push-out bond strengths of the three fiber posts used in this study. All posts bonded to root dentin at the same magnitude. Bonding is more predictable at the most coronal level of the root.

Saelee, D., Sooksuntisakoonchai, N., Mangkrasan, V., Jindanusorn, D. **Bond strength between quartz fibre posts and core materials**. *J Dent Res. 81 IADR Abstract # 1154; 2002* *(www.dentalresearch.org)*

**Objectives:** The purpose of this study was to determine the modes of failure and bond strength between quartz fiber post (**Æstheti-Plus,** RTD, St Egreve, France) and core build up materials (light cure composite resin, Alphadent, Dental Technologies, Inc., USA). **Methods:** Sixty quartz fiber posts were placed in extracted premolar and core were built up with light cure composite resin. Specimens were classified into 6 groups due to three diameters; 1.4, 1.8 and 2.1 millimeters at different heights; 2 and 4 millimeters. Universal Testing Machine (Lloyd LR30K, Lloyd Instruments, Ltd., England) was performed at the angulation of 45 degrees to the long axis of the tooth with cross head speed 0.2 millimeters/second. Each specimen was continuously loaded until fracture occurred. **Results:** It was found that the median load that caused core fracture out until fracture out of the post diameter 1.4, 1.8, and 2.1 millimeters were 244.3 N (95% CI: 218.2 N to 300.8 N), 393.5 N (95% CI: 373.8 N to 423.4 N), and 376.6 N (95% CI: 354.6N to 433.3N) respectively. The median fracture load measured from different post diameters was significantly different (P-value <0.001) whereas the load from various post heights was not significantly different (P-value=0.459). The modes of failure occurred between composite resin and post dentine (91.7%). No fractures were found within root, coronal tooth structure and post. **Conclusions:** From this study, it could be concluded that quartz fibers posts would not cause any coronal tooth structure and/or root fracture. Post diameter 1.8 and 2.1 were recommended due to higher bond strength between post and core materials.

Saelee, D., Swasdipanich, C., Gaveeyanon, E., Sooksuntisakoonchai, N., Chanatepaporn, P*.* **Effect of surface treatments on bond strength of fiber post.***J Dent Res. Vol 89 (Spec. Iss. B) Abstract #4480, 2010 (www.dentalresearch.org)*

**Objectives:** To evaluate the effect of hydrogen peroxide, and airborne particle abrasion on the bond strength of quartz fiber post. **Methods:** Forty five extracted single root premolars were randomly divided into three groups (n=15). The coronal part of the premolar was removed to allow the length of root to be approximately 14 mm. The endodontic treatment was then performed. Quartz fiber posts (**Aestheti Plus,** RTD, France) which were subjected to (1) airborne particle abrasion (AB) with 50 µm aluminium oxide (2) etching with 50% hydrogen peroxide (HP) for 1 minute, and (3) no treatment (control group), were cemented to the root canal with resin cement (Paracore®, Coltène/Whaledent, France). Each root was sliced into 3 sections (i.e., the coronal, middle, and apical portions), giving rise to 45 specimens per group. A parallel, transverse root sections of 2.0 mm thickness, was cut from each specimen. The bond strength between cemented post and root dentine were determined by push-out test. Data were logarithmic transformed and analyzed by one-way ANOVA and Tukey test (α=0.05). **Results:** The mean bond strength of the control group was 6.755±3.806 MPa. Group AB exhibited the lowest mean bond strength (4.881±3.076 MPa), while the highest mean bond strength was obtained from group HP (10.215±3.982 MPa). One way ANOVA showed significant difference between all groups (P < .001). Post-hoc Tukey test revealed that bond strength of group HP was significantly higher when compared to group AB (p < .001) and control group (P = .024). There was no significant difference between group AB and control group (P < .054). **Conclusion:** The surface treatment of quart fiber post with 50% hydrogen peroxide for 1 minute significantly enhanced the bond strength of resin cement due to its ability to dissolve the epoxy resin matrix and leaving intact, undamaged quartz fibers for micromechanical retention.

\*\*[Santos G.C.JR.](mailto:gildo.santos@schulich.uwo.ca), Santos, MJMC, Johnson, N., Rizkalla, A.S. **Micro-tensile bond strength of different composite core foundation materials.***J Dent Res.Vol 92 (Spec Iss A) Abstract #0498, 2013* *(*[www.dentalresearch.org](http://www.dentalresearch.org)*)*

**Objective**: The aim of this study was to evaluate the micro-tensile bond strength (µTBS) of four resin composite core foundation materials and their respective post systems with and without silane surface treatment. **Method**: Eight groups of posts (n=10) were divided into those with and without silane treatment. Four different core foundation materials were paired with their recommended posts and bonding agents as follows: Corecem + SealBond Ultima + Macro-Lock; Zircules + MPa+ **Macro-Lock**; RockCore + Prelude + IcePost; and ParaCore + ParaBond + ParaPost Fiber Lux. Following application of bonding agent, resin composite was injected around the post in a customized mold and light cured for 20s. For µTBS, specimens (1mm x 1mm cross-section and 8mm long) were produced. Testing was conducted using a universal Inston machine at a crosshead speed of 1mm/min. Statistical analysis was carried out using one-way ANOVA and Tukey-HSD test, p=0.05. **Result:** The µTBS values ranged from 18.59 MPa for Paracore without silane to 43.09 MPa for Corecem with silane. Silane treated Macro-Lock post paired with Zircules and Corecem exhibited the highest µTBS amongst groups, p<0.05, while ParaPost Fiber Lux without silane exhibited the lowest µTBS, p<0.05. SEM analysis demonstrated mixed adhesive/cohesive failures. FRC posts tend to lose surface fibers or break during stress failure, most notably in IcePost. **Conclusion**: Macro-Lock post associated with Corecem or Zircules, give the best results with and without silane. Silane coupling improved significantly the µTBS for three core foundation materials (p<0.05) with the exception of RockCore + IcePost.

\*Shirinzad, M, Ebadi, Sh, Shokripour, M, Darabi, M. **An in vitro evaluation of the effect of four dentin bonding system on the bond strength between quartz fiber post and composite core.***J Dent (Shiraz). 2014 Mar;15(1):22-7.*

**Statement of problem:** A strong bond of fiber post to resin core, as well as to dentin would critically ensure the durability of restorations in endodontically treated teeth. **Purpose:** The purpose of this study was to evaluate the effect of etch-and-rinse dentin bonding systems on the bond strength between resin core and fiber post after application of 24% hydrogen peroxide.

**Method:** 24 fiber posts (RTD; St. Egrève, France) were treated with 24% hydrogen peroxide for 10 minutes. They were randomly divided into 4 groups (n=6) based on the bonding agent used: Group P: Prime&Bond, Group O: One-Step, Group S: Single Bond and Group E: Excite. Each group was prepared according to the manufacturer's instructions. For all posts, a flowable composite core (ÆliteFlo; Bisco, USA) was built-up over the bonded area. Each specimen was sectioned to produce 2 sticks, 1mm in thickness and underwent microtensile bond strength (µTBS). Data were analyzed using one-way ANOVA at the 0.05 level. The fractured surfaces of all sticks were evaluated by stereomicroscope (× 20). Scanning electron microscopy(SEM) assessment of two sticks from each group was performed to evaluate the surface morphology. **Results:** The means and SDs of µTBS were: Group P: 10.95±1.74; Group S: 10.25±2.39; Group E: 9.52±2.07; and Group O: 9.12±1.34. There was no statistically significant difference in bond strength means between the groups tested (p> 0.05).   **Conclusion:** The results of this study indicated the bonding agents used had no significant influence on the bond strength of fiber post to composite core.

\*Soares, LP, Dias, KR, de Vasconcellos, AB, Sampaio, EM, Street, A**. Effects of different pretreatments on the bond strength of a dual-cure resin core material to various fiber-reinforced composite posts*.*** *Eur J Prosthodont Restor Dent. 2012 Mar;20(1):41-7.*

The aim of this study was to evaluate the effects of different pretreatments on the bond strength of a dual-cure resin core to 3 types of fiber posts. Bond strength was measured using a push-out design. One-sided t-Test of Hypothesis with unknown variance was performed (p-values < 5%). Sandblasting abrasion with 50 micro alumina particles at a specific distance, pressure and time was the only surface treatment in **DT Light-Post** (RTD St Egreve, France) and Transluma Post (Bisco Dental Products, Schaumburg, IL USA) that increased the bond strength to dual cure resin composite cores. FRC Postec Plus (Ivoclar, Schaan, FL) post did not shown an increase in bond strength in any group.

\*Wrbas, KT, Lenz, A, Schirrmeister, JF, Altenburger, MJ, Schemionek, W, Hellwig, E**. Bond strength of different resin composites to fiber-reinforced posts.** *Schweiz Monatsschr Zahnmed. 2006;116(2):136-41**(article in German)*

Endodontically treated teeth often have little coronal tooth tissue remaining and as such require a post to retain the core and the restoration. Therefore, tooth coloured adhesive inserted fiber posts in combination with resin based core material can be used. In this study, the tensile bond strength of core materials to fiber posts was investigated. Three different core materials, Clearfil Core, CoreRestore 2 and MultiCore Flow in combination with two different fiber posts systems, ER DentinPost and **DT Light-Post** (RTD St Egreve, France), were tested. The posts were shortened to the lengths of 15 mm.The specimens were obtained while the upper part (3 mm) of the posts was covered with standardized cylinders of the core materials. Clearfil Core in combination with the DT Light-Post (230.5 N +/- 42.2 N) and ER DentinPost (154. N +/- 33.6 N) had the highest tensile bond strengths of all groups. The tensile bond strength of CoreRestore 2 to D. T. Light-Post (149.9 N +/- 29.5 N) was higher than the tensile bond strengths of the combinations MultiCore Flow/D. T. Light-Post (140.9 N +/- 31.4 N) and Multi- Core Flow/ER DentinPost (122,. N +/-19,. N). The group Core-Restore 2TER DentinPost had the lowest tensile bond strengths (80,1 N ++/-19,4 N). The adhesion of the resin based core materials to the fiber posts is influenced by the post design and core materials. The combination of core materials with the type of fiber post has a great influence on the tensile bond strength.

\*Yenisey, M, Kulunk, S. **Effects of chemical surface treatments of quartz and glass fiber posts on the retention of a composite resin.** *J Prosthet Dent. 2008 Jan;99(1):38-45*

**Statement of problem:** Failure of a fiber post and composite resin core often occurs at the junction between the 2 materials. This failure process requires better characterization. **Purpose:** The purpose of this study was to evaluate the effect of 2 chemical solvents, hydrogen peroxide and methylene chloride, on the shear bond strength of quartz and glass fiber posts to a composite resin. **Methods:** Twenty-four posts (3 +/-0.1 mm in length) were prepared for each quartz (**Light-Post** (LP) RTD St Egreve, France)) and glass fiber (Cytec blanco (CB)) post. Posts were horizontally embedded in acrylic resin with half of the post diameter exposed. The exposed surfaces were successively ground with 400-, 800-, and 1200-grit silicon carbide papers, to ensure uniform smoothness. The specimens were divided into 3 subgroups (n=8) representing different surface treatment techniques, including application of silane for 60 seconds (S), etching with hydrogen peroxide for 20 minutes (H), and etching with methylene chloride for 5 seconds (M). Silane-treated specimens served as controls. A dual-polymerized composite resin (Tetric EvoCeram) was placed in a polytetrafluoroethylene mold (30 x 2 mm) positioned upon the post specimens and polymerized for 20 seconds with a light-emitting diode (LED) polymerization unit. The specimens were stored in water at 37 degrees C for 24 hours. Shear bond strength values (MPa) of posts and composite resin cores were measured using a universal testing machine with a crosshead speed of 0.5 mm/min. Data were analyzed by 2-way analysis of variance (ANOVA). Post hoc Tukey intervals for comparison among the 2 post materials and 3 surface treatment techniques were calculated (alpha =.05). The effect of the chemical surface treatments on glass and quartz fiber post surfaces were examined with a scanning electron microscope (SEM). **Results:** There were significant differences between the shear bond strength for LP and CB (P<.001). For all groups, the application of H showed the highest bond strength values. There was no significant difference between the S and M groups (P>.05). The SEM observations demonstrated that the fiber post surfaces were modified after chemical surface treatment techniques. **Conclusions:** The surface treatment of quartz and glass fiber posts with hydrogen peroxide significantly enhanced the shear bond strength of the composite resin tested due to its ability to dissolve the epoxy resin matrix used in each post. The lowest bond strength was obtained with M and S groups. Application of methylene chloride to the fiber post surfaces for 5 seconds was not effective in increasing the shear bond strength of the fiber post to composite resin.

**V. Clinical Results**

\*Bitter, K., Noetzel, J., Stamm, O., Vaudt, J., Meyer-Lueckel, H., Neumann, K., Kielbassa, A. **Randomized clinical trial comparing the effects of post placement on failure rate of postendodontic restorations: Preliminary results of a mean period of 32 months**. *J Endod; 2009 35: 1477 -82*

**Introduction:** The aim of this randomized clinical trial was to assess whether the placement of a fiber post (**DT Light-Post** (RTD St Egreve, France) (DT) and the amount of residual coronal dentin affect the time to failure of single-unit postendodontic restorations. **Methods:** Ninety patients providing 120 teeth were selected. Three groups (n = 40) were defined on the basis of the amount of residual coronal dentin: 2-walls group, 2 or more coronal walls; 1-wall group, 1 coronal wall; no-wall group, no wall exceeding 2 mm above the gingival level. Within each group teeth were randomized and allocated to 2 intervention groups (n = 20), including subgroups no post (no root canal retention) and subgroups post (placement of DT). **Results:** After a mean observation period of 32.4 (13.7) months in subgroups no post, the failure rates were 10%, whereas in subgroups post, failure rates of 7% were observed (P = .318). In no-wall group post placement significantly affected the time to failure of total restorations (P = .029, log-rank test). Teeth without post retention revealed a significantly higher failure rate (31%) compared with teeth restored with post retention (7%). **Conclusions**: Within the observation time of the present study, fiber post placement was efficacious to reduce failures of poste ndodontic restorations only with teeth that exhibited no coronal walls. Post insertion for teeth showing a minor substance loss should be critically reconsidered.

\*Cagidiaco, MC, Radovic, I, Simonetti M, Tay, F, Ferrari, M. **Clinical performance of fiber post restorations in endodontically treated teeth: 2-year results**. *Int J Prosthodont. 2007 May-Jun;20(3):293-8*

**Purpose:** This study evaluated the 2-year outcome of post-and-core restorative procedures in endodontically treated teeth. The effect of baseline factors (tooth type, number of residual coronal walls, and type of definitive restoration) on restoration failure was assessed. **Methods:** The consecutive sample design included 150 patients. A total of 162 teeth (57 anterior and 105 posterior) were restored. Sixty-nine teeth had 3 or 4 residual coronal walls, while 93 teeth had 2 or fewer walls. Crowns and direct resin composite restorations were placed in 121 and 41 teeth, respectively. After 23 to 25 months, all patients were evaluated. Logistic regression was used to identify the joint effect of variables recorded at baseline (P < .05). **Results:** The only failure modes observed were post debonding (4.3%, 2 in anterior teeth and 5 in posterior teeth) and endodontic failure (3.0%, 2 in anterior teeth and 3 in posterior teeth). All post debondings occurred in teeth with 2 or fewer coronal walls that were crown covered. All endodontic failures occurred in crown-covered teeth (1 failure in a tooth with 3 walls and the remaining 4 failures in teeth with 2 or fewer walls). Logistic regression found no statistical significance for any of the variables recorded at baseline. **Conclusions:** Restorations placed with the use of a fiber post (**D. T. Light-Post**, RTD, St Egreve, France) and core resulted in 4.3% post debondings and 3.0% endodontic failures after 2 years of clinical service. **PDF**

\*Cagidiaco, MC., Garcia-Godoy, F., Vichi, A., Grandini, S., Goracci, C., Ferrari, M., **Placement of fiber prefabricated or custom made posts affects the 3-year survival of endodontically treated premolars**. *Am J Dent; 2008 21: 179-184*

**Purpose:** To assess whether the amount of residual coronal dentin and the placement of a pre-fabricated (**D.T. Light-Post**, RTD,St Egreve, France) (LP) or a customized fiber post (Everstick Post) (ES) have a significant influence on the 3-year survival of endodontically treated premolars. **Methods:** A sample of 345 patients provided 6 groups of 60 premolars in need of endodontic treatment. Groups were defined based on the amount of dentin left at the coronal level after endodontic treatment and before abutment build-up. Within each group, teeth were randomly divided into three Sub-groups (n=20). In Sub-group A, no root canal retention was provided for the coronal restoration. In Sub-groups B and C, LP and ES, respectively, were placed inside the root canal. All the teeth were finally restored with a single unit metal-ceramic crown. **Results:** Data were not affected by any loss of follow-up. The overall 36- month survival rate of crowned, endodontically treated premolars was 76.7%. The lowest survival rate was recorded for teeth restored without any root canal retention (62.5%). Teeth restored with LP had a survival rate higher (90.9%) than those restored with ES (76.7%). The Cox regression analysis showed that the presence of root canal retention was a significant factor for survival (P<0.05). The decrease in failure risk was higher in teeth restored with LP (HR=0.1;95% CI for HR=0;.09 to 0.34; P<0.001) than when using ES (HR= 0.5; 95% CI for HR=0.3 to 0.7; P=0.003). Teeth retaining one (HR=0.3; 95% CI for HR=0.2 to 0.7; P=0.003), two (HR=0.2; 95% CI for HR=0.1 to 0.5; P<0.001), or three coronal walls (HR=0.1; 95% CI for HR=0.05 to 0.3; P<0.001), had a significantly lower failure risk than teeth deprived even of the ferrule effect. Similar failure risks existed for teeth missing all the coronal walls, regardless of the presence or absence of a ferrule effect (P>0.05). Interaction terms were not significant (P>0.05). Post placement and the amount of residual coronal dentin affected the 3-year survival of endodontically treated premolars. **Clinical significance:** To obtain the highest success rate, endodontically treated premolars should be restored with a fiber post and a complete crown. The “ferrule” structure has a direct influence on the clinical success rate. **PDF**

Fazekas, A, Menyhart, K, Bodi, K, Jako, E **Restoration of root canal treated teeth using carbon fiber posts**. *Fogorv Sz 1998 Jun;91 (6):163-70*

**Abstract/conclusions:** The restoration of root canal treated teeth – because of the significant loss of tooth structure- is often achieved with post and core. However, posts may generate stresses, which lead to vertical root fracture and the loss of the tooth. Since post design, materials used and post space preparation has significant influence on vertical fracture prevalence, broad investigation is in progress to find the optimal procedure. During the last decade, new prefabricated passive posts were introduced for postendodontic restorations. In order to collect information, clinical trials have been performed on the reconstruction of root canal treated teeth using Carbon fibre posts (**C-POST/ COMPOSIPOST**; RTD, St Egreve, France). Adhesive technique was applied to cement post in the root canal and for composite core reconstruction. The physical properties of the Carbon fibre posts and the composite are very close to those of the dentine. Post application is simple, does not require special skill and, for the patient, means minimum hazard. The position of the post was controlled by radiography. During the 24 months observation period, no failure was registered in patients treated (N=55). Hence, we attribute our good results to the homogenous reconstruction of the teeth. This procedure seems to be a good alternative to traditional cast metal dowel/cores or metal prefabricated posts.

Ferrari, M., Cagidiaco, C., Goracci, C., Vichi, A., Mason, P, N., Radovic, I., Tay, F. **Long-term retrospective study of the clinical performance of fiber posts**. *Am J Dent* *2007;20:287-291.*

**Purpose:** To retrospectively evaluate the long-term clinical performance of three types of fiber posts after a service period of 7-11 years. **Methods:** 985 posts were included in the study: 615 **Composiposts**, 160 **Æstethi-Posts** and 210 **Æstheti-Plus** Posts were placed into endodontically treated teeth. Four combinations of dentin adhesives/luting materials were used. Endodontic and prosthodontic results were recorded. **Results:** A 7-11% failure rate was recorded for the three types of posts. 79 failures in total were noted; 39 due to endodontic reasons, 1 root fracture, 1 fiber post fracture, 17 crown dislodgements and 21 due to post debonding. The mechanical failures were always related to the lack of coronal tooth structure. The results indicated that fiber posts in combination with bonding/luting materials may be used routinely for restoring endodontically treated teeth. Mechanical failure of restored teeth with fiber posts can be related to the amount of residual coronal structure. **PDF**

\*Ferrari, M., Cagidiaco, M., Grandini, S., DeSantis, M., Goracci, C. **Post placement affects survival of endodontically treated premolars.** *J Dent Res 86(8):729-734, 2007*

**Abstract:** Clinical evidence is lacking regarding the influence of the amount of residual coronal dentin and of post placement on the failure risk of endodontically compromised teeth. The aim of this prospective clinical trial was to assess whether these factors significantly affect the two-year survival of restored pulpless premolars. A sample of 210 individuals provided six experimental groups of 40 premolars in need of endodontic treatment. Groups were defined on the amount of dentin left at the coronal level. Within each group, in half of the teeth selected at random, a fiber post (**D. T. Light-Post**, RTD, St. Egreve, France) was inserted inside the root canal, whereas in the remaining half of the premolars, no post was placed. All teeth were covered with a crown. The Cox regression analysis revealed that post placement resulted in a significant reduction of failure risk (p <0.001). Failure risk was increased for teeth onder the “no ferrule” (p < 0.001) and “ferrule effect” conditions (p < 0.004). **PDF**

Ferrari, M., Vichi, A., and Garcia-Godoy, F. **Clinical evaluation of fiber-reinforced epoxy resin posts and cast post and cores.** *American Journal of Dentistry*. *13: 15B-18B, 2000.*   
   
**Purpose:** This retrospective study evaluated treatment outcome of cast post and core and **Composipost** systems after 4 yrs of clinical service. **Methods:** 200 patients were included in this study. They were divided into two groups of 100 endodontically treated teeth restored with a post. Group 1: Composipost (RTD St Egreve, France) systems were luted into root canal following the manufacturer's instructions. Group 2: Cast post and cores were cemented into root canal preparations with a traditional technique. The patients were recalled after 6 months, 1, 2 and 4 yrs and clinical and radiographic examinations were completed. Endodontic and prosthodontic results were recorded. **Results*:*** Group 1: 95% of the teeth restored with Composiposts showed clinical success; 3 of these samples were excluded for noncompliance and 2% showed endodontic failure. Group 2: Clinical success was found with 84% of teeth restored with cast post and core. 2% of these samples were excluded for noncompliance, 9% showed root fracture, 2% dislodgment of crown and 3% endodontic failure. Statistical evaluation showed significant differences between Groups 1 and 2 (P<0.001). The results of this retrospective study indicated that the Composipost system was superior to the conventional cast post and core systems after 4 years of clinical service. **PDF**

Ferrari, M., Vichi, A., Mannocci, F., and Mason, P. N. **Retrospective study of the clinical performance of fiber posts.** *American Journal of Dentistry*. *13: 9B-13B, 2000.*

**Purpose:** To evaluate the clinical performance of **Composipost, Aestheti-Posts and Aestheti-Plus Posts** (RTD, St Egreve, France) after a period of clinical service ranging from 1-6 yrs. **Methods:** 1,304 posts were included in the study: 840 Composiposts, 215 Aestheti-Posts and 249 Aestheti-Plus posts were placed into endodontically treated teeth. Four combinations of bonding/luting materials were used. The patients were recalled every 6 months and clinical and radiographic examinations were completed. Endodontic and prosthodontic results were recorded. Actuarial Life Table statistical analysis and Mantel-Haenszel comparison of survival curve have been performed at 95% level of confidence. **Results:** The 3.2% failure rate was due to two reasons: 25 posts debonded during removal of temporary restorations, and 16 teeth showed periapical lesions at the radiographic examination. No statistically significant differences were found among the four groups. The results of this retrospective study indicate that fiber posts in combination with bonding / luting materials can be routinely used. **PDF**

\*Ferrari, M, Cagidiaco, M. ,Vichi, A., Grandini, S., Goracci**,**C**. Post placement and residual coronal structure affect root-treated premolars' survival.** *J Dent Res. Vol 86 (Spec. Iss. A) Abstract #1385, 2007* *(www.dentalresearch.org)*

**Objective**: to assess whether the amount of residual coronal dentin and the placement of a fiber post (**D. T. Light-Post**; RTD, St Egrève, France) or EverStick Post (Stick Tech, Turku, Finland) have a significant influence on the three-year survival of restored pulpless premolars. **Methods:** A sample of 345 patients provided 6 cohorts of 60 premolars in need of endodontic treatment. Cohorts were defined based on the amount of dentin left at the coronal level after endodontic treatment and before abutment build-up. Within each cohort teeth were randomly divided into three Subgroups (n=20). In Subgroup A no endocanalar retention was provided for the coronal restoration. In Subgroups B and C a fiber post (RTD) and Stick Tech fibers (ST) respectively were placed inside the root canal. All the teeth were covered with porcelain fused to metal crowns. **Results:** Data were not affected by any loss to follow-up. The overall 36-month survival rate of crowned endodontically treated premolars was 76.70%. The lowest survival rate was recorded for teeth restored without any endocanalar retention (62.5%). Teeth restored with RTD had a survival rate higher (90.9%) than those restored with ST (76.7%). The Cox regression analysis showed that the presence of an endocanalar retention was a significant factor for survival (p<0.05). The decrease in failure risk was higher in teeth restored with RTD than when using ST. Teeth retaining one, two, or three coronal walls had a significantly lower failure risk than teeth deprived even of the ferrule effect. Similar failure risks existed for teeth missing all the coronal walls regardless of the presence or absence of a ferrule effect. Interaction terms were not significant (p>0.05). **Conclusion:** Post placement and the amount of residual coronal dentin affect the 3-year survival of endodontically treated premolars.

\*Ferrari, M., Vichi, A., Fadda, G.M., Cagidiaco, M.C., Tay, F.R., Breschi, L., Polimeni, A., Goracci, C. **A randomized controlled trial of endodontically treated and restored premolars**. *doi: 10.1177/0022034512447949 JDR July 2012 vol. 91 no. 7 suppl S72-S78*

This in vivo study examined the contribution of remaining coronal dentin and placement of a prefabricated **DT Light-Post** (RTD St Egreve, France) (LP) or customized fiber post (ES) to the six-year survival of endodontically treated premolars. A sample of 345 patients provided 6 groups of 60 premolars each in need of endodontic treatment. Groups were classified according to the number of remaining coronal walls before abutment build-up. Within each group, teeth were allocated to one of three subgroups: (A) no post retention; (B) LP; or (C) ES (N = 20). All teeth were protected with a crown. Cox regression analysis revealed that fiber post retention significantly improved tooth survival (p < 0.001). Failure risk was lower in teeth restored with prefabricated (p = 0.001) than with customized posts (p = 0.009). Teeth with one (p = 0.004), two (p < 0.001), and three coronal walls (p < 0.001) had significantly lower failure risks than those without ferrule. Similar failure risks existed for teeth without coronal walls, regardless of the presence/absence of ferrule (p = 0.151). Regardless of the restorative procedure, the preservation of at least one coronal wall significantly reduced failure risk. **PDF**

\*Ghavamnasiri, M, Maleknejad, F, Ameri, H, Moghaddas, MJ, Farzaneh, F, Chasteen, JE. **. A retrospective clinical evaluation of success rate in endodontic-treated premolars restored with composite resin and fiber reinforced composite posts***. J Conserv Dent. 2011 Oct;14(4):378-82. doi: 10.4103/0972-0707.87203.*

**Background:** The aim of this retrospective study was to assess the survival rate and causes of failure of quartz fiber posts used to restore endodontically treated teeth. **Methods:** Thirty-eight patients with endodontically treated premolar and anterior teeth that were then restored with a coronoradicular quartz fiber post and extensive composite resin restorations were selected for participation in the study. The age of the restorations ranged from 1 to 6 years. Survival probabilities of the restorations as well as causes of failures were analyzed using the Kaplan-Meier analysis and the Logistic regression (α = 0.05). **Results:** The overall cumulative survival rate (48.8%) was determined, while the survival probabilities after 1, 2, 4, 5, and 6 years of service were 88.37%, 60.95%, 45.71%, 32.65%, and 0%, respectively. **Conclusions:** The survival probability of endodontically treated teeth restored with a quartz fiber post and composite restorations is associated with the dental arch.

Glazer, B. **Restoration of endodontically treated teeth with carbon fibre posts - A prospective study.** *Journal of the Canadian Dental Association*. *66: 613-618, 2000.*  
   
**Abstract*:*** A prospective study was started in 1995 to evaluate the success of carbon fibre reinforced epoxy resin (**Composipost** (RTD, St Egreve, France) posts used to restore endodontically treated teeth. All the teeth in the study had lost more than 50% of their coronal structure. **Methods***:* Fifty-nine carbon fibre Composiposts cemented with C & B Metabond and built up with Core Paste cores were placed into the teeth of 47 patients. Each tooth received a full-coverage restoration (porcelain fused to metal crown) and was followed for 6.7-45.4 months (average = 28.0 months, standard deviation = 10.7). **Results:** Results for 52 teeth in 42 patients were analyzed. There were no fractures. The overall failure rate was 7.7% and the cumulative survival rate was 89.6% at the end of the follow-up period. The only statistically significant finding (p=0.04) was that posts in lower premolars were at higher risk of failure. **Conclusion:** Composipost posts are among the most predictable systems available today. Composipost posts in the upper anterior teeth are associated with a higher success rate and longer life than those placed in premolars, especially lower premolars. This study contributes to the growing body of evidence that supports the use of Composipost posts in the restoration of endodontically treated teeth. **PDF**

\*Goracci, C., Cagidiaco, M., Cagidiaco, E.,Vichi, A., Grandini, S., Ferrari, M.*.* **Effects of oral environment and occlusal wear on FRC-posts integrity**. *J Dent Res. Vol 86 (Spec. Iss. A) Abstract #0131, 2007 (www.dentalresearch.org)*

**Objectives:** To evaluate whether the exposure to the oral environment and occlusal wear during function affects the morphological integrity of fiber posts underlying a luted crown or a direct composite restoration. Methods: Two groups of endodontically treated teeth restored with **D. T. Light-Posts** (RTD, St. Egreve, France) were investigated. Group 1 included ten crowned teeth in which the abutment had the post head exposed on the surface. Group 2 included ten teeth directly restored with resin composite and presenting with the post head exposed on the occlusal surface of the restoration. For baseline evaluation, polyether impressions (Permadyne, 3M ESPE) were taken of the abutments before crown luting in Group 1, and of the restorations occlusal surfaces immediately after polishing in Group 2. Results: After a 5-year period of clinical service, polyether impressions were taken again for each experimental tooth. All the impressions were developed with epoxy resin and observed under a scanning electron microscope (Jeol, Tokyo, Japan), in order to assess whether the post surface underwent structural changes due to water uptake (Groups 1 and 2) and/or occlusal wear (Group 2) during the clinical function. Results: In neither group microscopic signs of post surface degradation due to water uptake were seen. In Group 2 wear signs were visible on the exposed post surface, as well as on the surface of the direct composite. Conclusion: Over a 5-year period, in case the fiber post surface is exposed on the top of the abutment, the seal provided by the crown effectively protects the fiber post against water uptake. When the post surface is exposed in a direct resin restoration, it does not show evident morphological changes related to water degradation, although it exhibits a loss of structure due to occlusal wear.

\*Grandini, S., Goracci, C., Tay, F,.Grandini, R., Ferrari, M **Clinical evaluation of the use of fiber posts and direct resin restorations for endodontically treated teeth** *Int J Prosthodont 2005;18:399–404.*

**Purpose:** Restoration of root-treated teeth is routinely performed in clinical practice with a choice of therapeutic options, considering many factors to provide optimal mechanical properties, esthetics, and longevity. The aim of the present work was to present a preliminary clinical report on the use of fiber posts and direct resin composites for restoring root-treated teeth. **Methods:** Thirty-eight anterior and 62 posterior endodontically treated teeth were selected from 3 private prosthodontic offices. The protocol used included endodontic treatment, with translucent fiber posts (**D. T. Light-Post**, RTD St Egreve, France) bonded to the post-space using a ‘1-bottle’ adhesive (One-Step, Bisco) and a dual-cure resin cement (Duo-Link, Bisco). Direct resin restorations were performed using a micro-hybrid resin composite (Gradia Direct, GC) and a layering technique. Both opaque dentin and enamel and translucent enamel shades were used. **Results:** Patients were recalled after 6, 12, 24, and 30 months, and the restorations assessed according to predetermined clinical and radiographic criteria. These clinician-mediated evaluation methods confirmed the good clinical performance of the restorations. **Conclusions:** Restoration of endodontically treated teeth with fiber posts and direct resin composites is a treatment option, that in the short term conserves remaining tooth structure and results in good patient compliance. **PDF**

[Malferrari S](http://www.ncbi.nlm.nih.gov/pubmed?term=%25252522malferrari%25252520s%25252522%2525255bauthor%2525255d), [Monaco C](http://www.ncbi.nlm.nih.gov/pubmed?term=%25252522monaco%25252520c%25252522%2525255bauthor%2525255d), [Scotti R](http://www.ncbi.nlm.nih.gov/pubmed?term=%25252522scotti%25252520r%25252522%2525255bauthor%2525255d). **Clinical evaluation of teeth restored with quartz fiber-reinforced epoxy resin posts.** *Int J Prosthodont. 2003 Jan-Feb;16(1):39-44.*

**Purpose:** This prospective clinical follow-up evaluated the acceptability of quartz fiber-reinforced epoxy posts used in endodontically treated teeth over a 30-month period. **Methods:** In 132 patients, 180 endodontically treated teeth were restored using **AEstheti-Plus** quartz-fiber posts (RTD, St Egreve, France). The posts were luted with the All-Bond 2 adhesive system and C&B Resin Cement according to the manufacturer's recommendations. The core was made with Core-Flo or Bis-Core, and all-ceramic crowns or metal-ceramic crowns were applied as final restorations. The parameters considered as clinical failure were displacement, detachment, or fracture of posts; core or root fracture; and crown or prosthesis decementation. Patients were reevaluated at 6, 12, 24, and 30 months. **Results:** One cohesive failure involving a margin of the composite core was observed after 2 weeks, and two adhesive fractures were seen after 2 months. These failures were located between the cement and the dentin walls of the canals. All three failures occurred during removal of the temporary crown. The percentage of failures was thus 1.7% over a 30-month period, but it was possible to successfully replace the restoration in all three failed cases. **Conclusions:** Over a 30-month period, the rehabilitation of endodontically treated teeth using quartz-fiber posts showed good clinical results. No crown or prosthesis decementation was observed, and no post, core, or root fractures were recorded. **PDF**

Malferrari, S, Baldissara, P, Arcidiacono, A, **Translucent Quartz Fiber Posts: a 20 Month In vivo Study**. *J Dent Res. 81 IADR Abstract #2656; 2002* *(www.dentalresearch.org)*

**Abstract:** In the attempt to achieve the best-performing post and core restoration, many post systems have been studied. In the recent past, the aesthetic fiber posts, in combination with resin luting cement, have been proposed to provide a reliable rehabilitation for the endodontically treated tooth. The new translucent fiber posts show interesting mechanical properties (comparable to the dentin) and aesthetic characteristics that enhance a final rehabilitation with an all-ceramic crown…with satisfying results. **Objectives:** The purpose of this study was to evaluate the clinical behavior of 84 endodontically treated teeth treated with translucent quartz fiber posts. Thirty four teeth recieved a **Light-Post** (RTD/Bisco Dental ) and 50 teeth received the Endo Light-Post (RTD, St. Egreve, France). To perform the cementation, Bisco One-Step and dual – cure Duo-Link (Bisco) were utilized. The luting cement was polymerized through the translucency of the post. **Methods:** All of the core restorations were performed using Core-Flo (Bisco) or Bis-Core (Bisco) composite resin and finalized with an all-ceramic crown. In accordance with the international literature, data, useful for the longitudinal evaluations, were recorded on diagrams. The survival rate of the post and core was valuated after 2 weeks, 1, 3, 6, 12 and 20 months. Post displacement or detachment, post fracture, restoration fracture and root fracture were investigated. **Results:** No failures took place up to the present day. **Conclusions:** According to these results, and within the limitations of this study, it is possible to assume that the clinical performance of these translucent fiber posts is successful. Further data will be needed for long-term clinical evaluations of the outcome.

Mannocci, F, Bertelli, E, Sherriff, M, Watson, TF, Ford, TR. **Three-year clinical comparison of survival of endodontically treated teeth restored with either full cast coverage or with direct composite restoration**. *J Prosthet Dent. 2002 Sep;88(3):297-301. Evid Based Dent. 2004;5(2):*45.

**Statement of problem:** Little information exists regarding the outcome of crown build-ups on endodontically treated teeth restored with metal-ceramic crowns or with only a direct-placed composite. **Purpose:** The aim of this study was to evaluate the clinical success rate of endodontically treated premolars restored with fiber posts and direct composite restorations and compare that treatment with a similar treatment of full-coverage with metal-ceramic crowns. **Methods:** Subjects included in this study had one maxillary or mandibular premolar for which endodontic treatment and crown build up was indicated and met specific inclusion/exclusion criteria. Only premolars with Class II carious lesions and preserved cusp structure were included. Subjects were randomly assigned to 1 of the following 2 experimental groups: (1) teeth endodontically treated and restored with adhesive techniques and composite or (2) teeth endodontically treated, restored with adhesive techniques and composite, and then restored with full-coverage metal-ceramic crowns. Sixty teeth were included in the first group and 57 in the second. All restorations were performed by one operator. Causes of failure were categorized as root fracture, post fracture, post decementation, clinical and/or radiographic evidence of marginal gap between tooth and restoration, and clinical and/or radiographic evidence of secondary caries contiguous with restoration margins. Subjects were examined for the listed clinical and radiographic causes of failure by 2 calibrated examiners at intervals of 1, 2, and 3 years. Exact 95% confidence intervals for the difference between the 2 experimental groups were calculated. **Results**: At the 1-year recall, no failures were reported. The only failure modes observed at 2 and 3 years were decementations of posts and clinical and/or radiographic evidence of marginal gap between tooth and restoration. There was no difference in the failure frequencies of the 2 groups (95% confidence interval, -17.5 to 12.6). There was no difference between the number of failures caused by post decementations and the presence of marginal gaps observed in the 2 groups (95% confidence intervals, -9.7 to 16.2 and -17.8 to 9.27**). Conclusion**: Within the limitations of this study, the results upheld the research hypothesis that the clinical success rates of endodontically treated premolars restored with fiber posts and direct composite restorations after 3 years of service were equivalent to a similar treatment of full coverage with metal-ceramic crowns

\*Monticelli, F., Grandini, S., Goracci, C., Ferrari, M. **Clinical behavior of translucent fiber posts: a 2-year prospective study.** *Int. J Prosthodont* *2003; 16:593-596*

**Purpose**: This study prospectively evaluated the clinical performance of three types of translucent posts over a follow-up period of between 2 and 3 years. **Methods:** Selected were 225 patients with one premolar in need of endodontic treatment, followed by restoration with a fiber post and porcelain crown. The sample was randomly divided into three groups of 75 patients each. The same type of post was used in all patients within the group: Group 1=**Aestheti-Plus posts** (RTD), Group 2= **D. T. Light-Post** (RTD, St Egreve, France), and Group 3= FRC Postec (Vivadent / Ivoclar). For bonding the posts, a light-cure adhesive (One-Step; Bisco Dental) and a dual-curing resin cement (Duo-Link; Bisco Dental) were applied in Groups 1 and 2, whereas self-curing materials ExciteDSC adhesive (Vivadent/ Ivoclar) and MultiLink resin cement (Vivadent / Ivoclar) were used with Group 3. After 6, 12 and 24 months, patients were recalled, and a clinical and radiographic examination was performed. For some patients, 30-month follow-up data were also collected. **Results:** Debonding of the post occurred in eight cases (3.5%); in another six cases, a recurrence of the periapical lesion was reported. **Conclusion:** The statistical analysis did not reveal any significant difference in the survival rate of the tested posts, suggesting that all are equally and sufficiently reliable for clinical use. **PDF**

\*Parisi, C, Valandro, LF, Ciocca, L, Gatto, MR, Baldissara, P. **Clinical outcomes and success rates of quartz fiber post restorations: A retrospective study.** *J Prosthet Dent. 2015 May 23. pii: S0022-3913(15)00148-1. doi: 10.1016/j.prosdent.2015.03.011. [Epub ahead of print]*

**Statement of Problem:** Cast metal posts and dowels are inherently dark and, when metal-free restorations are used, could impair the definitive esthetic appearance. Quartz fiber posts could represent a reliable choice for restoring abutment teeth. **Purpose:** The purpose of this study was to evaluate the long-term success rate of teeth restored with quartz fiber posts and fixed dental prostheses (FDPs). **Methods:** Ninety-nine teeth restored with 114 quartz fiber posts (**Light-Post** RTD, St Egreve, France) and FDPs were evaluated. The evaluation time ranged from 7 months to 9.25 years. The Kaplan-Meier method was used to obtain success curves. The influence of the tooth location, definitive restoration, and failure pattern upon the success function was analyzed with the log-rank test. The Cox regression test was used to evaluate possible predictors among the interactions of the observed parameters. **Results:** The success rate of the restorations was 85.86% in a mean period of 5.88 ±1.37 years, with an estimated success probability of 85% at 6.17 years. The statistical analysis identified the factors related to the arch (P=.045) and type of definitive restoration (P=.021) as significantly associated with success. Post debonding was the most frequent failure mode, followed by endodontic failure, with the latter not necessarily being related to the post itself. No root fractures were recorded. Twelve teeth out of the 14 that failed were restored again, bringing the overall survival rate of the teeth to 98%. **Conclusions:** The rehabilitation of abutment teeth with quartz fiber posts can be considered a reliable procedure; however, adhesive techniques and luting materials require improvement. **PDF**

Ree. M. H., Schwartz, R. S., **Long-term success of nonvital, immature permanent incisors treated with a mineral trioxide aggregate plug and adhesive restorations: a case series from a private endodontic practice.** *J Endod; 2017 43: 1370-77*

This case series evaluated the long-term clinical outcome of nonvital immature teeth treated with mineral trioxide aggregate (MTA) as an apical barrier and an adhesive restoration with or without a fiber post. Eighty-three teeth in 72 patients were treated by the first author with an apical MTA plug and an adhesive restoration of composite resin and in 45 of the 83 teeth 1 or more fiber posts (**DT Light-Post**, RTD St Egreve, France). All of the patients had been referred to the first author’s private endodontic practice with at least 1 immature tooth with signs of pulpal necrosis and subsequent apical periodontitis that had been caused by a variety of traumatic dental injuries. Three teeth presented had dens invaginatus. Of 83 teeth, 69 teeth in 60 patients were available for follow-up after 5 to 15 years (recall rate = 83%). The mean follow-up time was 8.29 years. No teeth were lost because of a root fracture. Ninety-six percent (66/69) of the recalled teeth were characterized as healed. Based on periapical radiographs and clinical examination, 96% of teeth treated with the MTA barrier technique and adhesive restorations were characterized as ‘‘healed’’ and were in function after 5 to 15 years (mean = 8.29 years). These results indicate that this is a viable and predictable treatment approach for the long-term success of nonvital immature teeth. **PDF**

Scotti, R., Malferrari, S., Monaco, C**.. Clinical evaluation of quartz fiber posts: 30 months results.** *J Dent Res. 81 IADR Abstract #2657; 2002* *(www.dentalresearch.org)*

The usage of the aesthetic fibre posts is progressively growing for their promising clinical performances and their good aesthetic characteristics. **Objectives:** the aim of this 30 months in vivo study is to evaluate the clinical success-rate of 180 endodontically treated teeth, restored by the usage of “white” quartz fiber post and finalized with the metal-ceramic crowns and all–ceramic crowns. **Methods:** all the teeth were endodontically treated according to the recent techniques. In accordance with the international literature, to achieve clinical information, parameters were recorded in diagrams. Posts used were **Aestheti-Plus** (RDT, St. Egréve, France) in combination with All-Bond 2 adhesive resin (Bisco, Schaumburg, IL, USA) and C&B Resin Cement (Bisco, Schaumburg, IL, USA), the build up of the core was performed with the composite material Core-Flo (Bisco, Schaumburg, IL, USA), or Bis-Core (Bisco, Schaumburg, IL, USA). The post and core restorations were evaluated after 2 weeks, 1, 3, 6, 12, 20 (Malferrari et al., IADR abstr #11; Rome 2001) and 30 months, recording the surviving rate. **Results:** three failures were observed, one was a cohesive fracture that occurred after two weeks, involving a margin of the composite restoration and two were adhesive fractures, that occurred after a a couple of months, both located at the interface cement and dentinal walls of the canal. As all the failures occurred during removing the temporary it was possible to replace the restorations, that are still in place up to the present day. The 3 failures that occurred during this period do not show any relevance according to the statistical analysis with the Chi Square test (p=0.246). **Conclusions:** according to these results, and considering the limits of this study, the quartz posts, within a 30 months period of rehabilitation of endodontically treated teeth, clinically performed with success.

Scotti, N, Eruli, C, Comba, A, Paolino, DS, Alovisi, M, Pasqualini, D, Berutti, E. **Longevity of class 2 direct restorations in root-filled teeth: A retrospective clinical stud**y. *J Dent. 2015 May;43(5):499-505. doi: 10.1016/j.jdent.2015.02.006. Epub 2015 Feb 17.*

**Objectives:** To evaluate retrospectively the longevity of endodontically treated teeth restored with direct resin composite without cusp coverage, with or without the insertion of fibre posts. The null hypothesis was that direct restorations with fibre posts perform better than those without fibre posts. **Methods:** Patients recruited for this study were treated in the Department of Cariology and Operative Dentistry, University of Turin, between 2008 and 2011. In total, 247 patients with 376 root treated posterior teeth, restored with direct resin composite, were recalled for a control visit. Only second-class cavities were considered. Two groups were defined based on the absence (Group A) or presence (Group B) of fibre post (RTD, St Egreve, France). Failures and complications, such as periodontal failure, endodontic failure, tooth extraction, root fracture, post fracture, post debonding, replacement of restoration, crown displacement, and coronal-tooth fracture, were noted. Functional restoration quality was evaluated following the modified USPHS criteria. Data were evaluated statistically with ANOVA. **Results:** Group A consisted of 128 patients with 178 restorations (88 premolars, 90 molars) with a median follow-up of 34.44 months. Group B consisted of 119 patients with 198 teeth (92 premolars, 106 molars) with a median follow-up of 35.37 months. Direct restorations with fibre posts were statistically significantly more functional (95.12% success) than those without fibre posts (80% success) because of less marginal discolouration, better marginal integrity, and higher restoration integrity. **Conclusions:** The null hypothesis was accepted because direct post-endodontic restorations with fibre posts performed better than restorations without posts after 3 years of masticatory function. **Clinical significance:** An evaluation of the longevity of post endodontic direct restoration would seem to enhance the fiber post insertion within a composite restoration to reduce clinical failures. **PDF**

### VI. Post Removal

\*Anderson, G. Jorge Perdigao, J., Hodges, J., Bowles, W. **Efficiency and effectiveness of fiber post removal using 3 techniques.** *Quintessence Int 2007; 38:663–670*

**Objective:** To evaluate the speed (efficiency) and effectiveness of 3 different fiber post removal systems. **Methods:** Fiber posts (**D.T. Light-Post** Size no. 1 (RTD St Egreve, France /Bisco Dental) and ParaPost FiberLux no. 5 (Coltène/Whaledent) were cemented into 60 single-rooted teeth after endodontic therapy and post space preparation were completed. Three methods of fiber post removal were evaluated—D.T. Light-Post removal kit, the Kodex twist/Tenax ParaPost fiber post removal drill kit, and a combination of diamond bur/Peeso reamer. **Results:** The efficiency to remove either fiber post was not significantly different, nor was efficiency of any of the 3 post removal systems significantly different. For effectiveness, no difference was observed between post types, but effectiveness was higher with the diamond bur/Peeso reamer compared with the Kodex twist/Tenax ParaPost drills, which in turn was more effective than the D.T. Light-Post removal kit. **Conclusions:** Fiber posts are efficiently removed by all 3 methods, but effectiveness of removal is higher using the diamond bur/Peeso reamer.

\*Aydemir. S*,* Arukaslan. G, Sarıdağ. S, **Comparing fracture resistance and the time required for two different fiber post removal systems.** *J Prosthodont. 2017 Jan 9. doi: 10.1111/jopr.12575. [Epub ahead of print]*

**Purpose**: To compare two fiber post removal techniques in terms of fracture resistance and time required for post removal. **Methods:** Post space was prepared to a 9-mm depth in each root canal. The roots were randomly divided into three groups of 15 specimens each. **D.T. Light-Posts** (RDT, St. Egréve, France) were cemented in all groups. In group 1, fiber posts were removed using the D.T. Light-Post**-**removal kit; in group 2, Start-X stainless-steel ultrasonic tips were used. In group 3, fiber posts were left without removal (the control group). For all groups, fracture resistance (N) value was measured and recorded using a universal testing machine. Times required for fiber post removal were also recorded for the two study groups. **Results:** There was no significant difference between the control and removal kit groups for fracture resistance values (p = 0.233). The fracture resistance value of the ultrasonic group was found to be significantly lower than that of the control group (p = 0.001) as well as that of the removal kit group (p = 0.032). The fiber post removal time for the ultrasonic group was significantly longer than that for the removal kit group (p < 0.001). **Conclusion**: Compared to the removal kit, removal of the fiber posts with an ultrasonic tip decreases the fracture resistance of the roots, although significantly more time is required.

\*Baldissara, P., Valandro, L.F., Bettazonni, S., Scotti, R.  **Tissue loss during post removal; A new post concept evaluation.** *J Dent Res. Vol 89 (Spec. Iss. B) Abstract #772, 2010 (www.dentalresearch.org)*

**Objectives:** to evaluate the tissue loss and tooth damages during fiber post removal. Clear colored fiber post removal is a challenging task due to the low color contrast with restorative materials and dentin. **Methods:** 40 human single-rooted teeth were treated endodontically and randomly assigned to four fiber posts groups restored with: 1) Premier90 (Innotech); 2) **DT Light-Post** #2 (RTD / Dentsply); 3) Unicore#3 (Ultradent); 4)a special, soft-cored “S” glass fiber post Hi-Rem Prosthetic#3 (Overfibers). An impression of the canal was taken prior post cementation. The posts were luted with Panavia F system (Kuraray). The specimens were mounted in a dental training manikin to reproduce the clinical conditions. The posts were removed using a diamond bur/Gates and Largo combination by postgraduate students. Cement and post remains were removed using an ultrasonic tip (Suprasson P5 Newtron, Satelec, France). The teeth were examined radiographycally 2 times seeking for cement, fiber composite debris and tooth damage. After post and cement complete removal, another PVSS impression (Elite HD, Zhermack) of the canal was taken to evaluate the canal enlargement, which was recorded by laser scanning of the impressions and calculated using 3D reverse engineering software (OpenScan). Then, the specimens were externally and internally (after fracturing) observed under the stereomicroscope. **Results:** among groups 1 to 3, dental tissue losses were not significantly different (Kruskal-Wallis and Dunn, p>.05). These groups showed 3 root perforations each and canal stripping in 18 cases. The canal enlargement was significantly lower in group 4) Hi-Rem Prosthetic posts (p<.05); no perforations or canal stripping occurred in this group. **Conclusion:** removal of posts avoiding dental tissue loss is a difficult task when performed in simulated clinical conditions. A new fiber post type Hi-Rem “easy removal post” conceived for safe and fast removal proved to be highly effective in dental tissue preservation when compared to conventional posts.

de Rijk, W. G. **Removal of fiber posts from endodontically treated teeth.** *American Journal of Dentistry*. *13: 19B-21B, 2000*.  
   
**Abstract/conclusions:** The removal of posts from endodontically treated teeth can be a major obstacle in the retreatment of teeth that have recurrent pathology, often leading to extraction of a tooth that could have been saved with endodontic retreatment. The use of a fiber post offers the advantages of a suitable elastic modulus and good bonding between post and cement, but also the advantage of easy removal, if so indicated by clinical findings. A special removal kit for fiber posts has been developed, and its use is illustrated, and described. The removal procedure can be completed in a very short time, usually less than 5 min. The tooth can then be restored with the same type and size of fiber post as was in the tooth prior to removal. Removal kits are found to be for single use only. **PDF**

Cormier, C., Burns, D., Moon, P., **In vitro comparison of the fracture resistance and failure mode of fiber, ceramic, and conventional post systems at various stages of restoration**. *J Prosthodont 2001; 10:26-36*

**Abstract/ conclusions**: The fiber posts evaluated provided an advantage over a conventional post that showed a higher number of irretrievable post and unrestorable root fractures. At the stage of final restoration insertion, there was no difference in force to failure for all but the FiberKor material, which continued to be weaker than all other materials tested. The fiber posts were readily retrievable after failure, whereas the remaining post systems tested were non-retrievable. **PDF**

Gesi, A., Magnolfi, S., Goracci, C., Ferrari, M. **Comparison of two techniques for removing fiber posts.***JOE Vol. 29, No. 9, September, 2003*

**Abstract/ conclusions:** The purpose of this study was to evaluate the time needed to remove several types of fiber posts using two different bur kits. Estimates refer to the time needed to pass the fiber post until arriving at the gutta percha. Sixty extracted anterior teeth were treated endodontically. A post space with a standard depth of 10mm was prepared in each root canal. The sample was randomly divided into 3 groups of 20 specimens each. Three different types of posts were cemented: group 1, Conic 6% tapered fiber posts (Ghimas), group 2, FRC Postec posts (Ivoclar/Vivadent); and group 3, **Composipost** carbon fiber posts (RTD, St Egreve, France). To remove the posts, for half of each group’s the burs for the RTD fiber post removal kit was used (subgroup A). For the other half of the teeth in each group (subgroup B) were removed by using a diamond bur and a Largo bur. Composipost (group 3) took significantly less time to remove that the other two types of posts (p<0.05). For the bur kits, the procedure involving the use of a diamond and a Largo bur (subgroup B) was significantly faster (p<0.05). The interaction between the type of post and the type of bur kit was not significant (p>0.05). **PDF**

[Lindemann, M](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed&cmd=search&term=%25252522lindemann+m%25252522%2525255bauthor%2525255d), [Yaman, P](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed&cmd=search&term=%25252522yaman+p%25252522%2525255bauthor%2525255d), [Dennison JB](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed&cmd=search&term=%25252522dennison+jb%25252522%2525255bauthor%2525255d), [Herrero, AA](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed&cmd=search&term=%25252522herrero+aa%25252522%2525255bauthor%2525255d). **Comparison of the efficiency and effectiveness of various techniques for removal of fiber posts.** *J Endod. 2005 Jul;31(7):520-2*.

A study was conducted to determine the efficiency and effectiveness of several techniques for fiber post removal. Four groups of 20 mandibular premolars were endodontically treated and obturated. Post spaces were prepared for the following post systems: ParaPost XH, ParaPost Fiber White, Luscent Anchors, and **Aestheti-Plus** (RDT, St. Egréve, France). After cementation, 10 posts of each group were removed with their corresponding manufacturer's removal kit and the other 10 removed with diamond burs and ultrasonics. Removal times were recorded and the teeth were sectioned vertically and microscopically analyzed for removal effectiveness based on a 0 to 5 point scale. Removal kits removed Luscent Anchors the fastest (mean = 3.9 min) and most effectively (mean = 2.6), while Aestheti-Plus posts were removed the slowest (mean = 7.3 min) and least effectively (mean = 3.4). Diamonds and ultrasonics required an average of 10 additional minutes for each fiber post system removal, yet removal effectiveness improved half a point. The results suggest recommended removal kits were significantly more efficient, while diamonds and ultrasonics were more effective. Removal kits could be enhanced with subsequent ultrasonic instrumentation to remove remaining fibers and cement. **PDF**

Sakkal, S., **Carbon-fiber post removal technique.** *Compendium*. *17: S86-1996.*  
**Abstract/ conclusions:** In the event of endodontic failure, removal of a metal post is a time-consuming, challenging and expensive task. The Carbon fiber post (**Composipost** RDT, St. Egréve, France)) is the first post with a proven and safe method of retrieval that takes only a matter of minutes. Chair-time is reduced and there is less chance of harming sound tooth structure during the removal process, because the entire procedure is performed using slow speed. The removal technique is described in 6 steps. **PDF**

**VII. CUSTOMIZED LOW-MODULUS RESTORATIONS**

\*Alkumru, H., Akkayan, B, et al, **Fracture strength of teeth in oval-shaped root canals restored with posts and accessory post systems.** *Canadian Journal of Restorative Dentistry & Prosthodontics/— Vol. 6, No. 1 — Spring, 2013.*

In contemporary restorative dentistry, post-root canal adaptation always represents an important role in successful and long-lasting treatment for the restoration of endodontically treated teeth. In some cases posts have to be placed in wide oval-formed root canal spaces. However, the impact of the treatment outcome of the increasing non-uniform cement thickness around the posts has not yet reached a consensus. The purpose of this research is to assess the treatment outcome of post systems with three different post geometries, combined with/without accessory posts as an alternative technique in the oval-shaped canals. Seventy-two teeth with oval-shaped canals were selected for the study. Crowns were sectioned at the cemento-enamel junction and endodontically treated. The roots were randomly divided into 2 groups of 36 specimens and each group was split into 3 subgroups of 12 as follows; G1-A, Quartz fiber post with double tapered cross-section (QFibDT); G1-B, Quartz fiber post with circular cross-section (QFibCir); G1-C Quartz fiber post with oval cross-section (QFibOv); G2-A Quartz fiber post with double tapered cross-section + two accessory quartz fiber posts (QFibDTAcces); G2-B Quartz fiber post with circular cross-section + two accessory quartz fiber posts (QFibCirAcces); G2-C Quartz fiber post with oval cross-section + two accessory quartz fiber posts (QFibOvAcces). Root canal preparations were performed with low-speed Torpan Drill tips of ISO 90, ISO 100 and ISO 120 in increasing order. All posts were cemented with self-adhesive dual polymerizing resin cement. Two specimens from each group were randomly chosen upon the cementation of all posts and processed for stereomicroscope (SM) evaluation of the fiber post-cemented interface. All sixty specimens were then embedded in auto polymerizing acrylic resin surrounded by aluminum cylinders and light-polymerized composite cores were produced. Pressed all ceramic crowns were cemented on each core. Specimens were secured in a universal testing machine with the use of a device that allowed loading of the specimens lingually at 135 degrees to the long axis. A compressive force was applied at a crosshead speed of 1 mm/min until fracture occurred. The fracture loads (N) were determined and the obtained data were analyzed by 1-way ANOVA with interaction followed by Tukey HSD tests. Student’s t test was used for between group comparisons. Representative stereomicroscope images and cement thickness measurements were performed on 2 mm sectioned specimens. Within-group comparisons for Group 1 specimens demonstrated statistically higher fracture strength values for groups cemented with G1-A, **DT Light-Post** (590 N) and G1-B, Match Post (570,9 N) groups compared to G1-C, Ellipson Post group (400,83 N) (p<.001). The highest fracture resistance was recorded for G2-A (QFibDTAcces) at 764,18 N, followed by group G2-B (QFibCirAcces) at 726,5 N. Within-group comparisons of these two groups (G2-A, G2-B) resulted in statistically higher fracture resistance of teeth compared to G2-C (QFibOvAcces) at 574,96 N (p<.001). Regardless of the post system geometry tested in this study, Group 2 specimens resulted in statistically higher fracture strength values compared to Group 1 specimens according to between group comparisons (p<.001). No catastrophic failures were present and there were no root fractures. It can be speculated that when restoring with posts, especially in wide oval-shaped canals, the use of accessory posts reduces the cement thickness around the posts thus increasing the endodontically treated teeth resistance to fractures. **PDF**

\*Akkayan, B., Gaucher, H., Atalay, S., Alkumru, H. **Effect of post geometry on the resistance to fracture of endodontically treated teeth with oval-shaped root canals.** *Canadian journal of restorative dentistry and prosthodontics. Summer 2010 Pages 20-26.*

**Abstract:** Post-root canal adaptation represents an important role in the biomechanical performance of teeth and the post-core systems. Close canal adaptation with minimal tooth structure removal provides a conservative and long-lasting treatment for the restoration of endodontically treated teeth. In some cases the root configuration could anatomically be an oval form rather than a circular shape or the resulting preparation of the canal during endodontic treatment may produce an oval form. The purpose of this study is to evaluate the effect of different fibre reinforced post systems of different geometrical cross sections, oval and circular, on the fracture resistance of endodonticallytreated teeth with oval-shaped root canals. Methods: 40 maxillary intact human canines were selected for this study. The crowns of each root were sectioned at the cemento-enamel junction. The roots were divided into 4 groups of 10 teeth following endodontic treatment; Quartz fibre post with oval section (0FibOv) **Ellipson**, RDT, St. Egréve, France); (2) Flexible resin-impregnated glass fibre stick (GFibSti); (3) Small diameter quartz fibre post with circular section and accessory cone (0FibCirAcces); (4) Glass fibre post with circular section (GFibCir). Root canal preparations were performed with the special preparation drills provided in each system. All posts were cemented with self-adhesive dual polymerizing resin cement and light-polymerized composite cores were formed. Specimens were then embedded in auto polymerizing acrylic resin melds and secured in a universal testing machine with the use of a device that allowed loading of the specimens lingually at 135 degrees to the long axis. A compressive force was applied at a crosshead speed of 1 mm/min until fracture occurred. The fracture loads (N) were determined and the data were analyzed by 1-way ANOVA with interaction followed by Tukey HSD tests. Results: The mean failure loads (Newtons) and standard deviations (SDs) of the different post groups were calculated. The highest fracture resistance was recorded for group 3 teeth (0FibCirAcces) at 635.6 N; followed by group 1 (0FibOv); group 4 (GFibCir); and group 2 (GFibSti) at 488.4 N, 449.3 N, and 314.8 N respectively. Between-group differences in the fracture resistance of teeth were significant (p <.001) except for groups 1 and 4 (p >.o5). Teeth in all 4 experimental groups displayed favourable fractures. No catastrophic failures were present and there were no root fractures. All fractures displayed favourable, repairable modes. Conclusions: It can be speculated that cross-sectional similarity between the root canal configuration and the geometric form of the pre- fabricated post system is an effective variable on the fracture resistance of endodontically treated teeth. Using accessory posts to fill the post space and decrease the cement layer thickness may result in higher values. **PDF**

Ariki, E.K, , Gonçalves, M, Souza, ROA, Z , S.C.,Gia, PEL, Takahashi, F.E., Bottino, M.A, **Resin bond to root dentin: Accessory posts and dentin hybridization effect.** *J Dent Res. Vol 87 (Spec. Iss. A) Abstract 1748 (www.dentalresearch.org)*

**Objective**: To evaluate the influence of accessory fiber posts (AFP) and intra-radicular dentin hybridization (IDH) on the push-out bond strength of fiber post luted with resin cement to bovine root dentin. The null hypotheses were that the AFP using and IDH do not affect the push-out bond strength. **Methods:** The canals of forty single-root bovine roots (16mm in length) were prepared at 12mm using the preparation drill (N0 3, RTD, France). With an assistance of a modifier parallelometer, each root had your apical region (4 mm length) embedded in acrylic resin and the roots were randomly divided into four groups, according the luting procedures (N=10): Gr1- IDH + fiber post n0 3; Gr2- IDH + fiber post n0 1; Gr3- IDH + fiber post n0 1 + AFP; Gr4- Fiber post n0 3 without IDH. Except for the group Gr4, the specimens (sps) were treated with the adhesive system (All Bond 2) and the fiber posts (Macro- Lock Illusion) were luted (Duo-Link) and after stored in distilled water prior the mechanical test (24 h, 37°C). Each specimen was cut in 4 disc samples (1.8 mm in thickness), which were submitted to the push-out test on a universal test machine (EMIC, model DL-1000) at a speed of 1mm/min. The data (MPa) were analyzed statistically by one-way analysis of variance (ANOVA). **Results:** The means (± standard deviation) values obtained after push out test were: Gr1- 5.4±1.3 MPa; Gr2- 4.2±2.4 MPa; Gr3- 4.6±1.5 MPa; Gr4- 3.3±1.7 MPa. The statistical analysis didn't observe influence among the groups (p=0.0966> 0.05). The null hypotheses were accepted. **Conclusion:** The AFP and the IDH do not improve nor diminish the bond strength of fiber post luted to bovine root dentin.

Balasubramanian, S., Schulze, K., Roetzer, P., Pipalia, M., Bhattacharyya, M. **Push-out-bond-strength of fiber posts and failure analysis**. *J Dent Res. Vol 96 (Spec. Iss. A) Abstract #2614, 2017(www.dentalresearch.org)*

**Objectives**: To investigate push-out-bond-strength of fiber posts cemented in root canals in conjunction with either dental cement or dental cement- Fibercones or dental cement-unidirectional fibers. The goal was to find out if additional material in the root canal replacing the cement affects push-out bond-strength. **Methods**: 18 extracted human central incisors were used by cutting off crowns. Root canals have been performed using rotary instruments (Wave One Gold,Dentsply) up to size Large(040.08and25mm). The canals have been filled with gutta percha points and sealed (Ribbond, ThermaSeal Plus,Dentsply). Unicore post drills(size-yellow) were used for 12mm into the canal. The canal was flared out from a bottom diameter of 1.15mm to a top diameter of 3.2mm using a prefabricated master pattern. The 18 roots were divided into 3 groups: 1.one fiber post cemented (Unicore, Ultradent,size-yellow) with the Prelude adhesive system(Danville) using Rockcore cement A2 in the auto-cure mode (BASELINE). 2.same size fiber post in the center and 3 additional **Fibercone** (RTD, St Egreve, France) inserted around (CONES). 3.same post size and additional unidirectional fibers (**Quartz Splint** UD, RTD, France) for 5mm into the canal (FIBERS). The roots have been stored for 24h at 100% humidity and 37°C before sectioning into 1 mm slices to obtain a coronal, middle and apical slice. All slices have been subjected to a push-out-bond-strength-test at a universal-testing-machine INSTRON-1011 at a crosshead speed of 1mm/min. Regression analysis using R-Software was used at a 95% confidence interval. **Results**: A statistical significant difference was found among the groups(p=0.0173) and among the position(p=0.0024). The FIBERS group replaced the most cement and reduced shrinkage from dentinal walls and from the post surface. While BASELINE and CONES group showed more adhesive failures between dentin/cement, the FIBERS group showed adhesive failure between post/cement. **Conclusions**: This study concludes that more replacement of the cement in the root canal with solid filling materials can help increase the bond strength and reduces stress at the dentin-cement interface.

\*\*Baldissara, P.,, V., Valandro, L.F. Arena, A., Scotti, R. **Non-axial Loading of crowns supported by new fiber post systems.** *J Dent Res. Vol 89 (Spec. Iss. B) Abstract #2195, 2010 (www.dentalresearch.org)*

**Objectives:** to evaluate the behavior of non-circular fiber post and accessory posts in supporting non-axially loaded cast metal crowns. Concerns remains about fiber posts used under crowns connected to RPDs using frictional attachments: the hypothesis tested is that an increase in the emerging section of fiber posts doesn't affect the restoration survival rate**. Methods:** 4 groups: 1)non-circular fiber post concept **Ellipson**; 2) Fibercone secondary post system (two posts) coupled with one **DT Light-Post Illusion** #0.5; 3) conventional DT Light-Post Illusion #1; and 4) **Macro-Lock Illusion** #1, all from RTD, France. 48 single rooted, crownless human teeth were selected and endodontically treated. The canal shape was standardized using the Ellipson ultrasonic diamond tip (Suprasson P5 Newtron, Satelec, France) to obtain a non-circular section, then the teeth were randomly distributed to the 4 groups. Panavia F and Photocore (Kuraray) were used as luting and core materials, respectively. Core was made using transparent shells. The specimens were prepared with chamfer margins and 1.5mm ferrule height. Cast metal crowns with 5mm off-set extensions were made using CrCo alloy (Vivi) and luted with Fuji Plus (GC). The crowns were subjected to 3.2 million cycles ranging from 100N to 150N under water irrigation. Kaplan-Meyer survival analysis was performed to compare the groups (α=.05). **Results:** the Fibercone accessory post group showed the highest survival rate (0.667), followed by Ellipson (0.583) and Macro-Lock (0.500) groups. Conventional DT post showed the lowest survival rate (0.333). The difference among the groups was not statistically significant (p=0.068). **Conclusion:** Since non-axial loading generates torsion forces, non-circular post design could better resist this type of stress. Although the number of the specimens is too low to reject the null hypothesis, the survival data suggest that complete crowns restored with accessory and non-circular fiber posts have a higher survival rate in comparison to conventional posts.

\*\*Boksman, L, Hepburn, AB, Kogan, E, Friedman, M, de Rijk, W**. Fiber post techniques for anatomical root variations.** Dent Today. 2011 May;30(5):104, 106-11.

In contemporary dental practice, there is no remaining reason to use metallic posts, custom or prefabricated. Many cases that several years ago would have required a retentive post will not require that post today, because of the many improvements in bonding agents and composite resin restoratives. However, in cases where less than 50% of coronal tooth structure remains--or in other cases wherein the judgment of the clinician a post is indicated--there are now aesthetic, non-corrosive, fracture resistant and radiopaque alternatives for all varieties that save time and money without compromise. Their most compelling advantage, regardless of the geometry or amount of residual tooth structure, is the protection from root fracture that a low modulus restoration provides. In selecting the materials (posts, resins) for these techniques, the dentist is advised not to cut corners, and to seek the strongest and most radiopaque products available. **PDF**

\*Erkut , S., Gulsahi, K., Caglar, A., Imirzalioglu, P., Karbhari, VM, Ozmen, I. **Microleakage in overflared root canals restored with different fiber reinforced dowels*.*** *Operative Dentistry, 2008, 33-1, 96-105*

Based on the in vitro results of this study, restoration of a tooth with an overflared root canal, using individually shaped polyethylene reinforced dowels, may help to reduce microleakage. This study evaluated microleakage in overflared root canals restored with four different types of adhesively-luted fiber-reinforced dowels: **DT Light-Post** (RTD, St. Egréve, France) (LP), Glassix (GL), Ribbond (RB) and StickTech Post (ST). Forty non-carious, single- rooted mandibular human premolars with straight root canals were prepared using a step- back technique and obturated with gutta-percha using lateral condensation. The restored roots were randomly divided into four groups (n=10). The root canals were over-prepared, creating an over-flared dowel space, and each dowel was adhesively luted using a total-etched adhesive (Single Bond) and dual-polymerizing luting agent (RelyX ARC). All specimens were thermal cycled 1000 times between 5°C and 55°C and stored in 2% methylene-blue solution for one week. The teeth were cut horizontally into three consecutive sections: apical (A), middle (M) and coronal (C). Each section was digitally photographed from the occlusal direction under a stereomicroscope. The images were transferred to a PC and stored in TIFF format. For each image, dye penetration was estimated as the ratio of methylene-blue–infiltrated surface divid- ed by total dentin surfaces. The data were com- pared and statistically analyzed using the Kruskal-Wallis test (p<.05). The Mann-Whitney U test was used to compute multiple pairwise comparisons to determine differences between the experimental groups (p=.083). Dentin-luting agent fiber-reinforced dowel (FRD) interfaces were evaluated under a scanning electron micro- scope. Scanning electron microscopy (SEM) showed detachment of the luting resin from the dentin surface in varying degrees in all specimens evaluated. All groups showed considerable leakage at the sections evaluated. Significant differences were demonstrated between LP-RB for the apical and middle sections and between GL- RB, LP-RB and ST-RB for the coronal sections (p<.0083). Among the FRDs evaluated, the individually shaped polyethylene-reinforced dowel (Ribbond) showed the least overall leakage.

\*Fathi, M., Mortazavi, V., Katiraie, N**., Fracture resistance of endodontically treated teeth restored with esthetic posts**. *J Dent Res. Vol 87 (Spec. Iss. A) Abstract #1857 (www.dentalresearch.org)*

**Objectives**: This study compared the effect of three esthetic post systems with different modulus of elasticity on the fracture resistance and fracture patterns of endodontically treated teeth with structurally compromised and normal roots. **Methods:** Forty five extracted and root canal treated central incisors were assigned to 2 main experimental groups called "narrow" and "flared" canals. Narrow-canal group divided into 2 and flared-canal group, divided into 3 experimental subgroups (n=9). For narrow-canal subgroups, post spaces were prepared with the corresponding drills to restore with quartz fiber double taper light posts (**D.T. Light-Post**; RTD, St. Egréve, France)) [subgroup A] and zirconia posts (CosmoPost;Ivoclar) [subgroup B]. For the flared-canal subgroups, thin–walled canals were simulated, and restored with quartz fiber double taper light posts[subgroup C], quartz fiber double taper light posts inserted within the polyethylene woven fibers (Ribbond;Ribbond,Inc) [subgroup D] and zirconia posts[subgroup E]. All posts were cemented with dual–polymerizing adhesive resin cement (Panavia F; Kuraray). After restoration of access cavity with composite and thermocycling, compressive load was applied to the palatal surface of tooth until fracture. Mean failure load values were analyzed using One-way ANOVA and Tukey test (P<0.05). Mode of failure was evaluated with Fisher exact test (P<0.05). **Results:** The mean failure loads ± SD were 678.55±90.86, 603.44±68.66, 638.22±93.71, 732.44±81.78, and 573.66±91.340 N for subgroups A to E, respectively. Subgroup D exhibited significantly higher resistance to fracture compared to subgroups B, C and E (P<0.05). Subgroup E showed significantly less fracture resistance compared to subgroups A and D (P<0.05). Subgroups B and E showed more root fracture compared to subgroups A, C, and D (P=0,004). **Conclusion:** Significantly higher fracture resistance was observed in flared root canal treated teeth restored with quartz fiber double taper light posts + polyethylene woven fibers. Zirconia posts showed lower fracture resistance and significantly more root fracture compared to fiber posts.

\*Geramipanah, F, Rezaei ,SM, Sichani, SF, Sichani, BF, Sadighpour, L. **Microleakage of different post systems and a custom adapted fiber post**. *J Dent (Tehran). 2013 Jan;10(1):94-102. Epub 2013 Jan 31.*

**Objective:** The effects of closely adapting a prefabricated fiber to the post space remain unknown. The purpose of this study was to quantify the microleakages of a custom adapted fiber-reinforced post, a prefabricated quartz fiber post and a cast post using nondestructive methods. **Methods:** Sixty-five extracted human premolars were endodontically treated and randomly divided into three groups (n=15), which were restored using a cast post-and-core, a custom adapted fiber post (Refropost) with a micro-hybrid microfiller resin composite (Gradia), or a prefabricated quartz fiber post (**DT Light-Post** (RTD, St Egreve, France) and two groups of control (n=10). All groups were cemented using a dual polymerizing resin cement (Panavia F2.0). A composite core (Z100) was used for the fiber posts. The microleakage was calculated for the experimental and control groups before and after thermal cycling and cycling loading using a radiotracer solution (thallium 201 chloride) and a gamma counter device. Data were subjected to statistical analysis of ANOVA and Tukey HSD at significant level of P< 0.05. **Results:** Significantly lower microleakage values were found for the cast post-and-core (mean value =16.04 ×10(4)) and custom adapted fiber post groups (mean value=14.36×10(4)). Thermal cycling and cyclic loading had no significant effect on the microleakage value of any tested group. **Conclusion**: Post systems with improved adaptation showed similar microleakage to casting posts. **PDF**

\*Grandini, S, Goracci, C, Monticelli, F, Borracchini, A, Ferrar,i M. **SEM evaluation of the cement layer thickness after luting two different posts.** *J Adhes Dent. 2005 Autumn;7(3):235-40.*

**Purpose:** To verify with SEM the cement layer thickness and uniformity of resin-relined translucent fiber posts (anatomic posts) and standard translucent fiber posts. **Methods:** On 20 extracted maxillary anterior teeth, the roots were endodontically treated and prepared for the insertion of a fiber post. Translucent fiber posts (**DT Light-Post** (RTD, St Egreve, France) were luted with a dual-curing resin cement (Duo-Link) in 10 specimens (group 1) after the canal walls had been treated with the One-Step bonding system. In the other 10 specimens (group 2), experimental anatomic posts (Anatomic Post'n Core, RTD St Egreve, France) were tested. To these posts, a layer of light-curing resin is added to allow for a pre-cementation relining of the post, aimed at improving its fit into the endodontic space. For luting, the same adhesive-resin cement combination of group 1 was used. All the roots were sectioned and prepared for SEM observations. At the 1-mm, 4.5-mm, and 8-mm level of each root, cement thickness was measured, and the presence of gaps or voids within the luting material or at its interfaces was evaluated. A statistical analysis was performed to test the significance of differences in the cement layer thickness around the two types of post and at different levels of the same type of post. **Results:** In the presence of anatomic posts, the cement layer was significantly thinner and more uniform at the coronal and middle level of the root. In both groups, voids and bubbles were detected within the luting material, within the abutment material, and between fiber post and cement. Gaps were also visible between post and relining material. **Conclusions:** The resin cement thickness was significantly lower in the anatomic post group than in the control group (standardized posts), except at the apical third of the canal, where there was no statistically significant difference. A good adaptation of anatomic posts was evident in all of the specimens.  **PDF**

\*Kececi , A.D., Ureyen Kaya, B, Adanir, N. **Micro push-out bond strengths of four fiber-reinforced composite post system and 2 luting materials**. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2008 Jan;105(1):121-8*

**Objectives:** The aim of this study was to compare the bond strengths of 2 types of dual-cured luting agents used for cementation of 4 different fiber-reinforced composite (FRC) posts by using a push-out test and to evaluate the failure modes of these systems. **Methods:** Eighty human maxillary central incisors were divided into 8 groups (n = 10), decoronated, and roots filled and restored with one of the following post systems: groups 1 to 4: translucent quartz FRC posts (**DT Light-Post** (RTD, St Egreve, France); groups 5 and 6: opaque glass FRC post; and groups 7 and 8: individually formed electrical glass fiber post. Cementation was performed with 2 types of dual-polymerizing resin luting agents: Variolink II (groups 1, 3, 5, and 7) and a new self-adhesive resin cement, RelyX Unicem (groups 2, 4, 6, and 8). Slices with a thickness of 1.00 +/- 0.05 mm were prepared from the coronal third of each root by using a low-speed saw. Push-out tests were performed at a crosshead speed of 1 mm/min by using a universal testing machine, and the data was statistically analyzed (analysis of variance [ANOVA] and Duncan tests; P < .05). Fracture modes were evaluated at original magnification x40. **Results:** Micro push-out bond strengths were significantly affected by the type of luting agent and the type of post (P < .05, 2-way ANOVA). A significant difference was found among the groups (1-way ANOVA, P < .05). Fiber-reinforced composite posts luted with Variolink II showed higher bond strengths, and the groups ordered as 5, 1, 3, 7, 6, 2, 4, and 8, with the values (MPa, mean +/- SD): 13.80 +/- 5.00, 13.77 +/- 3.78, 12.20 +/- 4.79, 9.39 +/- 2.48, 9.21 +/- 7.76, 7.25 +/- 1.56, 3.89 +/- 4.41, and 3.77 +/- 1.20, respectively. Adhesive failures between dentin and cement were observed more than cohesive failures in cement or post. **Conclusions:** Push-out bond strengths can be affected by luting agent and post type. Variolink II and fiber post combinations resulted in high bond strength values.**PDF**

\*\*Li Q, Xu B, Wang Y, Cai Y. **Effects of auxiliary fiber posts on endodontically treated teeth with flared canals.** *Oper Dent. 2011 Jul-Aug;36(4):380-9. Epub 2011 Aug 11.*

This study investigated the fracture resistance and retention of endodontically treated roots with over-flared canals restored with different post systems, including one cast metal post and four fiber posts with/without auxiliary fiber posts. One hundred endodontically treated incisor roots were experimentally flared using a tapered diamond bur. The roots were restored using one of the five post systems: Ni-Cr cast metal post (CM), **D.T. Light-Post** quartz glass fiber post (RTD, St Egreve, France) (DT), Macro-Lock glass fiber post (ML), ML+2 Fibercone auxiliary fiber posts (2FC), and ML+5 Fibercone auxiliary fiber posts (5FC). After fabrication of the crowns, half of the specimens (n=50) were subjected to a fracture failure test-loading with an incremental static force at an angle of 45 degrees to the long axis of the root. The other 50 samples underwent a pull-out test. Fracture failure strength and pull-out strength were measured and analyzed using one-way analysis of variance (ANOVA) followed by Tukey's post hoc test (α=0.05). After the tests were completed, all specimens displayed oblique root fractures or cracks, initiating from the palatal cervical margin and propagating in a labial-apical direction. The order of the fracture failure strength was as follows: 5FC=CM=2FC>ML>DT. Cast metal posts demonstrated the highest pull-out strength (p<0.05). No significant differences in pull-out strength were found in the ML, 2FC, and 5FC groups. **Conclusion:** Within the limitations of this study, it was concluded that the application of an auxiliary fiber post could significantly increase the fracture resistance of over-flared roots; however, no beneficial effects in enhancing retention were observed. **PDF**

Maceri, F, Martignoni, M, Vairo, G. **Mechanical behaviour of endodontic restorations with multiple prefabricated posts: a finite-element approach.** *J Biomech. 2007;40(11):2386-98. Epub 2007 Jan 24*

This paper investigates some mechanical aspects of a new endodontic restoration technique, based on the idea that the root cavity can be more efficiently filled if multiple prefabricated composite posts (PCP) are employed. Multi-post technique increases bearing capacity and durability of endodontically treated teeth, as shown by numerical simulations performed through three-dimensional elastic finite-element static analyses of a lower premolar, constrained by a non-linearly elastic spring system representing the periodontal ligament, under several parafunctional loads. The influence of PCPs' number, material and dimensions is investigated by comparison of the resulting stress fields with those obtained in cases of traditional restorations (cast metal post and cemented single-PCP) and natural tooth, highlighting the advantages of the proposed technique when standard restorative materials are considered. A risk-analysis of root-fracture and interface-failure shows that cast gold-alloy post produces high stress concentrations at post-dentin interface, whereas multi-post solution leads to a behaviour closer to the natural tooth's, exhibiting some advantages with respect to single-PCP restorations. As a matter of fact, whenever PCPs' overall cross-section area increases, multi-post solution induces a significant reduction of stress levels into the residual dentin (and therefore the root-fracture-risk decreases) as well as of the expected polymerization shrinkage effects. Moreover, interfacial stress values in multi-post restorations can be higher than the single-PCP ones when carbon-fibre posts are considered. Nevertheless, the interfacial adhesive/cohesive failure-risk is certainly acceptable if glass-fibre posts are employed. **PDF**

\*Porciani, P., Vano, M., Radovic, I, Goracci, C., Garcia-Godoy, F., Ferarri, M. **Fracture resistance of fiber posts: Combinations of several small posts vs standardized single post.** *Am J Dent 2008; 21: 373-376*

**Purpose:** To determine the fracture resistance of different sizes of standardized single fiber posts and the combinations of multiple small experimental posts. **Methods:** Single posts in 3 different sizes (1, 2 and 3 **DT Light-Post**; RTD St Egreve, France) as control, and seven combinations of experimental small posts, reproducing the the sizes of several endodontic files were cemented in endodontic resin blocks. The combination of small posts were made combining 2-4 small posts so as to reach the the sizes of the standardized DT Light-Posts. The posts were loaded at an angle of 45degrees to the long axis of the block using a crosshead speed of 1 mm/min. until specimen failure. Ten posts/combinations were tested using one – way ANOVA., followed by Tamhane test for the *post hoc* comparison (p<0.05). **Results:** For the single posts, fracture resistance increased when increasing the diameter of the post. The use of multiple posts resulted in fracture resistance comparable to that of the single post in 2 of the 3 post diameters studied (DT1 and DT2). For the largest diameter studied (DT3), the use of multiple posts resulted in lower fracture resistances than did the single (DT3) post. **PDF**

\*Sharafeddin, F, Alavi, AA, Zare, S **Fracture resistance of structurally compromised premolar roots restored with single and accessory glass or quartz fiber posts.** *Dent Res J (Isfahan). 2014 Mar;11(2):264-71.*

**Background:** Glass and quartz fiber posts are used in restoration of structurally compromised roots. Accessory fiber posts are recently introduced to enhance the fiber post adaptation. This study evaluated the effectiveness of glass versus quartz accessory fiber posts. **Methods:** In this experimental study, 40 mandibular premolar roots with similar dimension (radius of 3.5 ± 0.2 mm and length of 13 ± 0.5 mm) were selected and their root canals were flared until 1.5 mm of dentin wall remained. They were randomly assigned to four groups (n = 10) and restored as follows: Exacto glass fiber post (EX), Exacto glass fiber post + 2 Reforpin accessories (EXR), **D. T. Light-Post** (RTD, St Egreve, France) quartz fiber post (DT), and D. T. Light-Post quartz fiber post + 2 **Fibercone** (RTD, St Egreve, France) accessories (DTF). All posts were cemented with Duo-Link resin cement and the cores were built with the particulate filler composite. Following 1-week water storage, specimens were subjected to fracture loads in a universal testing machine. The maximum loads and failure modes were recorded and analyzed with the two-way analysis of variance (ANOVA) and Fisher's exact tests (α = 0.05). **Results:** The mean fracture resistance values (N) were 402.8 (EX), 378.4 (EXR), 400.1 (DT), and 348.5 (DTF). Two-way ANOVA test showed neither reinforcing method (P = 0.094), nor post composition (P = 0.462) had statistically significant differences on fracture resistance of the structurally compromised premolar teeth. Fisher's exact test also demonstrated no statistically significant difference regarding two variables (P = 0.695). Core fracture was the most common failure mode (62.5%). **Conclusion:** Glass and quartz fiber posts with or without accessories restored the weakened premolar roots equally. **PDF**

1. **MISCELLANEOUS / OVERVIEW / REVIEW ARTICLES**

Boksman, L., Pameijer, C., Broome, J. **The clinical significance of mechanical properties in retentive posts.** *Compendium, June 2013, Vol35, No. 6 446-455*

When selecting dental materials for use in the permanent restoration of severely broken down teeth, clinicians must choose a material with the optimal mechanical and physical properties for that particular application, with esthetics as a secondary consideration. As the trend in dentistry shifts towards fiber-reinforced composite endodontic posts and away from metal posts, this article reviews how fiber posts differ from their metal predecessors and how they vary intrinsically from one design and composition to another. Additionally, the article examines how fiber posts actually function and interact with the tooth

Boksman, L., Glassman, G., Coelho-Santos, G., Friedman, M., **Fiber posts and tooth reinforcement; Evidence in the literature**. *Oral Health, May 2013, 32-47*

In addition to the traditional definition of mechanical reinforcement: restoring a compromised tooth to a fracture strength equal to or greater than its original “untreated” fracture resistance, we clinicians perhaps should be more focused on the predictability of outcomes, particularly in worst-case scenarios. That is the contribution of the post versus no post, or composite only, to the remaining structures. The most predominant conclusion emerging from the growing body of in vitro (and clinical) data is that failures of fiber posts in situ are more likely to be described as “non-catastrophic” or “repairable” which is usually not the case with high modulus posts.

\*Brown, P., Hicks, N., **Rehabilitation of endodontically treated teeth using the radiopaque fiber post.** *Compendium Vol. 24, No. 4, April, 2003, 275-282*

Metallic posts fall short of satisfying contemporary guidelines for ideal post / core rehabilitation. Along with technological advancements in adhesive resin cements and composite restoratives, the evolution of fiber-reinforced posts allows the rehabilitation of endodontically treated teeth with greater esthetics anv virtually no predisposition to root fracture. At least one fiber post system now complies with all of the ideal post characteristics described in the endodontic text. This article describes the potential for displacement of metal posts by low-modulus fiber posts, the differences between them and the development and clinical placement of a radiopaque, translucent, double-tapered fiber post. **PDF**

\*De Rijk, W., Pecora, N. **Effects of cutting methods on fiber posts, SEM evaluation**. *J Dent Res. Vol 86 (Spec. Iss. A) Abstract #2700, 2007 (www.dentalresearch.org)*

**Objectives:** Prefabricated fiber posts, used in the restoration of endodontically treated teeth, routinely require a reduction in length, to accommodate the individual patient. This study evaluated the effect of trimming fiber posts with either a diamond bur or a diamond disk. **Methods:** Five different post systems: 1) CF Carbon fiber post (J. Morita USA Inc), 2) **DT Light-Post** (RTD St Egreve France.), 3) FRC Postec (Ivoclar Vivadent) Parapost FW (Coltene Whaledent), 5)Twin Lucent (Dentatus USA), were trimmed with either a diamond bur (8862) or a diamond disk (911HF, Brasseler USA). Two different core systems were used CompCore AF (Premier) and Light Core (Bisco Inc). The posts were cut, once through the core material and once at 3mm above the apical end. The cut surfaces were then evaluated by SEM. The surfaces showed various degrees of resin loss between the fibers. Two investigators estimated the total surface area with resin loss. **Results:** The observed surface area (in %) with resin loss is listed. No differences were observed between the two core materials, hence all core data have been combined. **Conclusions:** From these data we conclude that: 1) the use of a diamond disk produces less resin loss from the fiber post, when compared to a diamond bur, and 2) that for those fiber posts, for which by design the coronal part of the post is to be trimmed, the post should be trimmed after the post and the core material have been placed. The materials for this study have been provided by the various manufacturers, and their support is hereby acknowledged.

Dietschi, D, Duc, O, Krejci, I, [Sadan, A](http://www.ncbi.nlm.nih.gov/sites/entrez?db=pubmed&cmd=search&term=%25252522sadan%25252520a%25252522%2525255bauthor%2525255d&itool=entrezsystem2.pentrez.pubmed.pubmed_resultspanel.pubmed_discoverypanel.pubmed_rvabstractplus). **Biomechanical considerations for the restoration of endodontically treated teeth: a systematic review of the literature, Part II (Evaluation of fatigue behavior, interfaces, and in vivo studies.** *Quintessence Int. 2008 Feb;39(2):117-29*

**Objective:** The restoration of endodontically treated teeth has long been guided by empirical rather than biomechanical concepts. Part I of this literature review presented up-to-date knowledge about changes in tissue structure and properties following endodontic therapy, as well as the behavior of restored teeth in monotonic mechanical tests or finite element analysis. The aim of the second part is to review current knowledge about the various interfaces of restored, nonvital teeth and their behavior in fatigue and clinical studies. **Review method:** The basic search process included a systematic review of articles contained in the PubMed/Medline database, dating between 1990 and 2005, using single or combined key words to obtain the most comprehensive list of references; a perusal of the references of the references completed the review. **Conclusions:** Nonvital teeth restored with composite resin or composite resin combined with fiber posts resisted fatigue tests and currently represent the best treatment option. In comparison to rigid metal and/or ceramic posts, when composite resin or composite resin/fiber posts fail, the occurrence of interfacial defects or severe tooth breakdown is less likely. Adhesion into the root, however, remains a challenge because of the unfavorable ovoid canal configuration, as well as critical dentin microstructure in the deepest parts of the canal. Thus, specific combinations of adhesives and cements are recommended. The clinical performance of post-and-core restorations proved satisfactory overall, in particular with a contemporary restorative approach using composite resin and fiber posts. However, the clinical literature does not clearly isolate or identify exact parameters critical to success. This, in turn, emphasizes the importance and relevance of in vitro studies to further improve the quality and long-term stability of prosthetic foundations. **PDF**

Glazer, B. **Endodontic post evolution: from metal to quartz** *Oral Health, May, 2002 43-45*

Abstract/conclusions: The Light-Post is a 15-year evolution of post research at RTD. Its genesis began with the carbon fiber **Composipost/** C-POST, transformed into the **Aestheti-Plus**, made of white quartz fiber, and finishing with the **Light-Post**, made of translucent quartz fiber. This transition from Carbon to Quartz was completed without any compromise in strength, modulus of elasticity, resistance to fatigue or the ability for re-treatment. The Light-Post offers clinicians significant aesthetic and clinical advantages due to its translucency. **PDF**

\*Pitel, M. L., Hicks, N. L. **Evolving technology in endodontic posts**. *Compendium 24 13-29, 2003*

**Abstract/conclusions**: This article provides a brief overview of important, recent changes in the philosophy, materials and technology that have impacted significantly on the art and science of endodontic post placement. The growing interest in esthetic dental restorations and adhesion dentistry has driven both manufacturers and dentists to create some innovative new post materials and techniques for restoring the endodontically treated tooth. Although metal posts were used extensively for many years, their popularity is currently in the decline. With more than 10 years of proven clinical success, there is now widespread interest in the use of non-metallic post materials and techniques. Over the last decade, in vitro and in vivo testing has demonstrated that some fiber-reinforced endodontic posts can dramatically reduce the incidence of root fracture, tissue discoloration and allergic reaction. If endodontic re-treatment is necessary, most fiber posts can be removed from a root canal with ease and predictability when necessary without compromising their only true function; core retention. Today's marketplace offers the dentist many choices in size, radiopacity and designs to fit the needs of the specific tooth and clinical application. The use of a highly translucent post not only can serve to enhance esthetics in the final restoration, but can also be useful as an instrument in the light-curing process. **PDF**

de Melo, RM, Chaves, C, Galhano, GA, Bottino, MA, Balducci, I. **The adhesive system and root canal region do not influence the degree of conversion of dual resin cement.** *J Appl Oral Sci. 2010 Sep-Oct;18(5):477-81*

**Objectives:** The aim of this study was to evaluate the influence of two adhesive systems and the post space region on the degree of conversion of dual resin cement and its bond strength to root dentin. **Methods:** One three-step etch-and-rinse (All-bond 2, Bisco Dental, Schaumburg Il, USA) and another one-step self-etch (Xeno III, Dentsply) adhesive systems were applied on 20 (n=10) crownless bovine incisors, at 12-mm-deep post space preparation, and a fiber post (**DT Light-Post**, RTD, St Egreve France / Bisco) was cemented using a dual cure resin cement (Duo-Link, Bisco). Three transverse sections (3 mm) were obtained, being one from each study region (cervical, middle and apical). The degree of conversion of the dual cure resin cement was determined by a micro-Raman spectrometer. The data (%) were submitted to repeated-measures analysis of variance and Tukey's test (p<0.05). **Results:** For both groups, the degree of conversion means (%) (All bond 2cervical = 69.3; All bond 2middle = 55.1; All bond 2apical= 56; Xeno IIIcervical = 68.7; Xeno IIImiddle = 68.8; Xeno IIIapical = 54.3) were not significantly different along the post space regions (p<0.05). **Conclusion:** Neither the adhesive nor the post space region influenced the degree of conversion of the cement layer.

Ree, M., Schwartz, R. **The Endo-restorative interface; Current concepts**, *Dent Clin N Am 54 (2010) 345–374*  
*doi:10.1016/j.cden.2009.12.005*

The primary goals of endodontic treatment are straightforward: to debride and disin- fect the root canal space to the greatest possible extent, and then seal the canals as effectively as possible. The materials and techniques change somewhat over time, but not the ultimate goals. The primary goals of restorative treatment are to restore teeth to function and comfort and in some cases, aesthetics. Once again, the materials and techniques change, but not the ultimate goals of treatment. Successful endodontic treatment depends on the restorative treatment that follows. The connection between endodontic treatment and restorative dentistry is well accepted, but the best restor- ative approaches for endodontically treated teeth have always been somewhat controversial. The topic is no less controversial today, despite the massive (and ever growing) amount of information available from research, journal articles, courses, ‘‘expert’’ opinions, and various sources from the Internet. In fact, information overload contributes to the controversy because so much of it is contradictory. With the emergence of implants into the mainstream of dentistry, there has been more emphasis on long-term outcomes and on evaluating the ‘‘restorability’’ of teeth prior to endodontic treatment. Patients are not well served if the endodontic treatment is successful but the tooth fails. The long-term viability of endodontically treated teeth is no longer a ‘‘given’’ in the implant era. In consequence, some teeth that might have received endodontic treatment in the past are now extracted and replaced with implant-supported prostheses if they are marginally restorable or it makes more sense in the overall treatment plan. It is not possible to review in one article all the literature on the restoration of endodontically treated teeth. This article therefore focuses primarily on current concepts.

\*Vichi, A., Schiavetti, R., Pacifici, E., Giovanetti, A. Goracci, C., Ferrari, M. **Masking of temperature-induced color changes in a Thermo-sensitive fiber post.** *Am J Dent 2012;25:123-128.*

**Purposes:** To evaluate (1) the efficiency of the color changing technology featured by the **DT Light-Post** Illusion (RTD, St Egreve, France) aimed at safely identifying the post in case of retreatment and,(2) the efficacy of a resin composite layer to mask the post if color shift occurs due to cold food and beverages. **Methods:** Five “master disks) of 3 mm of thickness were prepared by embedding in a resin composite for thermo-sensitive posts and one translucent post ( control) cut in bars. Discs of resin composite in 0.5/1.0/1.5 mm thickness were prepared as well. Digital images were taken of the master discs with and without the overlying of the resin composite discs, at 5° C and at 35° C temperature. By the use of Adobe Photoshop “ layering function” and ” multi-layer option”, differences in color were calculated between the post-free and the post-containing areas. **Results:** The differences between the resin color and the post color were remarkably higher when the temperature was at 5° C, showing that the technology of color change of the post was effective. With resin disk overlaid, at 35° see none of the differences in color were above the threshold for clinical acceptability. At 5° C blue and black colored posts were visible when the overlaid resin thickness was 0.5 mm, while at 1.0 mm and 1.5 mm, none of the posts were visible. **Clinical significance**: Thermo-sensitive color pigment technology of DT Illusion was effective in selectively differentiating the post, by lowering the temperature, useful in case of endodontic re-treatment. Color changes due to cold food and beverage consumption were not visible if at least 1 mm of resin composite was layered over the post. **PDF**

\*Barceleiro, M., Soares, LP, I. Poiate, IAVP, Portero, PP, Vasconcellos, AB, Teixeira, CA. **Influence of autoclave sterilization on flexural strength of fiberglass posts** . *J Dent Res. Vol 92 (Spec. Iss. A) Abstract #3130, 2013 (www.dentalresearch.org)*

Objectives: The sterilization of fiber-reinforced resin posts may be necessary if during adaptation tests, they are changed by other with different diameter. The sterilization in autoclave, however, may generate some kind of structural change that may prejudice their mechanical properties and clinical performance. The aim of this study was to evaluate the influence of sterilization method on the physical structure of reinforced fiberglass posts (FRC Postec - Ivoclar and Transluma - Bisco) or fiber quartz posts (DT Light-Post - (RTD, St Egreve, France)) after 1 or 2 cycles of sterilization. Methods: Eight posts of each brand, divided into 3 groups (FRC, TRL and DT), were subdivided into three subgroups, according to the number of sterilization cycles: a subgroup with no sterilization (control), one with one sterilization (Subgroup 2) and Subgroup 3 with 2 sterilization cycles. After sterilization procedures, the posts were submitted to three-pointing bending test (ASTM D2344). Results: The main values of maximum force required to fracture the pin in different groups were: DT1 (202 ± 8.39 N), DT2 (190.2 ± 10.02 N), DT3 (177.9 ± 14.75 N); FRC1 (152.6 ± 27.19 N); FRC2 (130.9 ± 25.99 N); FRC3 (128.1 ± 18.41 N); TRL1 (143.5 ± 6.15 N); TRL2 (144 ± 8.62 N); TRL3 (134 ± 6.51 N). The results treated by ANOVA and SNK (p ≤ 0.05) showed significant differences within the groups DT (1 = 2> 3) and TRL (1 = 2> 3). Conclusions: It was concluded that the posts tested can be sterilized by an autoclave cycle with no loss in flexural strength. The FRC Postec Post can be sterilized by two cycles without mechanical damage.

\*Iorizzo, G., Betazzoni, S., Ciocca,L, Baldissara, P., **Effect of sterilization on fiber posts fracture Strength** . J Dent Res. Vol 88 (Spec. Iss. B) Abstract #359, 2009 (www.dentalresearch.org)

**Objectives**: Fiber post sterilization could be required for various reasons during clinical procedures. The purpose of this study was to evaluate the effect of autoclave sterilization on the fracture resistance of fiber posts made with different types of fiber. **Methods:** The specimens were subdivided in four groups of 10 posts each, as follows: 1) “S” glass Prosthetic OverPost #3 (Overfibers); 2) silica glass RelyX Fiber Post #2 (3M ESPE); 3) Glass-zirconia Fototech 1.8 (Isasan); 4) Quartz **DT Light-Post** Illusion #2 (RTD/Dentsply). In each group, five posts were subjected to two sterilization cycles at 135°C and 2 Bar pressure, the other five were used as controls. The specimens were inserted in acrylic resin cylinders leaving an external portion 8mm in length, and loaded at 45° with an Instron machine until complete fracture occurred. A thin lead foil was inserted between the post head and the loading shaft to avoid stress concentration on the fiber composite. Fracture resistance and strain to failure were recorded and statistically analyzed (paired Student-t test, 1-way ANOVA, Bonferroni multiple comparison test, alpha=0.05). **Results:** Fracture resistance of RelyX (41.3±1.9 MPa) and Fototech (33.3±1.6 MPa) posts was significantly reduced by the treatment (24% and 24.8%, respectively; P<0.004). OverPosts and DT Light-Post Illusion resistance was not influenced by sterilization cycles (P>0.9); also, these posts showed a significantly higher strength (55.8±3.8 and 46.3±1.4 MPa, respectively) than the other types. Strain to failure of Fototech posts was significantly reduced by the treatment, increasing the stiffness of the glass-zirconia composite. **Conclusions:** fracture resistance of “S” glass fiber and quartz fiber posts are not affected by autoclave sterilization cycles.

**\* Indicates that DT Light-Post is included**

**\*\*Indicates that Macro-Lock post is included**

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