IV. Adhesion / Retention Testing

A. POST TO ROOT

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***

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); ALL-BOND 2 / C&B Cement (Bisco), 2) Quartz fiber post **AesthetiPost** (RTD); ALL-BOND 2 / C&B Cement (Bisco), 3) Quartz fiber **LIGHT-POST** (RTD); ONE-STEP (Bisco) and DUO-LINK cement (Bisco), 4) Glass fiber FIBER-KOR (Jeneric Pentron) Post; BOND-1 (Jeneric Pentron) and Cement-It! (Jeneric Pentron) , 5) Quartz fiber D. T. LIGHT-POST (RTD); 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 37^0C. During each cycle, the load ranged from 3 to 21 Newtons and was applied directly one the post in 45^0 direction. The controls were stored in water at 27^0C. 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.

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) was used in G-3 and the opaque post **Aestheti-Plus** (RTD) 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**), and quartz-coated-carbon-fiber posts (**Aestheti-Plus**). 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.

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 non-homogeneous 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 **(Light-Post**, RTD, France)with composite resin cements.

Drummond, J. L., Toepke, T. R. S., and King, T. J. **Thermal and cyclic loading of endodontic posts.** ***European Journal of Oral Science*****.** ***107: 220-224, 1999.***

Abstract/conclusions: The intent of this study was to determine pullout (shear) strength of carbon (**ComposiPost**) and stainless steel serrated posts from teeth. The tooth-posts groups were controls, thermal-cycled, load-cycled (load applied at either a 45^{o} angle or along the long axis of the post), and thermal- and load-cycled. Human extracted third molars were embedded in denture acrylic. Post space was prepared and the posts were cemented with a resin cement according to manufacturer's instructions. The testing was in tension at a loading rate of 2 mm/min. The pullout (shear) strengths (MPa$\pm$SD) for the carbon posts were: controls 6.1$\pm$3.3; load-cycled 4.3$\pm$2.2; and thermal cycled 4.2$\pm$2.2. The thermal-cycled then load-cycled carbon posts all fractured during testing and were unable to be evaluated for shear strength. The pullout (shear) strengths (MPa$\pm$SD) for the stainless steel posts were: controls 6.6$\pm$2.9; load-cycled 7.1$\pm$3.2; thermal cycled 4.8$\pm$ 2.0; and thermal load-

cycled 6.8+3.5. The statistical analysis indicated no significant difference in the pullout (shear) strength between any of the post groups tested. Two different operators then prepared specimens using carbon posts abraded with 50 micron alumina and non-abraded carbon posts. The alumina abrasion caused a decrease in the post bond strength with the alumina particles impinging on the carbon fibers resulting in their fracture. The significant difference between bond strengths was attributed to each operator's years of clinical experience.

Goto, Y., Nicholls, J. I., Phillips, K., Junge, T., **Fatigue resistance of endodontically treated teeth restored with three dowel-and-core systems.** ***J Prosthet Dent 2005;93:45-50***

Purpose: The purpose of this study was to compare the load fatigue of 3 dowel and core systems. **Materials and Methods:** Fifteen endodontically treated maxillary central incisors were sectioned perpendicular to the long axis at a point 1.5mm incisal to the CEJ. At the level of the CEJ, specimens were then prepared for crowns with 1mm complete shoulder finish lines and 1.5mm of axial wall height. The prepared teeth were divided into three groups (n=5) and restored with one of of the following dowel and core combinations: Group CG, cast gold dowels and cores, Group TA, Titanium Alloy dowels (ParaPost XH) with composite cores, or Group FR, fiber-reinforced resin dowels (ParaPost FiberWhite) with composite cores. A dentin bonding agent (Optibond Solo) was placed prior to the composite cores. Dowel and core castings and Titanium alloy dowels were cemented with zinc phosphate cement. The fiber-reinforced dowels were cemented with a resin cement (ParaPost Cement). The crowns for all specimens were cast with an incisal notch for applying the fatigue load. The independent variable was the number of load fatigue cycles required to cause luting cement failure. The data were subjected to 1-way analysis of variance and the Student-Newman-Keuls test for 3 subsets (a=.05). **Results:** The mean value +/- standard deviation for the cycles to failure for each group was Group CG: 11,897 +/- 4080 load cycles, Group TA: 24,384 +/- 8231 load cycles, and Group FR: 50,696 +/- 7063 load cycles. Significant differences were found between all groups (***P***<.05). **Conclusions:** Fiber-reinforced dowels and bonded composite cores under fatigue loading provided significantly stronger crown retention than cast gold dowels and Titanium Alloy dowels with composite cores.

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. **Materials and Methods**: The posts studied were Cosmopost (ceramic), Composipost / **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 ($p<0.05$).

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 intraradicular 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**). 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 microtensile 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 ($p<0.0001$).

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]) or opaque (**Aestheti Post** [AP]) 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.

Maya, A., Millstein, P, Freeman, Y. **Determining post-core retention of smooth-surface metal, non-metal posts.** ***J Dent Res. 77 AADR Abstract #435; 1998***.

Abstract/conclusions: Core-post retention is dependent on post head surface geometries. The purpose of this study was to compare the retention of smooth-surface metal and non-metal post-core assemblies. Thirty smooth-surface post head samples measuring approx. 1.45mm in diameter were separated into 3 groups of 10 samples, according to type of post: Group A; **ComposiPost**, Group B; Zirconium Ceraposts, Group C; Cast silver palladium. Post heads were uniformly sanded with aluminum oxide (50um). Prior to core formation, all posts were pretreated with ALL-BOND 2. Core-post assemblies were made with Bis-Core in special molds (Teflon), with the post head 1mm from the top surface of the core covering. All samples were allowed to set for 96 hours. Tensile failure loads were measured in the absence of crowns using an Instron test machine (4505) at a cross-head speed of 25mm/min. Values were recorded in pounds. Mean values were analyzed with a one-way ANOVA. There was a significant interaction between posts. Metal posts (111 +/- 17 lbs) and ComposiPosts (120 +/-16 lbs) were most retentive and displayed significantly greater retention than Zirconium posts (45 +/-20lbs).

Mannocci, F., Innocenti, M., Ferrari, M., and Watson, T. F. **Confocal and Scanning Electron Microscopic Study of Teeth Restored with Fiber Posts, Metal Posts, and Composite Resins.** ***Journal of Endodontics***. 25: ***789-794, 1999.***

Abstract/conclusions: Forty-two single-rooted lower premolars, extracted for periodontal reasons, were endodontically treated and divided into 7 groups of 6 teeth each. In five of the groups, three different types of carbon fiber posts (**Composipost**), quartz fiber posts (**Aestheti-Plus**), and titanium posts were used in combination with ALL- BOND 2 dental adhesive. In two groups, two types of carbon fiber posts were also cemented with Panavia 21 dental adhesive. After 3 wk storage in saline, the teeth were longitudinally sectioned; one half was observed using confocal microscopy and the other by scanning electron microscopy. The specimens were evaluated for the presence of a resin dentin interdiffusion zone for the presence of voids at post-resin-dentin interfaces and for the determination of the fiber posts' structure. Upon examination with the confocal microscope, the interfaces of teeth restored wtih ALL- BOND 2 showed a higher percentage ($p<0.05$) of resin dentin interdiffusion zone than those treated with Panavia. The fiber size and the post structure were similar in all the fiber posts observed.

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.

Pest, L. B., Cavalli, G., Bertani, P., Gagliani, M. **Adhesive post-endodontic restorations with fiber posts: push-out tests and SEM observations**. ***Dental Materials 18 (2002) 596-602***

Objectives: Nowadays, the restoration of endodontically treated teeth is based on the use of materials with a modulus of elasticity similar to that of dentin (18.6 GPa). Fiber posts, resin cements and some composite resins all have this characteristic. This study evaluated the bond strength between luting materials, root dentin and (4 different) fiber posts through push-out tests and examined the integration among these three components through scanning electron microscopy. **Methods**: Endodontically treated extracted teeth and plastic plates were used to test the interface between luting agent and dentin and dentin and luting agent and post. **Results:** Chemical affinity between different components (luting materials and fiber posts) is extremely important in achieving high bond strength. The bond strength tests and SEM observations showed that in-vitro, composite resins perform better than resin cements. **Conclusions:** Adhesive luting of posts is an alternative technique that is comparable and in some ways superior to the traditional technique that uses resin cements. Composite resins are easy to use and ergonomically advantageous because the same material can be used to lute the post and restore the core. Particular attention should be paid to the association between translucent posts and light-cured composite resins. This technique has the advantage of prolonged working time. Further investigation is needed to demonstrate the complete conversion of light-cured composite at different depths. **Significance:** The in vivo use of these materials may significantly reinforce residual tooth structure therefore reducing the risk for fracture and debonding.

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 (**Bisco Dental / RTD) with C&B chemically-cured cement (Bisco Dental), 2. carbon fiber/glass fiber **Aestheti-Plus** (RTD) post with C & B cement, 3. glass fiber Aestheti-Plus Post (RTD) with C&B cement, and 4. glass fiber **Light-Post** (RTD) 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.

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. **Materials and 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) 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.

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. **Materials and 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 Light-Posts 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.

B. RESIN TO POST

Coelho 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. **CONCLUSION:** 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.

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***

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). 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.

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***

Objectives: The purpose of this study was to determine the modes of failure and bond strength between quartz fiber post (***Æstheti-Plus,*** R.T.D., 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.