Albuquerque, R C, Polleto, LT, Fontana, RH, Cimini CA. **Stress analysis of an upper central incisor restored with different posts.** *J Oral Rehabil. 2003 Sep;30 (9):936-43.* **Summary / conclusions:** The effect of different anatomic shapes and materials of posts in the stress distribution on an endodontically treated incisor was evaluated in this work. This study compared three post shapes (tapered, cylindrical and two-stage cylindrical) made of three different materials (stainless steel, titanium and carbon fibre on Bisphenol A-Glycidyl Methacrylate (Bis-GMA) matrix). Two-dimensional stress analysis was performed using the Finite Element Method. A static load of 100N was applied at 45 degrees inclination with respect to the incisor's edge. The stress concentrations did not significantly affect the region adjacent to the alveolar bone crest at the palatine portion of the tooth, regardless of the post shape or material. However, stress concentrations on the post/dentin interface on the palatine side of the tooth root presented significant variations for different post shapes and materials. Post shapes had relatively small impact on the stress concentrations while post materials introduced higher variations on them. Stainless steel posts presented the highest level of stress concentration, followed by titanium and carbon/Bis-GMA posts. (PDF)

Aminsalehi, E., **Strength of incisors restored by metallic, fiber and ceramic posts.** *J Dent. Res 84 (Spec Issue B), African and Middle East Section 2005*.(www.dentalresearch.org). **Objectives:** In endodontically treated teeth, because of extensive structural defects, the risk of fracture is increased. For reconstruction of coronal structure posts provide retention. Composite fiber posts were recently introduced to dentistry. This study compared the fracture strength of maxillary central incisors restored by metallic, fiber-reinforced composite and ceramic posts. **Methods:** 30 human maxillary central incisors were used. The crown of each incisor was cut off 1 mm coronally to C.E.J. perpendicular to long axis of the tooth by metal disc. Root canals of teeth were prepared for posts after RCT. Specimens were embedded in autopolymerizing acrylic resin 4 mm below the CEJ and then tested in a universal testing machine (Zwick-Germany). A compressive load was applied at 130 degrees to the long axis until fracture, at a cross-head speed of 0.5 mm/min. Fracture loads were recorded. All data collected were analyzed statistically using the ANOVA and LSD tests. **Results:** The mean and standard deviation (S.D.) of failure loads (in Newtons) were 765 +/- 113/265 N, 790 +/- 95/34 N, 614 +/- 105/32 N for glass-fiber, ceramic and metallic groups, respectively. ANOVA test detected statistically significant differences between all groups. Teeth restored with fiber and ceramic posts exhibited significantly higher resistance to fracture than with titanium posts. Teeth restored by fiber and ceramic posts were statistically similar by LSD test. The highest proportion of undesirable fractures was seen with titanium posts. **Conclusion:** Usage of fiber and ceramic posts are preferable to titanium posts. Because of more undesirable fractures in the ceramic group than fiber group, use of the fiber posts are recommended overall.

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, DUOLINK™ (Bisco) and core build-up was done with light-cured composite, LIGHTCORE™ (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 followings are the data of fracture resistance and they were analyzed by Kruskal-Wallis test and Duncan's multiple range test at P<0.01 (unit: N). Standard deviations are in parenthesis. The highest fracture resistance was recorded for Cast post and Para post (P<0.01). In failure mode, C-post 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.

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) 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.

Borcic, J. et al. Finite element study of the glass fiber endodontic post. J Dent Res. Vol 83 (Spec. Iss. A) Abstract #0530, 2004 (www.dentalresearch.org). Objectives: Post and core applications are generally used in the restoration of endodontically treated teeth. The stress distribution during masticatory function in a tooth restored with a post and core can cause root fracture. The different mechanical behavior of post and dentine is a critical parameter for the load transmission. In order to minimize the rigidity difference between the post and the dentine, a new kind of post was developed. The aim of this study was to analyze the mechanical behavior of a new polymeric composite post reinforced with glass fibers. A natural tooth was considered as a reference model. Methods: The 3D finite element method (FEM) was selected to perform the stress analysis of the two-rooted first maxillary premolar restored with glass fiber posts. Composite resin was used as the core material and full porcelain crowns covered the model. Four nodded tetrahedral were applied in the description of the tooth morphology, resulting in 1,684,512 elements and 246,510 nodes with 739,539 degrees of freedom. A total force of 200N was applied. Results: The greatest stresses were observed in the palatal cervical region (-16.126 MPa) and in the intraradicular parts of the post (-23.898 MPa). In the cervical region, the mean high-intensity compressive stress areas were more extensive in the natural tooth (-175.222 MPa). Conclusions: The glass fiber composite post induces a stress field similar to that of the natural tooth, except in the cervical region, where the tooth has higher compressive stresses.

Brown, P., Hicks, N., Rehabilitation of endodontically treated teeth using the radiopaque fiber post. Compendium Vol. 24, No. 4, April, 2003, 275-282. Abstract/conclusions: 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 and 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 replacement 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)

Christensen, G. J. Post concepts are changing. JADA, Vol. 135 Sept., 2004, 1306-1310. Recently there is a clearly observable movement toward use of fiber-reinforced resin-based composite posts used in conjunction with composite build-ups. The resin-cemented fiber posts, followed by composite build-ups were as strong as the metal posts used with composite build-ups. They do NOT impart any objectionable color to the tooth. In terms of most of the necessary post characteristics, the fiber posts are superior to metal prefabricated posts. They are easy to place, are relatively inexpensive, can be bonded to resin cement, and are easy to remove if the tooth needs to be retreated endodontically. (PDF)

Chuang, S-F, Chang, C-H, Su, K-C, Yaman, P. Effect of post length and material on periodontally involved teeth. J Dent Res. Vol 85 (Spec. Iss. B) Abstract #0006, 2006 (www.dentalresearch.org). Objective: To investigate the stress distribution of periodontally involved teeth restored with different posts using finite element analysis. Methods: 2-D models of a maxillary central incisor consisting of a PFM crown, composite core, parallel post, dentin, gutta percha, periodontal ligament, and cortical/trabecular bone were constructed using ANSYS v9.0 software. The posts tested were stainless steel (SS), carbon fiber (CF), and glass fiber (GF) at 10mm and 5mm lengths into the root canals. The alveolar bone level was set either as intact periodontium or with bone loss even with the apical end of short post. All materials were assumed to be linearly elastic and isotropic except CF and GF posts which were orthotropic. Teeth were subjected to two different loads: the first a 70N force on the incisal tip; the second a 100N force on the lingual surface of crown at a 145 degree angle. Results: With the 70N load the stress distribution patterns were similar among the groups. For the 100N load at 45 degrees, the models representing periodontal bone loss showed higher von Mises stress over the middle part of root periphery and around the post ends compared to the intact periodontium groups. In the intact periodontium groups, the stress around the crown margins was higher than the middle of the root. The SS post exhibited higher stress levels than the other posts only around the apical end of the post. The SS/5mm group with periodontal bone loss showed higher von Mises stress over the middle part of root periphery and around the post ends compared to the other groups. Conclusion: Teeth with posts and periodontal bone loss generate higher stress concentrations with an increased risk of root fracture. The major difference in stress distribution between rigid and non-rigid posts is primarily around the apical ends of the posts.

Chuang, S-F, Yaman, P., Dennison, J., et al. Fracture resistance of devitalized teeth restored with different prefabricated posts. J Dent Res. Vol 84 (Spec. Iss. A) Abstract #2926, 2005 (www.dentalresearch.org). Objectives: To investigate the fracture characteristics of devitalized teeth restored with posts of different materials and length. Methods: Sixty intact extracted incisors of similar size were chosen and sectioned 2mm coronal to the CEJ. The root canals were instrumented and obturated. Three different post systems were tested: stainless steel post (SB), glass-fiber post (GF), and carbon-fiber post (CF). The teeth were prepared to post lengths of 5 and 10 mm with the appropriate reamers for each post system. Composite cores of
reduce stress concentrations within the root canal and reduce the incidence of fractures. An additional feature with the newer systems has focused on physical properties, such as modulus of elasticity (rigidity), more closely matched to dentin, to polymeric, ceramic carbon or fiber-reinforced, and other novel systems have emerged into the post material market. These be reached.

guidelines for post selection in restoring endodontically treated teeth should become more defined and a general consensus may however, results have been favorable, with high retention rates and a lack of root fractures demonstrating that metallic posts have a greater number of disadvantages over selective modern technologies, it is now time to G1-3.0, G2-1.7, G3-4.6. A significant difference was observed (p<0.05) (T=16.25 and p=0.0003.) G2 had the best result.

fatigue test. The maximum load was 60N. After the fatigue test, the groups were thermocycled and immersed in ethylene blue the periodontal ligament. The angle of test was 45º . An Instron 4444 (Universal Test Machine) was used for the compressive G3 was just restored with composite resin. For the fatigue test, the teeth were mounted in epoxy supports with a simulation of the root. All groups were endodontically treated and received a full cast crown. G1 e G2 were cut 1mm to the cervical limit. groups. G1 – Cast post and core. G2 – Fiber resin post and composite core G3 – without post and core. Post was introduced 2/3 of the specimens in the metal post groups exhibited fracture planes passing through the apex of the post. Conclusions: Use of a 10 mm metal post did not improve the fracture strength of the restored devitalized teeth. Fiber posts provide more uniform stress distribution, which may prevent fracture at the apical end of the post. The fracture patterns of the teeth were associated with the post materials, while the post length had little influence on either the fracture strength or patterns of the teeth.

Dietchi, D., Duc, O., Krejci, I., Sadan, A. Biomechanical considerations for the restoration of endodontically treated teeth: A systematic review of the literature-Part 1. Composition and macro-structure alterations. Quintessence Int 2007; 38:733-743. The specific biomechanical alterations related vitality loss or endodontic procedures are confusing issues for the practitioner and have been controversially approached from a clinical standpoint. The aim of part 1 of this literature review is to present an overview of the current knowledge about composition changes, structural alterations, and status following endodontic therapy and restorative procedures. The basic search process included a systematic review of the PubMed/Medline database 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 relevant sources completed the review. Only negligible alterations in tissue moisture and composition attributable to vitality loss or endodontic therapy were reported. Loss of vitality followed by endodontic therapy proved to affect tooth biomechanical behavior only to a limited extent. Conversely, tooth strength is reduced in proportion to coronal tissue loss, due to either caries lesion or restorative procedures. Therefore the best current approach for restoring endodontically treated teeth seems to (1) minimize tissue sacrifice, especially in the cervical area so that a ferrule effect can be created, (2) use adhesive procedures at both radicular and coronal levels to strengthen remaining tooth structure and optimize restoration stability and retention, and (3) use post and core materials with physical properties close to those of natural dentin, because of the limitations of current adhesive procedures.

Duke, S. E. New Directions for posts in restoring endodontically treated teeth. Compendium 23 116-121, 2002 Abstracts / conclusions: Metallic prefabricated posts have dominated the market for a number of years. Yet, in the past several years, polymeric, ceramic carbon or fiber-reinforced, and other novel systems have emerged into the post material market. These newer systems have focused on physical properties, such as modulus of elasticity (rigidity), more closely matched to dentin, to reduce stress concentrations within the root canal and reduce the incidence of fractures. An additional feature with the newer posts has been the esthetics with composite core materials. Minimal clinical research or simulation studies are available; however, results have been favorable, with high retention rates and a lack of root fractures. With the abundance of literature demonstrating that metallic posts have a greater number of disadvantages over selective modern technologies, it is now time to examine the dental school academic curriculums concerning post techniques. As more clinical data becomes available, the guidelines for post selection in restoring endodontically treated teeth should become more defined and a general consensus may be reached. (PDF)

Fellippe, L. A., Monteiro, S. et al. Influence of the use and type of endo posts used in the cervical stress level of central incisors submitted to the fatigue test: an in vitro study. J Dent Res. Vol 81 (Spec. Iss. A) Abstract #0057, 2002 (www.dentalresearch.org). Objectives: The objective of this study was to observe the biomimetic behavior of the fiber resin post and cast post in the cervical stress level of central incisors submitted to the fatigue test. A group of non-posted tooth was also evaluated. Methods: Thirty six recently extracted upper central incisors were selected. The teeth were divided in three groups. G1 – Cast post and core. G2 – Fiber resin post and composite core G3 – without post and core. Post was introduced 2/3 of the root. All groups were endodontically treated and received a full cast crown. G1 e G2 were cut 1 mm to the cervical limit. G3 was just restored with composite resin. For the fatigue test, the teeth were mounted in epoxy supports with a simulation of the periodontal ligament. The angle of test was 45º . An Instron 4444 (Universal Test Machine) was used for the compressive fatigue test. The maximum load was 60N. After the fatigue test, the groups were thermocycled and immersed in ethylene blue die for 24 hrs. Results: were obtained after teeth sectioning. The Kruskal-Wallis test was used. The average for each group was G1-3.0, G2-1.7, G3-4.6. A significant difference was observed (p<0.05) (T=16.25 and p=0.0003.) G2 had the best result. Conclusion: the study suggests that teeth with fiber resin post better resists the fatigue test than teeth with cast post or without post, under the specific conditions of the study.

vitro failure modes of fiber reinforced post systems with prefabricated 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 of in vitro studies on fracture resistance of single rooted human teeth restored with prefabricated 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 prefabricated 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 prefabricated metal and cast post systems. Comparative studies of the different post systems are scarce.

Gluskin, A., Ahmad, I, Herrero, D. The aesthetic post and core: unifying radicular form and structure. Pract Proced Aesthet Dent 2002;14(4):313-321. Abstract/conclusion: Use of a post system for the rehabilitation of endodontically treated teeth requires traditional planning for the function of the restoration as well as a structural and aesthetic strategy for novel technologies in ceramic and composite dentistry. Contemporary material options have greatly expanded the clinician’s ability to rehabilitate the coronoradicular complex. Transilluminating posts, bondable fabrics and high-technology ceramics create exciting possibilities in post and core design. The use of bondable materials allows the practitioner to unify the structure and morphology of root systems to provide creative solutions to challenges heretofore unmet. (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 AesthetiPlus, made of white quartz fiber, and finishing with the Light-Post, made out 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)

Hayashi M, Takahashi Y, Imazato S, Ebisu S. Fracture resistance of pulpless teeth restored with post-cores and crowns. Dent Mater. 2005 Sep 16. Objectives: The present study was designed to test the null hypothesis that there is no difference in the fracture resistance of pulpless teeth restored with different types of post-core systems and full coverage crowns. Methods: Extracted human upper premolars were restored with a fiber post, prefabricated metallic post or cast metallic post-core. Teeth with full crown preparations without post-core preparations served as a control. All teeth were restored with full coverage crowns. A 90-degree vertical or 45-degree oblique load was applied to the restored teeth with a crosshead speed of 0.5mm/min, and the fracture loads and mode of fracture were recorded. Results: Under the condition of vertical loading, the fracture load of teeth restored with the cast metallic post-cores was greater among the groups (two-factor factorial ANOVA and Scheffe’s F test, P<0.05). All fractures in teeth restored with all types of post-core systems propagated in the middle portions of roots, including the apices of the posts. Under the condition of oblique loading, the fracture load of teeth restored with pre-fabricated metallic posts was significantly smaller than that in other groups. Two-thirds of fractures in the fiber post group propagated within the cervical area, while most fractures in other groups extended beyond the middle of the roots. Significance: From the results of the present investigations, it was concluded that under the conditions of vertical and oblique loadings, the combination of a fiber post and composite resin core with a full cast crown is most protective of the remaining tooth structure.

Lang, H., Raab, W., Interferometric assessment of teeth restored with different post systems. J Dent Res. Vol 84 (Spec. Iss. A) Abstract #0666, 2005 (www.dentalresearch.org). Objectives: This study evaluated the deformation of endodontically treated teeth with 3 different post systems at 4 simulated clinical stages. Methods: Extracted human anterior maxillary teeth (n=30) were used and randomly assigned to 3 groups (i.e. post systems): fiber-reinforced epoxy resin posts –Group 1 (ER DentinPost), zirconium oxide ceramic posts –Group 2 (ER CeraPost) and titanium posts –Group 3 (ER Titan post) (all from Komet, Brasseler GmbH, Lemgo, Germany). A series of endodontic treatments was applied and after each single procedure the teeth were loaded (3.75N) and the deformation was assessed using Speckle pattern interferometry. The following treatments were applied: a) no treatment (control), b) access preparation and initial root canal instrumentation (Kerr files ISO 40), c) post preparation (Size 110) and d) cementation of the posts (gr. 1+2: resin bonded / Gr. 3: zinc phosphate cement). Results: Access preparation (with root canal instrumentation) and post preparation significantly increased the deformation under loading (p<0.05 - one-way ANOVA and post-hoc Scheffé test). All posts reduced the deformation of the teeth but the levels were significantly different:
titanium posts - 0.38±0.02µm > zirconium oxide ceramic posts - 0.45±0.02µm > fiber-reinforced epoxy resin posts - 0.53±0.03µm (p<0.05). Conclusion: It can be concluded that a) the increase of stability corresponds to the mechanical properties of the post materials and that b) the fiber-reinforced epoxy resin posts can almost preserve the deformation pattern of teeth without a post. This might be favorable in view of studies showing a high incidence of unrestorable root fractures in case of post materials with mechanical properties significantly different from the properties of root dentine.

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 modulus) 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)

Oliviera, L.C.A., Candido, M.S.M., Duarte, S., Oliviera, S.A.G., Comparative study of stress distribution in upper incisors; biometric behavior of post systems. J Dent Res Vol 82(Spec Issue A), Abstract #0548 2003 (www.dentalresearch.org). Objective: this work proposes a study about the distribution of mechanical stresses in the radicular dentin restored with different post systems, by means of Photoelastic and Finite Element techniques. This analysis is conducted for the following post systems: carbon fiber, fiberglass, zirconium, stainless steel, titanium and cast metal (Cu-Al alloy) and the healthy tooth (control). The computer analysis and numerical results were validated by laboratory experimental data (Photoelastic). Methods: For this purpose, representative 2-dimensional models were of the upper central incisor were built for both methods. These models were subject to a 100N load applied at the tip of the crown, at 45° from the axis along the tooth. These results are expressed in terms of the Von Mises and Sy stresses and the fringe order, for the Finite Element and photoelastic methods, respectively. Results: Through the analysis of these results, it can be concluded that significant stress distributions arise between the 6 different post systems tested, so that those made of zirconium, stainless steel, titanium and cast metal produced high stress concentration at the post/dentin interface region. In the cases of carbon fiber and fiberglass, on the other hand, the stress distribution along the radicular surface is uniform, lacking stress concentration areas. Conclusion: The zirconium, stainless steel, titanium and cast metal posts present mechanical properties which are different from those of the tooth structure, resulting in significant alterations over the mechanical behavior of the dental structure. The non-metallic posts comply more satisfactorily with the requirements necessary to provide a mechanical behavior more similar to that of the dental structure, the compatibility among the mechanical properties found in these systems and the dentin providing a biometric behavior, reducing the risk of failure or fracture of the root.

Okada, D., Miura, H., Sozoki, C., Komada, W., Yamamoto, M., Masuoka, D., Shin, C. Stress distribution in roots restored with different post systems. J Dent Res Vol. 85, (Special Issue B) #0011, 2006 (www.dentalresearch.org). Objectives: Composite resin core materials in conjunction with various kinds of prefabricated posts are gaining in popularity. However, it is not yet clear, which kind of material is most suitable for the post. The aim of this study was to evaluate the influence of the prefabricated post on stress distributions in an abutment tooth restored with composite resin by 3-dimensional finite element analysis. Methods: Four 3-dimensional finite element models of an endodontically treated premolar were made. In these four models, posts and cores were built up with composite resin and four types of prefabricated post; glass fiber post (GFP), Titanium post (TIP), Zirconia post (ZRP), and Stainless steel post (STP). In all the models, an occlusal force similar to chewing beef jerky, was applied to the center of occlusal surface (lingual direction: 24N,distal direction:29N, apical direction:164N), which was measured with a small 3-dimensional occlusal force meter. Then Von Mises stress distributions within the root were calculated. Results: In all models, there were similar distributions of stress concentration at the apical area. However, in the dentin of the root around the end of the prefabricated posts, there were differences in stress concentration. The magnitudes of stress in this area for GFP, TIP, ZRP and STP were 11.5 Mpa, 12.6 MPa, 12.0 MPa, and 14.9 MPa respectively. Conclusion: Within the limitations of this experiment, GFP was indicated to be most suitable since this model showed lower stress values, which means less possibility of root fracture.
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 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)

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 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. (PDF)

Aesthetic posts and cores for metal-free endodontically treated teeth. Pract Periodont Aesthet Dent 2000; 12(9):875-884. Abstract/conclusions: Utilization of contemporary post and core systems has facilitated the aesthetic restoration of endodontically treated teeth. Light transmission and biocompatibility have been enhanced by the introduction of metal-free post systems. The periodontal and endodontic status, root length and histological structure of the devitalized teeth must be considered in order to achieve successful restoration after endodontic treatment. This article presents various restorative criteria for the esthetic placement and buildup of post and core materials, as well as the preservation of maximum coronal and root structure. (PDF)

In vitro fracture resistance and marginal adaptation of metallic and tooth-colored post systems. J Oral Rehabil, 2004 Jul;31(7):675-81. Summary: The aim of this in vitro study was to compare the fracture resistance and marginal adaptation of all-ceramic incisor crowns with all-ceramic posts, glass-fibre-reinforced posts and titanium posts as well as a control without any post. Three groups of eight maxillary incisors were restored with an all-ceramic post, a fibre-reinforced composite (FRC) post, a titanium post and a further group was restored without posts. Composite cores
were provided and all-ceramic crowns were adhesively luted. After artificial ageing, the fracture resistance of the restored teeth was determined. The marginal adaptation of the restorations at the interfaces between cement-tooth and cement-crown was evaluated by scanning electron microscopy using replica specimens before and after ageing. The restored teeth without posts [270N (235/335)] showed no significantly different fracture strength compared with teeth with the titanium system [340N (310/445)]. The all-ceramic posts [580N (425/820)] and the FRC posts [505N (500/610)] both provided a significant higher fracture resistance than the teeth without posts. Prior to ageing, all materials showed <5% separation at the margins cement-tooth or cement-crown (‘marginal gap’). After ageing, the interfaces of all systems deteriorated to values between 6 and 14% marginal gap. The greatest marginal gap was found with the titanium system (14%) at the interface cement-crown and with the all-ceramic posts (12%) at the transition between cement-tooth. Regarding fracture resistance and the marginal adaptation, the all-ceramic and FRC posts may be considered as an alternative to the commonly used titanium post restorations.

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 (Special Issue A) 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.

Usumez A, Cobankara FK, Ozturk N, Eski traceback Giul GL, Belli S. Microleakage of endodontically treated teeth with different dowel systems. J Prosthet Dent. 2004 Aug; 92(2):163-9. Statement of problem: Several new esthetic dowel systems are available for the restoration of endodontically treated teeth, but little is known about how effectively these dowels seal the restored teeth. Purpose: The purpose of this in vitro study was to compare microleakage of 3 esthetic, adhesively luted dowel systems with a conventional dowel system. Methods: The root canals of 41 human intact single-rooted extracted teeth were prepared using a step-back technique. The teeth were randomly divided into 4 experimental groups (n=10), and 1 tooth served as a positive control. The decoronated roots were obturated with gutta-percha using lateral condensation. Roots were restored with 1 of the following dowel systems according to the manufacturer’s instructions: (1) stainless steel dowels (ParaPost), (2) glass fiber dowels (Snowpost), (3) resin-supported polyethylene fiber (Ribbond) dowels, or (4) zirconia dowels (Cosmopost). Using a fluid filtration method, coronal leakage of the specimens along the dowel space and root canal restorative material was measured. Fluid movement measurements were made at 2-minute intervals for 8 minutes to measure the presence of voids existing in the obturated canals, at 1 week, 3 months, and 6 months following dowel insertion. A repeated-measures analysis of variance (ANOVA) was used to analyze logarithmic transformations of data (time and dowel material) for significant differences. The Tukey HSD test and paired 2-tailed tests were used to perform multiple comparisons (alpha= 0.05). Results: The data indicated that the leakage values varied according to the dowel system used (P<.01). There was significant interaction between dowel systems and time of testing (P<.01). The sealing ability of zirconia dowels decreased over time (P<.01), but sealing abilities of stainless steel and resin-supported polyethylene fiber dowels remained constant (P>.05). The sealing ability of glass fiber dowels increased at 3 months (P=.032) and remained constant over the next 3 months (P=.758). Statistically, resin-supported polyethylene fiber and glass fiber dowels showed the lowest coronal leakage when compared with stainless steel and zirconia dowels at all time periods (P<.01). There were no significant differences between resin-supported polyethylene fiber and glass fiber dowels at any time period. The initial leakage measurement in zirconia dowel and stainless steel dowels were similar (P=.914), but became significantly different at 3 and 6 months (P<.01). Conclusion: Resin-supported polyethylene fiber dowels and glass fiber dowels tested exhibited less microleakage compared to zirconia dowel systems. The latter system should be further evaluated because of its unacceptable level of leakage.

Zhang, WY, Shi, CX et al. Three-dimensional photoelastic stress analysis of roots restored with FRC posts and Ni-Cr alloy posts. J Dent Res. Vol 83 (Spec. Iss. B China), 2004. Objectives: Post-and-core is a perfect restoration method for residual crown or root of pulpless teeth. More and more emphasis has been placed on how to avoid tooth fracture and maintain esthetic appearance without reducing strength and retention. This study shows that the new developed fiber-reinforced composite post (FRC) used successfully for several years, because of their strength and relative flexibility, ease of placement or ease of removal. The purpose of this study was to analyze the effect of two modulus elasticity material posts on root stress.
distribution by using three-dimensional photoelastic analysis. **Methods:** The photoelastic models were divided into four groups according to posts material and loading. The roots stress distribution, which restored with FRC posts and Ni-Cr alloy posts, was analyzed by three-dimensional photoelastic analysis. **Results:** The material of posts influenced the root stress distribution significantly. The greater stress concentration was found at apex of Ni-Cr alloy posts with high modulus, the stress was evenly in FRC posts groups. **Conclusions:** The study concluded that the modulus of posts material influenced the root stress distribution significantly. The FRC posts which modulus was closed to teeth could protect roots from fracture.

**Carbon Fiber: Composipost® / C-POST®**

Baldissara, P, Pieri, F, Arcidiacono, A. Fatigue resistance of fiber posts: a comparative study. J Dent Res. Vol 80 (Spec 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/ Bisco C-POST); ALL-BOND 2 / C&B Cement (Bisco), 2) Quartz fiber post AesthetiPost (RTD / Bisco); ALL-BOND 2 / C&B Cement (Bisco), 3) Quartz fiber LIGHT-POST (RTD / Bisco); 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 / 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 37°C. During each cycle, the load ranged from 3 to 21 Newtons and was applied directly one the post in 45° direction. The controls were stored in water at 27°C. After the tests, all the specimens were imbedded in epoxy resin and sectioned transversely, obtaining 1mm thick sections. The sections were observed under the stereo microscope 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 experiments 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.

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)

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)

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) placed, and a composite build-up. All specimens were subjected to a 45-degree load of 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)

Dietzchi, D., Romelli, M., and Gortetti, A. Adaptation of adhesive posts and cores to dentin after fatigue testing. International Journal of Prosthodontics. 10: 498-507, 1997. Abstract/conclusions: An in vitro nondestructive fatigue test was applied to adhesive posts and cores made on endodontically treated human teeth. Five post-and-core systems were evaluated: one Zirconia oxide post, two Titanium posts (with resinous or ceramic coating), and two resin-fiber posts. Each test specimen was intermittently loaded and thermocycled. The scanning electron microscope observation of sample sections showed that only the interfaces between restorative materials and dentin exhibited substantial deficiencies. The Komet ER (Brasseler) exhibited the greatest percentages of continuity at the coronal (83.88%) or the radicular (78.12%) dentin levels, while the Zircon experimental post presented insufficient adaptation to the radicular 21.25% continuity) and to the coronal (53.25% continuity) dentin. Seven of eight samples in the Komet group showed root fractures. The carbon-fiber post (Composipost) behaved satisfactorily (67.38% radicular continuity), in spite of the use of an older bonding agent formulation. (PDF)

Dietzchi, D., Romelli, M., and Gortetti, A. Evaluation of post and cores in the laboratory: Rationale for developing a fatigue test and preliminary results. Compendium. 17: S65-S73, 1996. Abstract/conclusions: Prosthetic treatment failures related to the biomechanical deficiencies of post and cores still represent a problem of clinical significance. To overcome the difficulties of clinical studies, numerous in vitro methods were developed to address specific properties of post-and-core restorations. Most of them, however, were based on an oversimplified mechanical testing of the restored tooth. Experience proved that the fatigue of the restored materials was a primordial factor in clinical failures. Therefore, special devices were built that simulate the physiological masticatory cycle. Tests performed with adhesive post-and-core systems seem to indicate that materials placed in the tooth should have physical properties as close as possible to those of natural tissues. New carbon-epoxy posts (Composipost) appear to offer a promising solution for restoring the endodontically treated tooth. (PDF)

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° 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±SD) for the carbon posts were: controls 6.1±3.3; load-cycled 4.3±2.2; and thermal cycled 4.2±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±SD) for the stainless steel posts were: controls 6.6±2.9; load-cycled 7.1±3.2; thermal cycled 4.8±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 fracture. The sig-nificant difference between bond strengths was attributed to each operator's years of clinical experience. (PDF)

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 C-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 has a fracture resistance superior to most metals. (PDF)

Fazekas, A, Menyhart, K, Bodı, 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). 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., 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 C-Posts, Aesthetic-Posts and Aestheti-Plus Posts 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., 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 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, Cagidiaco ,MC , Goracci, C ,Vichi, A., Mason, PN , 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 Æsthetic Posts and 210 Æsthetic 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)

Fredriksson, M., Astback, J., Pamenius, M., and Arvidson, K. *A retrospective study of 236 patients with teeth restored by carbon fiber-reinforced epoxy resin posts*. *Journal of Prosthetic Dentistry*. 80: 151-157, 1998. **Statement of problem:** The Composipost dowel is made of stretched, aligned carbon fibers embedded in an epoxy-resin matrix. It is widely used in Europe and Canada for the restoration of endodontically treated teeth and was introduced in the United States 2 years ago as the C-Post dowel. **Purpose:** This retrospective study evaluated treatment outcome of the Composipost system after 2 to 3 years. **Methods:** A total of 236 patients treated during a 1-year period by seven Swedish dental practitioners were included. Of those, 146 patients consented and data were collected from the dental records of the remaining patients. Thus, the material comprised 236 teeth restored with carbon fiber-reinforced epoxy resin post, 130 maxillary and 106 mandibular teeth, with a mean restoration time of 32 months (range 27 to 41). Periodontal conditions, radiographic signs, and prosthodontic results were recorded. **Results:** Five teeth (2%) had been extracted for reasons unrelated to the Composipost system. Periodontal conditions such as plaque accumulation, gingival health, bleeding on probing, and pocket depth around the teeth with Composipost dowels were similar to the control teeth. No dislodgement or root or post fractures were observed clinically or on radiographs. Radiographic examination of bond height measured from the apex to the bone margin mesially and distally showed differences on the mesial side but not on the distal surface (p < 0.05) between the Composipost-treated teeth and the controls. **Conclusions:** Promising results after 2 to 3 years of clinical service indicate that this system can be a viable alternative to conventional post-and-core systems. (PDF)
Galiano, 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.

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). To remove the posts, for half of each group’s the burs for the RTD fiber post removal kit were 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).

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) 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 Composipost cementsed 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 90.6% 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.

Hedlund, SO, Johanson, NG, 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 fiber posts). 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).

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). 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; \( P<0.02 \)) than those of the carbon fiber posts. (PDF)

Kazemi, R. B., Reid, L. C., Meiers, J. C., A new test system for measuring concurrently fatigue and microleakage, J Dent Res. Vol 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 (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 5°C and 55°C. 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.

King, PA, Setchell DJ. An in vitro evaluation of a prototype CFRC prefabricated post developed for the restoration of pulpless teeth. J Oral Rehabil. 1990 Nov;17(6):599-609. Abstract/conclusions: Carbon fibre reinforced carbon (CFRC) in the form of a prefabricated post has recently been developed and is theoretically acceptable for consideration in an endodontic post-retained crown system. This study compared four different types of postcore system cemented into 40 extracted anterior human teeth. The test groups consisted of CFRC posts cemented with a composite resin luting agent, and used with either a cast gold alloy core (Group B) or a composite resin core (Group C). Two existing post-core techniques were used as controls for comparison with the CFRC groups. One control was a prefabricated wrought precious alloy post having a cast gold alloy core, and cemented with zinc phosphate cement (Group A). The other was a prefabricated stainless steel post with a composite resin core, and cemented with a composite resin luting agent (Group D). All specimens were restored with a gold alloy crown and tested to failure with an obliquely applied compressive load at 130 degrees in an Instron using a cross-head speed of 5 cm/min. The results showed that post-retained crowns using a prefabricated CFRC post exhibited properties comparable with, and in some cases better than, those of existing prefabricated posts. The mode of failure of specimens restored with a CFRC post was more favourable to the remaining tooth tissue than was that of specimens restored with a metallic post. (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) 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)

Maya, A., Millstein, P, Freeman, Y. Determining post-core retention of smooth-surface metal, non-metal posts. J Dent Res. 77 (Spec Issue A) AADR Abstract #435; 1998 (www.dentalresearch.org). 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 +/-20 lbs).

Osada, T., Warota, S. Hu, K., Kawawa, T. Determining the effect of the post on corono-radicular reconstruction. J Dent Res. Vol 80 (Spec Issue A) IADR Abstract # 1432; 2002 (www.dentalresearch.org). Adhesion between the resin composite and the radicular dentin structure serves an important role by supporting both the core and the superstructure. The aim of this in-vitro study was to investigate the efficacy of two dentin bonding systems and two resin composites on the fracture resistance of pulpless teeth and to determine the effect of the post. Root canal instrumentation was performed for twenty mandibular first premolars and divided into four groups: 1. experimental dentin bonding system (EXP) self-cured resin composite (Clearfil Fli, Kuraray: Fli); 2. EXP/dual-cured resin composite (Clearfil DC CORE, Kuraray: DC); 3. commercial dentin bonding system (ED primer and Clearfil Photo Bond, Kuraray: ED)(Fli:4 ED/DC. Slowly increasing forces were applied perpendicular to the longitudinal tooth axis in an Instron testing machine with a crosshead speed of 0.5 mm/min. until the root fractured. Results [mean SD (Kgl)] were compared with those previously obtained for with and without the C-POST) (Osada et al. JDR 79: 628.2000) using two-way ANOVA and Scheffe test. There was no significant difference in the dentin bonding system/resin composite combinations. When the post was present, the fracture resistance was significantly improved (p<0.01), probably due to reinforcing and supporting of the resin composite core.

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

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. Abstract/conclusions: The purpose of this study was to evaluate a new nondestructive test system, which could be used to 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; 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)

Torbjorner, A., Karlsson, S., Syverud, M., and Hensten-Pettersen, A. Carbon fiber reinforced root canal posts: Mechanical and cytotoxic properties. European Journal of Oral Science. 104: 605-611, 1996. Abstract/ conclusions: The aim of this study was to compare the mechanical properties of a prefabricated root canal post made of carbon fiber reinforced composites (Composipost; RTD, St. Egreve France) with metal posts and to assess the cytotoxic effects elicited. Flexural modulus and ultimate flexural strength was determined by 3 point loading after Composipost posts had been stored either dry or in water. The bending test was carried out with and without preceding thermocycling of the Composipost posts. The cytotoxicity was evaluated by an agar overlay method after dry and wet storage. The values of flexural modulus and ultimate flexural strength were for dry stored Composipost 82+6 GPa and 1154+65 MPa respectively. The flexural values decreased significantly after water storage and after thermo-cycling. No cytotoxic effects were observed adjacent to any Composipost. Although fiber reinforced composites may have the potential to replace metals in many clinical situations, additional research is needed to ensure a satisfying life span. (PDF)
Wiskott, HWA, et al. **Rotational fatigue-resistance of seven post types anchored on natural teeth.** Dental Mater. (2007), doi:10.1016/j.dental.2006.12.001  **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, Biostop, Composipost, Easypost, DT Light-Post, Eversickpost. 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: Biostop, Unimetric-Ti, Unimetric-SS, Composipost, Easypost, Eversickpost, DT Light-Post.  **Significance:** The fatigue resistance of the two fibrous posts with the highest fatigue resistance was twice that of any of the ceramic or metal posts.  **PDF**

### Tooth-Colored: Aestheti-Post / Aestheti-Plus posts

Baldissara, P, Pieri, F, Arcidiacono, A. **Fatigue resistance of fiber posts: a comparative study.** J Dent Res. 80 (Spec Issue A) IADR 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. Fiftysound 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/ Bisco C-POST); 2) All-BOND 2 / C&B Cement (Bisco), 2) Quartz fiber post AesthetiPost (RTD / Bisco); 3) Quartz fiber LIGHT-POST (RTD / 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 / 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 37°C. During each cycle, the load ranged from 3 to 21 Newtons and was applied directly one the post in 45° direction. The controls were stored in water at 27°C. 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 experiments 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.  **Method and Materials:** 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/Bisco) was used in G-3 and the opaque post Aestheti-Plus (RTD/Bisco) 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 (â = .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.

Bodhuis, P, de Gee, A, Feilzer, A. **Influence of fatigue loading on four post-and-core systems in maxillary premolars.** Quintessence 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, upper, 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.

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 (Spec Issue A) 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 manufacturer's 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/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 45° 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. All groups showed statistically similar results (p>0.05). Conclusions: The different preparation depths of the root canals did not influence the results of the strength tests.

Cornier, 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 were readily retrievable (C-Post: 1:21min., Aestheti-PLUS: post 1:17min., and Fk Post: 1:25min.), whereas the remaining post systems (ParaPost metal, CosmoPost ceramic, cast post) were not retrievable. (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 (Spec Issue A) IADR Abstract #1952, 2003 (www.dentalresearch.org) (www.dentalresearch.org). Objectives: Composites are used in post-endodontic core rebuilding 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 & Luxcarex:DMG) and two light-curing composites (Licht-Post: Bisco & HelioMolar: Vivadent) were used to build a core on quartz fiber posts (Light-Post: RTD/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 (RTD/Bisco). In all, 8 groups of 10 specimens each were prepared. All the cores were built by using the same form (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-29.20 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.

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 photactivation, 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

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 C-Posts, Aestheti-Posts and Aestheti-Plus Posts 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, MC, Goracci, C, Vichi, A, Mason, PN, 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 yrs. Methods: 985 posts were included in the study: 615 Composiposts, 160 :Esthetic Posts and 210 :Esthetic 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)

Galgano, 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 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

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)

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 (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 5°C and 55°C. 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.

Lindemann, M, Yaman, P, Dennison, JB, Herrero, AA. 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. 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)

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), carbon-quartz fiber (Aestheti-Post), 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. Conclusion: 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)

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
reliable for clinical use. Not reveal any significant difference in the survival rate of the tested posts, suggesting that all are equally and sufficiently cases (3.5%); in another six cases, a recurrence of the periapical lesion was reported. 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

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. 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 4 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 (Bisco Dental / RTD) post with C & B cement, 3. glass fiber Aestheti-Plus Post (Bisco Dental / RTD) with C&B cement, and 4. glass fiber Light-Post (Bisco Dental / RTD) with dual-curing Duo-Link cement (Bisco Dental) was assessed by means of a micromechanical 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)

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; 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)

Saelee, D., Sooksuntisaokonchais, N., Mangkran, V. AND Jindanusorn, D. Bond strength between quartz fibre posts and core materials. J Dent Res. 81 (Spec Issue A) 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 (Estheti-Plus, R.T.D.,

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 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.

Translucent: Light-Post®, D. T. Light-Post®


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 (DT Light-Post), glass fiber
Conducted for evaluation of the mode of failure (P<.001). 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 (DT Light-Post). Fractures that would allow repeated repair were observed in teeth restored with quartz fiber and glass fiber posts. 

Akkayn, 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 Prosthodont 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 (DT Light-Post-RTD/France), glass fiber ER DentinPost/Brasseler-Komet, Germany), glass fiber plus zirconia (EasyPost, Dentsply-Maillefer, Switzerland), and zirconia (CosmoPost, Ivoclar-Vivadent, Liechtenstein). All dowels were luted with adhesive resin cement (RellyX ARC), restored with composite cores (Valux Plus), and Ni-Gr 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) 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 (DT Light-Post). Fractures that would allow repeated repair were observed in teeth restored with quartz fiber and glass fiber posts.

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. **Method:** Fiber posts (D.T. Light-Post no. 1 [Bisco Dental] and ParaPost FiberLux no. 5 [Coltène/Walident]) 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 effectiveness 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.
the root. The posts were cemented using the dentin adhesive and the cement suggested by the manufacturer: 1) Carbon fiber (Composipost RTD/ Bisco C-POST); ALL-BOND 2 / C&B Cement (Bisco), 2) Quartz fiber post AesthetiPost (RTD / Bisco); ALL-BOND 2 / C&B Cement (Bisco), 3) Quartz fiber LIGHT-POST (RTD / Bisco); 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 / 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 37°C. During each cycle, the load ranged from 3 to 21 Newtons and was applied directly one the post in 45º direction. The controls were stored in water at 27°C. 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.

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 ground, 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, France) showed the best fit (although not ideal) when compared to single tapered or parallel sided posts. The mean canal length was 8.9,±1.4mm. When graphically superimposed on the 3-D images, extremely good adaptation was found with a post having a tapered root portion of 6E(12mm), 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.

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. Materials: 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/Bisco) was used in G-3 and the opaque post Aestheti-Plus (RTD/Bisco) 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 PDF

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. Objective: 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). Method and materials: 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). **Conclusion:** It is concluded from this study that there is no statistical difference in retention between quartz fiber tapered posts (D. T. Light-Post) and stainless steel parallel-sided posts (ParaPost) 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**)

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 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 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 system 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 designed 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 (translucent and off-white) provide a favorable foundation for eliminating discoloration caused by a metallic post placed under all-ceramic crown systems. (**PDF**)

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. **Conclusion:** Restorations placed with the use of a fiber post (DT Light-Post, RTD, France) and core resulted in 4.3% post debondings and 3.0% endodontic failures after 2 years of clinical service. (**PDF**)

Cifuentes, I, Fernandez, A, Petrasic, L, et al **Photoelastic stress distribution for four endodontic post systems.** 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), 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 prefemred 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). **Objective:** 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-Whaledent), IntegraPost (Titanium post, Premier), Mooser Post (Steel-post, Maillefer) and DT-Light Post (Quartz fiber post, RTD, France) were determined with a two-dimensional 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.

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**

Ferrari, M, Cagidiaco, M., Vichi, A., Grandini, S., and 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 endocanalear 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 endocanalear 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 endocanalear 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.

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.

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 fibre 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: Statistical analysis showed that the post diameter did not affect the bond strengths of the fibre posts of the D.T. Light-Post system (p< 0.05, Tukey's test). Posts cemented with Panavia showed higher bond strengths. In the case of size 3 posts this difference was significant (p< 0.05, Tukey's 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.

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 fibre posts underlying a luted crown or a direct composite restoration. Methods: Two groups of endodontically treated teeth restored with DT 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 fibre 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 fibre posts and direct resin composites for restoring root-treated teeth. Materials and 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 fibre posts (DT Light-Post) bonded to the post-space using a ‘1-bottle’ adhesive (One-Step, Bisco) and a dual-cure resin cement (DuoLink, 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. Conclusion: Restoration of endodontically treated teeth with fibre posts and direct resin composites is a treatment option, that in the short term conserves remaining tooth structure and results in good patient compliance.

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) 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)**

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**

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 [Bisco Dental Products, Schaumburg, IL, USA]), 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. **Conclusion:** 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**

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-
Monticelli, F., Grandini, S., Goracci, C., Ferrari, M.

Translucent posts over a follow-up period of between 2 and 3 years. Not to reveal any significant difference in the survival rate of the tested posts, suggesting that all are equally and sufficiently performed. For some patients, 30-month follow-up data were also collected.

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 post roots. Two adhesive systems were used: Scotchbond Multi-Purpose Plus (SBMP) (autopolymerized) as a control group, and Single Bond (SB) (photactivated). 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.

Perdigão, J, Gomes, G, Augusto, V.

The effect of dowel space on the bond strengths of fiber posts. J Prosthet Dent. 2007 May-Jun;107(5):644-9. 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 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
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 Post (Bisco Dental / RTD) post with C & B cement, 3. glass fiber Aestheti-Plus Post (Bisco Dental / RTD) with C&B chemically-cured cement (Bisco Dental), and 4. glass fiber Light-Post (Bisco Dental / 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. (PDF)

Prisco, D., De Santis, R, Mollica, F., Ambrosio, L., Rengo, S., Noccolas, 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 Post (Bisco Dental / RTD) post with C & B cement, 3. glass fiber Aestheti-Plus Post (Bisco Dental / RTD) with C&B chemically-cured cement (Bisco Dental), and 4. glass fiber Light-Post (Bisco Dental / 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. (PDF)
Sawada, N, Hikage, S, Sakaguchi, K, 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, followed by the Tukey test (alpha=.05). Representative specimens from each group were examined with recorded (N). Mean values and SD for DTS values (MPA) were calculated, and data were analyzed statistically with 1-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.

Salameh, Z, Sorrentino, R, Papacchini, F., Ouni, 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. 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.

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 the other metal 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. (PDF)

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 DT Light-Posts (RTD) 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. SEM examination indicated that for PRP failure was 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)

Salameh, Z, Sorrentino, R, Papacchini, F., Ouni, 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. 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.

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. (PDF)

Sawada, N, Hikage, S, Sakaguchi, K. Shape of composite resins photopolymerized by the translucent post. J Dent Res.81 (Spec Issue A) 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/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 (Gripilight 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.

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 **Objectives:** 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. **Methods:** Eight types of fiber post were selected for this study. Fiber Kor (Jeneric-Pentron), Para Post Fiber White (Coltene), Lucsent Anchor (Dentatus), Twin-Lucsent 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 DT 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

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, 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 not 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.

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 DT Light-Posts 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 DT 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 DT Light-Posts can significantly increase the resistance-to-fracture of root-treated maxillary central incisors with thin root walls.

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 (DT Light Post #1 or #2, RTD) 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. Conclusion: 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.

Valandro, L., Bottino, M., Galhano, G., Melo, R., Mallmann, A., Baldissara, P., Scotti, R., Mechanical cycling of FRC resin-bonded to root dentin J Dent. Res Vol 85 (Spec Issue B) Abstract 0083, 2006 (www.dentalresearch.org). Objectives: This study evaluated the effect of the mechanical cycling on the bond strength of fiber posts resin bonded to root dentin. Methods: The tooth crown of the 60 single-rooted human teeth was cut, leaving a 16-mm long root specimens (sp) that were endodontically treated and the space prepared in 12mm. Thirty sp received a quartz fiber post (D.T. Light-Post) and 30 sp received a glass fiber post (FRC Postec Plus). The posts were resin luted in the post space and each sp was embedded with epoxy resin (resin 285, Schaller, Florence, Italy) in a PVC cylinder (height: 25 mm, diameter: 10 mm). Sp were divided into 6 groups, considering the fiber post type and number of the mechanical cycles (load: 50 N; angle of 45°; frequency: 8Hz): G1- DT + without cycling; G2- DT + 20,000 cycles; G3- DT + 2,000,000 cycles; G4- FRC + without cycling; G5- FRC + 20,000 cycles; G6- FRC + 2,000,000 cycles. The sp were cut perpendicular to their long axis, to form 2-mm-thick disk-samples (4 sections / sp), which were submitted to the push-out test (1mm/min). The mean bond strength values were calculated for each tooth (n=10) and data were statistical analyzed (alpha=0.05). Results: ANOVA revealed that: (a) the bond strengths of DT (7.12 ± 2.20 MPa) and of FRC (6.87 ± 2.12 MPa) were statistically similar (P=0.665); (b) the mean values for the “without cycling” groups (6.96 ± 2.44 MPa), “20,000 cycles” groups (6.99 ± 2.08 MPa) and “2,000,000 cycles” groups (7.02 ± 2.00 MPa) were not statistically different (P=0.996); (c) the 6 groups were not statistically different (P=1.000). Conclusion: The mechanical cycling did not affect the bond strength of two fiber posts resin bonded to dentin.

Wiskott, HWA, et al. Rotational fatigue-resistance of seven post types anchored on natural teeth. Dental Mater. (2007) doi:10.1016/j.dental.2006.12.001 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, Everstickpost, DT Light-Post. Significance: The fatigue resistance of the two fibrous posts with the highest fatigue resistance was twice that of any of the ceramic or metal posts.
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, 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 DT Light-Post (149.9 N +/- 29.5 N) was higher than the tensile bond strengths of the combinations MultiCore Flow/DT 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.