ACCESSORY POST BIBLIOGRAPHY
(December, 2014)

Aggarwal, V., Singla, M., Miglani, S., Kohli, S. **Comparative evaluation of fracture resistance of structurally compromised canals restored with different dowel methods.** *J Prosthodont. 2012 Jun;21(4):312-316. doi: 10.1111/j.1532-849X.2011.00827.x. Epub 2012 Feb 19.*

Purpose: The objective of this in vitro study was to evaluate and compare the fracture resistance and fracture mode of endodontically treated teeth with wide root canals restored with various dowel methods. **Methods:** Fifty human uni-radicular mandibular premolar teeth were de-coronated and endodontically-treated. The canals were widened with diamond points. The specimens were divided into five groups on the basis of type of dowel method used: conventional custom-made cast metal dowel; single glass fiber-reinforced resin dowel; glass fiber-reinforced resin dowel with accessory fiber dowels; relined glass fiber-reinforced resin dowel; and dowels formed with the help of polyethylene fiber ribbon-reinforced resin composite. Specimens were restored with indirect composite crowns, and 150,000 cycles of cyclic loading were applied. The specimens were loaded to test the fracture resistance and fracture mode (repairable and non-repairable). **Results:** The cast metal dowel groups had the highest fracture resistance but showed non-repairable fracture in 90% of specimens. **Conclusions**: Cast metal dowels had the highest fracture resistance but led to non-repairable fracture while restoring the wide root canals under cyclic loading. Specimens restored with fiber dowels, accessory dowels, relined dowels, and ribbon-reinforced resin provided adequate fracture resistance with increased incidence of repairable fractures. **PDF**

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

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

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

In contemporary restorative dentistry, post-root canal adaptation always represents an important role in successful and long-lasting treatment for the restoration of endodontically treated teeth. In some cases posts have to be placed in wide oval-formed root canal spaces. However, the impact of the treatment outcome of the increasing non-uniform cement thickness around the posts has not yet reached a consensus. The purpose of this research is to assess the treatment outcome of post systems with three different post geometries, combined with/without accessory posts as an alternative technique in the oval-shaped canals. Seventy-two teeth with oval-shaped canals were selected for the study. Crowns were sectioned at the cemento-enamel junction and endodontically treated. The roots were randomly divided into 2 groups of 36 specimens and each group was split into 3 subgroups of 12 as follows; G1-A, Quartz fiber post with double tapered cross-section (QFibDT); G1-B, Quartz fiber post with circular cross-section (QFibCir); G1-C Quartz fiber post with oval cross-section (QFibOv); G2-A Quartz fiber post with double tapered cross-section +

two accessory quartz fiber posts (QFibDTAcces); G2-B Quartz fiber post with circular cross-section + two accessory quartz fiber posts (QFibCirAcces); G2-C Quartz fiber post with oval cross-section + two accessory quartz fiber posts (QFibOvAcces). Root canal preparations were performed with low-speed Torpan Drill tips of ISO 90, ISO 100 and ISO 120 in increasing order. All posts were cemented with self-adhesive dual polymerizing resin cement. Two specimens from each group were randomly chosen upon the cementation of all posts and processed for stereomicroscope (SM) evaluation of the fiber post-cemented interface. All sixty specimens were then embedded in auto polymerizing acrylic resin surrounded by aluminum cylinders and light-polymerized composite cores were produced. Pressed all ceramic crowns were cemented on each core. Specimens were secured in a universal testing machine with the use of a device that allowed loading of the specimens lingually at 135 degrees to the long axis. A compressive force was applied at a crosshead speed of 1 mm/min until fracture occurred. The fracture loads (N) were determined and the obtained data were analyzed by 1-way ANOVA with interaction followed by Tukey HSD tests. Student's t test was used for between group comparisons. Representative stereomicroscope images and cement thickness measurements were performed on 2 mm sectioned specimens. Within-group comparisons for Group 1 specimens demonstrated statistically higher fracture strength values for groups cemented with G1-A, DT Light Post (590 N) and G1-B, Match Post (570,9 N) groups compared to G1-C, Ellipson Post group (400,83 N) ($p<.001$). The highest fracture resistance was recorded for G2-A (QFibDTAcces) at 764,18 N, followed by group G2-B (QFibCirAcces) at 726,5 N. Within-group comparisons of these two groups (G2-A, G2-B) resulted in statistically higher fracture resistance of teeth compared to G2-C (QFibOvAcces) at 574,96 N ($p<.001$). Regardless of the post system geometry tested in this study, Group 2 specimens resulted in statistically higher fracture strength values compared to Group 1 specimens according to between group comparisons ($p<.001$). No catastrophic failures were present and there were no root fractures. **Conclusions:** It can be speculated that when restoring with posts, especially in wide oval-shaped canals, the use of accessory posts reduces the cement thickness around the posts thus increasing the endodontically treated teeth resistance to fractures. **PDF**

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

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

Belli, S., Eraslan, O., Eraslan, O., Eskitascioglu, G. Effect of post-restoration on stress-distribution in roots with over-flared canals. *J Dent Res. Vol 91 (Spec. Iss. B) Abstract #160067, 2012 (www.dentalresearch.org)*

Objective: The aim of this finite element analysis (FEA) study was to test the effect of five different restorative techniques on stress distribution in roots with over-flared canals. **Method:** Six types of three-dimensional (3-D) FEA mathematical models simulating a maxillary incisor with supporting structures were created as follows: a) sound; b) with an over-flared root-canal restored using a prefabricated post; c) restored using one main and two accessory posts; d) restored with i-TFC system (Sun Medical, Japan); e) the thickness of the a root has been increased using composite resin and the root was then restored using a prefabricated post; f) an over-flared root restored with an anatomic post. The cores were created using composite resin. A 300-N static vertical occlusal load was applied on the node at the center of occlusal surface of the tooth to calculate stress distributions. Solidworks / Cosmosworks structural analysis programs were used for FEA analysis. **Result:** The analysis of the von Mises stress values revealed that accessory post and i-TFC post system showed almost similar stress distribution. They both showed high stress areas at the buccal side of the root (3.67 MPa) and at the cervical region (>3.67 MPa) and low stress accumulation within the post space (0-1 MPa). Anatomic post has kept the stress inside its body and forwarded less stress towards the remaining tooth and root structure and has showed an advantage for the remaining root structure. **Conclusion:** Creation of an anatomic post using composite resin and glass fiber post can save the remaining tooth structure in roots with over-flared canals.

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

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

Bonfante, G, Kaizer, O.B, Pegoraro, L.F, do Valle, A.L. **Fracture strength of teeth with flared root canals restored with glass fibre posts.** *Int Dent J. 2007 Jun;57(3):153-60.*

Objective: to investigate the fracture strength and pattern of failure of teeth with weakened roots reconstructed by different procedures. **Methods:** In an in vitro study root posts were placed in 50 endodontically treated canines, divided into 5 groups (n=10) as follows: cast metallic post; glass fibre post with smaller diameter than the root canal; glass fibre post with smaller diameter than the root canal + glass fibre strips; glass fibre post with smaller diameter than the root canal + accessory glass fibre posts; anatomical post (glass fibre post with smaller diameter than the root canal, relined with low viscosity composite resin). Posts were luted with resin cement and the coronal portion of posts was constructed with composite resin. Metallic crowns were cemented on the posts. Specimens were submitted to compressive load in a universal testing machine. Fracture strength values of each group were compared. **Results:** Fracture strength values were for Groups 1-5 respectively: 1087.06; 745.69; 775.41; 920.64; 876.12 kgf, with significant differences between Groups 1 and 2 and between Groups 1 and 3 ($p<0.05$). Observed patterns of fracture were: Group 1 - 100% of roots fractured; Groups 2 and 4 - variable fracture modes; Group 3 - 60% of fractures occurred in the cervical root third; Group 5 - 50% of failures occurred in the coronal portion of the post. **Conclusions:** The fracture strength of teeth with cast metallic posts, teeth with anatomical posts or teeth with glass fibre posts combined with accessory posts was similar. All teeth restored with cast metallic posts presented fractures and were unfavourable to maintenance of the remaining tooth structure. Teeth with fibre posts (Groups 2 to 5) presented variable fracture modes; however, the maximum percentage of unfavourable fractures was 30%. **PDF**

Braz, R, Conceição, AAB, Conceição, E.N., Loretto, S.C., Lyra, A.M.V.C., Silva, .A.K.S. **Evaluation of reinforcement materials used on filling of weakened roots**. *J Dent Res. Vol 84 (Spec. Iss. A) Abstract #1733, (www.dentalresearch.org)*

Objectives: The purpose was to evaluate flexural strength of glass fiber posts associated with filling materials used for root reinforcement, and fracture resistance of flared roots reinforced with the same materials. **Methods:** For flexural test, 10 cylinders, 3.5mm (diameter) and 14mm (length), were made for each group, according to the reinforcement material used: G1 - Reforpost (Angelus)+dual resin cement Variolink II (Ivoclar/VIvadent); G2 - Reforpost+dual composite core BisCore (Bisco); G3 - Reforpost+three accessory posts Reforpin (Angelus)+Variolink II. Cylinders were dry stored (24h) and tested in a universal testing machine (0.5mm/min). For fracture resistance test, 30 human maxillary canines were used and their crowns removed at the cement-enamel junction (CEJ). The canals were endodontically treated, after which the fillings were removed and the canals widened by 3.5mm, simulating flared canals. The dual adhesive system Excite DSC (Ivoclar/Vivadent) was applied to the roots, which were randomly divided into 3 groups as performed for flexural strength test. After the cementation, coronal complements were made with composite-resin and the roots were assembled in metallic cylinders filled with self-curing acrylic-resin 2mm below the CEJ. After storage (24h), the samples were fixed at a 45º angle to a metal funneled tip that applied a force on the lingual surface (0.5mm/min). Statistics were performed using analysis of variance and Tukey`s test (5%). **Results:** The flexural mean values (MPa) were: G1 - 206.52, G2 - 224.39 and G3 – 272.64, showing a statistically difference between the reinforcement materials used, with G3 presenting statistically higher flexural strength compared to other groups. For fracture resistance, mean values (Kgf) were: G1 – 47.45, G2 – 66.57 and G3 – 74.11, showing that G1 presented a statistically lower mean value than the other groups. **Conclusion:** Therefore, it was possible to conclude that glass fiber post, associated with accessory posts, is the method of choice for reinforcing structurally weakened roots.

Cardoso, P.E., Valera, M.C., Oliveira, L.D., Camargo, C.H.R Carvalho, C.A.T**. Fracture resistance of endodontically treated immature roots after different reinforcements.** *J Dent Res. Vol 90 (Spec. Iss. A) Abstract # 3103, 2011 (www.dentalresearch.org)*

Objectives: This study evaluated fracture resistance of brittleness bovine teeth simulating immature teeth, that received different reinforcements within radicular canal. This evaluation was made in comparison to teeth without reinforcements within radicular canal and teeth no brittleness. **Methods:** For that purpose, seventy bovine mandibular incisors were selected; of these, 56 were internally prepared, and then to simulating immature roots, were enlarged with Gates-Glidden, fast steel and videa burs. The specimens were distributed into five groups (n= 14): a) carbon fiber post and three accessory glass fiber posts; b) carbon/glass post and three accessory glass fiber posts; c) composite resin reinforcement; d) without reinforcement and e) without canal preparation and without reinforcement . The specimens were submitted to the fracture resistance testing with application of tangential compressive loading at an angle of 45º, at a speed equivalent to 1mm/min until the fracture using EMIC machine. **Results:** Results

were subjected to statistical analysis (Tukey, t student and Dunnet), at a significance level of 5%. Results indicated statistically significant differences (p <0,05) in relation to root conditions. G1 presented higher resistance in comparison with other groups and G4 presented smaller resistance. **Conclusion:** It could be ended like this that the use of intra-radiculars reinforcements with different posts or resins composite increased fracture resistance of brittleness teeth under compression force.

Clavijo, V.G, Reis, JM, Kabbach, W, Silva, AL, Oliveira Junior, OB, Andrade, MF. **Fracture strength of flared bovine roots restored with different intra-radicular posts**. *J Appl Oral Sci. 2009 Nov-Dec;17(6):574-8.*

Objective: The aim of this study was to evaluate the fracture strength and failure mode of flared bovine roots restored with different intra-radicular posts. **Methods:** Fifty bovine incisors with similar dimensions were selected and their roots were flared until 1.0 mm of dentin wall remained. Next, the roots were allocated into five groups (n=10): GI- cast metal post-and-core; GII- fiber posts plus accessory fiber posts; GIII- direct anatomic post; GIV- indirect anatomic post and GV- control (specimens without intra-radicular post). A polyether impression material was used to simulate the periodontal ligament. After periodontal ligament simulation, the specimens were subjected to a compressive load at a crosshead speed of 0.5 mm/min in a servo-hydraulic testing machine (MTS 810) applied at 135 masculine to the long axis of the tooth until failure. The data (N) were subjected to ANOVA and Tukey's post-hoc test (alpha=0.05). **Results:** GI and GIV presented higher fracture strength ($p<0.05$) than GII. GIII presented intermediate values without statistically significant differences ($p>0.05$) from GI, GII and GIV. Control specimens (GV) produced the lowest fracture strength mean values ($p<0.05$). Despite obtaining the highest mean value, GI presented 100% of unfavorable failures. GII presented 20% of unfavorable failures. GIII, GIV and GV presented only favorable failures. **Conclusions:** Although further in vitro and in vivo studies are necessary, the results of this study showed that the use of direct and indirect anatomic posts in flared roots could be an alternative to cast metal post-and-core. **PDF**

Costa, R.G.,Morais, E.C.C. Moreira-Da-Silva, S.M.L. Michel, M.D., Gonzaga, C.C.,Correr G.M. Bindo, M.J.F., Campos,E.A., **Fatigue and fracture resistance of customized fiber dowel**. *J Dent Res. Vol 90 (Spec. Iss.A) Abstract # 3103, 2011 (www.dentalresearch.org)*

Objectives: The aim of this study was to evaluate the root fracture strength of human uni-radicular premolars restored with customized fiberglass dowel-core systems after fatigue simulation. **Methods:** Forty premolars with standard dimensions were chosen, cleaned, and stored in 0.5% chloramine T. The crowns were cut and the root length was standardized to 13 mm. The teeth were endodontically treated and embedded in acrylic resin. The specimens were distributed into 4 groups (n = 10) according to the restorative material used: G1 (prefabricated fiber post), G2 (prefabricated fiber post + accessory fiber posts), G3 (prefabricated fiber post + unidirectional fiberglass), and G4 (unidirectional fiberglass customized post). All posts were luted using resin cement and the cores were build-up with a composite resin, following manufacturer instructions. The samples were stored for 24 hours at 37°C and 100% relative humidity and then submitted to mechanical cycling (250.000 cycles with 30 N at a frequency of 2 Hz). The specimens were then compressive-loaded in a universal testing machine with a 3000 N load cell at a crosshead speed of 0,5 mm/min until fracture. The failure patterns were analyzed and classified. Data was submitted to statistical analysis (one-way ANOVA and Tukey's test) at a significance level of 5%. Descriptive analysis was used to assess the failure pattern. **Results:** The mean values of maximum load (N) were: G1 - 811,4 ± 124,3; G2 - 729,2 ± 157,2; G3 - 747,5 ± 204,7; G4 - 762,4 ± 110. Statistical differences were not observed among the groups. G1 showed more catastrophic failures than the other groups. G2, G3, and G4 showed 100% non-catastrophic failures. **Conclusions:** It can be concluded that dowel-core techniques do not interfere with the fracture strength of the tooth/dowel/core system; conversely, customized posts showed reversible and favorable type of failures.

Costa, RG, De Morais, EC, Campos, EA, Michel, MD, Gonzaga, CC, Correr, GM. **Customized fiber glass posts. Fatigue and fracture resistance.** Am J Dent. 2012 Feb;25(1):35-8

Purpose: To evaluate the root fracture strength of human single-rooted premolars restored with customized fiberglass post-core systems after fatigue simulation. **Methods:** 40 human premolars had their crowns cut and the root length was standardized to 13 mm. The teeth were endodontically treated and embedded in acrylic resin. The specimens were distributed into four groups (n=10) according to the restorative material used: prefabricated fiber post (PFP), PFP+accessory fiber posts (PFPa), PFP+unidirectional fiberglass (PFPf), and unidirectional fiberglass customized post (CP). All posts were luted using resin cement and the cores were built up with a resin composite. The samples were stored for 24 hours at 37 degrees C and 100% relative humidity and then submitted to mechanical cycling. The specimens were then compressive-loaded in a universal testing machine at a crosshead speed of 0.5 mm/minute until fracture. The failure patterns were analyzed and classified. Data was submitted to one-way ANOVA and Tukey's test (alpha = 0.05). **Results:** The mean values of maximum load (N) were: PFP - 811.4 +/- 124.3; PFPa - 729.2 +/- 157.2; PFPf- 747.5 +/- 204.7; CP - 762.4 +/- 110. Statistical differences were not observed among the groups. All groups showed favorable restorable failures. **Conclusions:** Fiberglass customized post did not show improved fracture resistance or differences in failure patterns when compared to prefabricated glass fiber posts. **PDF**

da Rosa, R. A., Barreto , M. S., da Rosa, T.A., Reis, K.R., Kaizer, O.B. **Fracture resistance of weakened teeth restored using accessory glass fiber posts.** *Gen Dent. 2013 Mar-Apr;61(2):45-9.*

This study used differential root weakening to evaluate the fracture resistance of bovine teeth restored using glass fiber posts (with or without accessory glass fiber posts). Fifty bovine mandibular incisors were sectioned 14 mm from the apex, fixed in acrylic resin blocks, and divided into 5 groups: healthy roots with a glass fiber post (Group 1), partially weakened teeth with a glass fiber post (Group 2), partially weakened teeth with a glass fiber post and 2 accessory glass fiber posts (Group 3), extensively weakened teeth with a glass fiber post (Group 4), and extensively weakened teeth with a glass fiber post and 5 accessory glass fiber posts (Group 5). Posts were luted with resin cement, cores were prepared using composite resin, and metallic crowns were cemented. The specimens were stored in distilled water at 37°C for more than 72 hours until the fracture resistance test. Specimens were loaded at 135 degrees relative to the long axis of the tooth at a crosshead speed of 0.5 mm/minute in a universal testing machine. **Conclusion:** All groups predominantly exhibited favorable failure patterns and there were no statistically significant differences between groups (two-way ANOVA, $\alpha = 0.05$).

da Silva GR, Santos-Filho, PC, Simamoto-Júnior, PC, Martins, L,R, Mota, A,S,, Soares, C.J. **Effect of post type and restorative techniques on the strain and fracture resistance of flared incisor roots**. *Braz Dent J. 2011;22(3):230-7.*

Restoring flared endodontically treated teeth continues to be a challenge for clinicians. This study evaluated the effect of post types and restorative techniques on the strain, fracture resistance, and fracture mode of incisors with weakened roots. One hundred five endodontically treated bovine incisors roots (15 mm) were divided into 7 groups (n=15). The two control groups were (C) intact roots restored with Cpc (cast posts and core) or Gfp (glass fiber posts). The five experimental groups were (F) flared roots restored with GfpAp (Gfp associated with accessory glass fiber posts), GfpRc (anatomic Gfp, relined with composite resin), and GfpRcAp (anatomized Gfp with resin and accessory glass fiber posts). All teeth were restored with metal crowns. Mechanical fatigue was performed with 3x10(5)/50 N. Specimens were loaded at 45º, and the strain values (μS) were obtained on root buccal and proximal surfaces. Following that, the fracture resistance (N) was measured. One-way ANOVA and Tukey's HSD tests (α=0.05) were applied, and failure mode was checked. **Conclusions:** No significant difference in strain values among the groups was found. Cpc presented lower fracture resistance and more catastrophic failures in flared roots. Gfp associated with composite resin or accessory glass fiber posts seems to be an effective method to improve the biomechanical behavior of flared roots. **PDF**

Gomes, GM, Rickli, EH., Gomes, OMM, Rezende, EC, Gomes, JC, Loguercio, AD, Reis, **A. Fracture strength of bonded fiber-post techniques to flared roots**. *J Dent Res.Vol 92 (Spec Iss A) Abstract #1852, 2013 (www.dentalresearch.org)*

Objectives: The aim of this study was to evaluate the effect of alternative techniques to improve the adaptation of pre-fabricated fiber posts (FP) to oversized dowel spaces on the tooth fracture resistance (FR) of metal-free restorations after mechanical fatigue (MF). **Methods:** The root canals of 24 single-rooted mandibular premolars were prepared, and they were randomly divided into 4 groups. In groups GPC (positive control), the root canal was prepared with a drill compatible with the FP # 0.5 (Whitepost DC, FGM). In groups GNC (negative control), GAP (accessories posts) and GAD (anatomical direct post), oversized root canals were prepared and the FP # 0.5 were cemented without any additional technique (GNC), with accessories post (GAP) and after individualization of the FB with a composite resin (GAD). The luting procedures were performed with the adhesive Excite DSC and the resin cement Variolink II (Ivoclar Vivadent) according to the manufacturer's recommendations. Metal-free crowns were cemented on composite resin cores, the periodontal ligament was simulated and the specimens were submitted to MF (1.2 X 10^6 cycles, 30 N) followed by FR test at a compressive load (0.5 mm/min). The data were subjected to one-way ANOVA and Tukey's tests (α = 0.05). **Results:** The means and standard deviations of FR (N) for each group were: GPC: 1024.1±26.5, GNC: 740.8±126.2, GAP: 1051.9±200.6 and GAD: 785.5±17.0. The highest FR values were observed for GPC and GAP ($p < 0.0001$), which were similar one another. **Conclusion:** To improve the fracture resistance of metal-free crowns bonded to oversized root canals, it is advisable to use prefabricated fiber posts in combination with accessory posts.

Gomes, GM, Gomes, OM, Gomes, JC, Loguercio AD, Calixto AL, Reis A. **Evaluation of different restorative techniques for filling flared root canals: fracture resistance and bond strength after mechanical fatigue**. *J Adhes Dent. 2014 Jun;16(3):267-76. doi: 10.3290/j.jad.a31940.*

Purpose: To evaluate the fracture resistance (FR) and bond strength (BS) after mechanical fatigue (MF) of flared root canals restored with different restorative techniques for fiber post cementation. **Methods:** The root canals of 84 single-rooted premolars were endodontically treated and prepared in order to simulate an oversized root canal, except for the positive control group (PC), in which a prefabricated fiber post (PFP) with a diameter compatible with the post cavity was cemented. In the oversized root canals, alternative restorative techniques for post cementation were tested, as follows: NC: negative control (PFP with a diameter smaller than that of the root canal); AP: PFP + accessory posts; RR: root reinforcement with composite resin; DAP: direct anatomical post; IAP: indirect anatomical post. After the luting procedures using Excite DSC and Variolink II, indirect composite crowns were cemented on composite resin cores and the specimens were mechanically fatigued (1.2 x 106 cycles, 40 N). From each group, 8 specimens were subjected to

the push-out BS test and the others 6 specimens to the FR test. For both tests, the data were subjected to ANOVA and Scheffe's tests ($\alpha = 0.05$) **Results:** In terms of FR, all alternative techniques showed intermediate performance, being similar to both control groups. In terms of BS, only the groups DAP and IAP were similar to the well-adapted condition (positive control group). **Conclusion:** The use of DAP and IAP should be the first choice for fiber post cementation in oversized root canals.

Latempa, A.M.A, Almieda, S.A., Nunes, N.F., deSilva, E.M., Guimaraes, LJ.G.A. and Poskus, L.T. **Techniques for restoring enlarged canals: as evaluation of fracture resistance and bond strength.** *International Endodontic Journal, doi:10.1111/jej. 12272, 2014*

Aim: To verify the influence of fiberglass post diameter, as well as the use of accessory posts on fracture resistance and bond strength, when used for restoring enlarged root canals. **Methodology:** 100 maxillary single rooted canine human teeth were decoronated and root canals were prepared using a number 4 drill (White Post, FGM). The roots were assigned into five groups (EC1) Post number 1 (Exacto Conical , Angelus, Londrina, PR Brazil); (EC2) post number 2, (DC3) post number 3 Exacto , (ECA) post number 1 Exacto +2 accessory posts and (WP) post number 4 (White Post, FGM). Posts 1-4 have a crescent diameter. Post were luted (Rely-X Arc, 3M ESPE, USA), and composite resin filling cores were prepared for the fracture resistance test (n =10). For the push out -test (n=10), roots were sectioned into one millimeter thick slices. Both tests were performed in the universal testing machine. Data were analyzed using ANOVA and Tukey's Test. **Results:** group's WP, and DC three, had higher fracture resistance than the other groups ($P < 0.05$), which were statistically similar. Root fractures occurred in 14% of the specimens. Group EC1 and IC2 had lower bond strength values and groups EC3 and ECA, which were lower than the WP group ($P < 0.05$). **Conclusions:** thicker posts were associated with higher resistance to fracture and bond strength through canals. Using a post +2 accessory post improved the bond strength but not the fracture resistance. **PDF**

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

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

Maceri, F, Martignoni, M, Vairo, G. **Optimal mechanical design of anatomical post-systems for endodontic restoration.** *Comput Methods Biomech Biomed Engin. 2008 Jul 16:1. [Epub ahead of print]*

This paper analyses the mechanical behaviour of a new reinforced anatomical post-systems (RAPS) for endodontic restoration. The composite restorative material (CRM) completely fills the root canal (as do the commonly used cast metal posts) and multiple prefabricated composite posts (PCPs) are employed as reinforcements. Numerical simulations based on 3D linearly elastic finite element models under parafunctional loads were performed in order to investigate the influence of the stiffness of the CRM and of the number of PCPs. Periodontal ligament effects were taken into account using a discretised anisotropic nonlinearly elastic spring system, and the full discrete model was validated by comparing the resulting stress fields with those obtained with conventional restorations (cast gold-alloy post, homogeneous anatomical post and cemented single PCP) and with the natural tooth. Analysis of the results shows that stresses at the cervical/middle region decrease as CRM stiffness increases and, for large and irregular root cavities that apical stress peaks disappear when multiple PCPs are used. Accordingly, from a mechanical point of view, an optimal RAPS will use multiple PCPs when CRM stiffness is equal to or at most twice that of the dentin. **Conclusion**: This restorative solution minimizes stress differences with respect to the natural tooth, mechanical inhomogeneities, stress concentrations on healthy tissues, volumes subject to shrinkage phenomena, fatigue effects and risks of both root fracture and adhesive/cohesive interfacial failure. **PDF**

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

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

Martelli-Júnior, H, Gonini-Júnior A, Wang L, Fabre HSC, Pereira WB., **Fracture resistance of endodontically- treated teeth restored with glass fiber accessory posts.** *J Dent Res. Vol 84 (Spec. Iss. B) 2005 (www.dentalresearch.org)*

Caries, fractures or endodontic procedures can leads to a loss of dental structure, weakening the remaining dental structure. This can increase the risk of root fracture, even after restoration of affected tooth. The aim of this work is to evaluate the behavior of extremely compromised roots when restored with accessory glass fiber posts, which are meant to fill the internal root remaining space. Thirty roots of bovine teeth with compatible diameter were selected for this study. The roots received preparations to provide regular internal walls and occlusal divergence, obtaining a cervical diameter of 3,5mm. The teeth were divided in 5 groups of 6 teeth each as a pilot test. In Group 1 cores of metal alloy were used as control. In Group 2 the main glass fiber posts were used, and in Group 3 the accessory posts were added. Groups 4 and 5 were similar to Groups 1 and 2, with preservation of 3mm of remaining crown. The teeth were submitted to an elastic limit essay, simulating anterior teeth with a class I occlusion. The mean value of elastic limit was 55.25, 73.50, 67.52, 60.42, and 58.46 Kgf respectively for Groups 1 to 5, however, no significant statistic difference occurred. All of the essays resulted in root fracture, except in Group 3, where 83.4 % of the samples did not present root fracture. **Conclusions:** Within the limitations of this study the following conclusion can be made: the utilization of accessory glass fiber posts can be an alternative technique for the restoration of teeth presenting ample root destruction.

Martelli, H Jr, Pellizzer, EP, Rosa, BT, Lopes, MB, Gonini, A. Jr. **Fracture resistance of structurally compromised root filled bovine teeth restored with accessory glass fibre posts.** *Int Endod J. 2008 Aug;41(8):685-92. Epub 2008 Jun 28.*

Aim: To evaluate the mechanical behaviour of structurally compromised root filled bovine roots after restoration with accessory glass fibre posts. **Method:** Fifty roots of bovine teeth received conventional post preparations with a cervical diameter of 3.5 mm. The roots were assigned to five groups (n = 10): group MP - cast metal post, group GP - glass fibre post and group AGP - glass fibre post plus accessory glass fibre posts. In groups GP-R and AGP-R (similar to groups GP and AGP), 2 mm of coronal tooth structure were left intact. All groups were subjected to an elastic limit assay and tested in an universal machine for fracture resistance. Repeated measures anova were performed to examine differences in fracture resistance; fracture modes were analysed by Fischer's exact test. **Results:** The mean fracture resistance values (kgf) were 61.8 (MP), 63.1 (GP), 55.5 (AGP), 56 (GP-R) and (53.1) AGP-R. No statistically significant difference was found between groups. The Fisher's exact test indicated significant differences ($P < 0.05$) in the fracture mode amongst groups MP, GP and AGP, indicating 100%, 50% and 10% of catastrophic fractures, respectively. **Conclusions:** The use of accessory glass fibre posts affected the fracture mode favorably: 90% of fractures in group AGP were in the coronal third. **PDF**

Moosavi, H, Maleknejad, F, Kimyai S. **Fracture resistance of endodontically-treated teeth restored using three root-reinforcement methods.** *J Contemp Dent Pract 2008 January; (9)1:030-037.*

Aim: The aim of this in vitro study was to compare the fracture resistance of endodontically-treated anterior teeth with their roots reinforced using three different restorative methods. **Methods and Materials:** Forty sound maxillary human central incisors were randomly assigned to four groups (n=10). The crowns of the teeth were removed at a level 2 mm incisal to the cementoenamel

junction (CEJ). After root canal therapy, flared canals were simulated in three groups. In the first, second, and third groups the flared canals were reinforced with resin composite (RCO) (Clearfil DC Core Automix), two Reforpins (REF), and a resin cement (RCE) (Panavia F 2.0), respectively. In the fourth (DEN) group flared canals were not created. The same size fiber reinforced composite (FRC) posts were cemented with resin cement (Panavia F 2.0) in all groups. After post cementation and restoration of the teeth crown with a core build-up composite (Clearfil Photo Core), the roots of the teeth were embedded in acrylic resin blocks up to 1 mm below the CEJ. The samples were loaded in an Instron testing machine with a crosshead speed of 0.5 mm/min at a 45o angle to the long axis of the tooth on the palatal surfaces until failure occurred. Data were analyzed using the Kruskal-Wallis, Mann- Whitney, and Chi-square tests (p=0.05). **Results:** Significant differences were found between fracture resistance in all of the groups (P<0.05) with the exception being among the RCO and REF groups. The least mean value 230 (130) N and the highest mean value 830 (220) N were shown in the fracture resistance of the RCE and DEN groups, respectively. **Conclusion:** Reforpin can be used as an alternative to resin composite for internal reinforcement of weakened roots according to the results of this study. For reinforcement of flared canals, fiber posts along with Reforpin or resin composite proved to have higher fracture resistance than resin cement. Non flared canals had the highest fracture resistance. **PDF**

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

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

Raposo, L.H.A. Silva, G. R., Santos-Filho, P.C.F., Soares, P.V., Soares, C.J. **Effect of posts and materials on flared teeth's mechanical behavior.** *J Dent Res. Vol 90 (Spec. Iss. A) Abstract #1862, 2008 (www.dentalresearch.org)*

Objectives: Assess the effect of different post systems and restorative techniques on stress-strain behavior and fracture resistance of flared roots. **Methods:** The coronary portion was removed from 105 bovine incisors, leaving a 15.0 mm root. After endodontic treatment samples were embedded in polystyrene resin and the periodontal ligament was simulated. The specimens were divided into 7 groups (n=15) and the roots of two reference groups were restored with cast post and core (CPC – G1) and fiber-glass post (FGP – G2). In the other groups, root canal were flared and restored with CPC (G3); FGP (G4); FGP and accessories FGP (G5); and FGP directly (G6) or indirectly (G7) rebased with accessories FGP and composite resin. All teeth were restored with all-metal crowns. Samples were submitted to mechanical fatigue (3x105 cycles of 50N). Strain-gauges were attached to the roots and strain values (μS) were obtained under a 100N load. Fracture resistance (N) was tested with a oblique load at a 0.5 mm/min cross-head speed. Data were analyzed with one-way ANOVA and Tukey HSD test (p<0.05). Failure mode was classified in accordance to the degree of dental structure destruction. Bi-dimensional finite element analysis was performed with representative models of each group, based on von Mises stress distribution criteria.Results: The results (N) were: G6- (867.9±198.1)a; G1- (859.9±199,2)a; G7- (847±112.2)a; G5- (842.7±174)a; G2- (627.1±119,8)b; G4- (625.3±164,3)b; G3- (620.2±164.2)b. There was no significant difference in the strains measured among groups, however, CPC increase catastrophic failures. Finite element analyses revealed higher stress concentration in CPC than in FGP, irrespective of restorative technique. **Conclusion:** Fiber-glass posts associated with composite resin or with accessory fiber-glass posts seem to be more indicated as alternative to cast post and core in flared roots, because of the lower risk of catastrophic failures and better stress distribution.

Saavedra, G.D.S.F.A., Zogheib, L., Komori, P.C.D.P., Borges, A.L.S. , TANGO, R.N., et al. **Resistance to compression of weakened roots submitted to root reconstruction.** *J Dent Res. Vol 90 (Spec. Iss. A) Abstract # 1121, 2011 (www.dentalresearch.org)*

Objective: This study evaluated, in vitro, the fracture resistance of human non-vital teeth restored with different reconstruction protocols. **Methods:** Forty human anterior roots of similar shape and dimensions were assigned to four groups (n=10), according to root reconstruction protocol: Group I (control): non weakened root with glass fiber post; Group II: root with resin composite by incremental technique and glass fiber post; Group III: root with accessory glass fiber posts and glass fiber post and Group IV: root

with anatomic glass fiber post technique. Following post cementation and core reconstruction, the roots were embedded in chemically activated acrylic resin and submitted to fracture-resistance testing, with a compressive load at an angle of 45° in relation to the long axis of the root at a speed of 0.5 mm/min until fracture. All data were statistically analyzed with bilateral Dunnett test (5%). **Results:** Group I presented higher mean values of fracture resistance when compared to three experimental groups. Besides, the 3 experimental groups evaluated presented similar resistance to fracture when compared among them. None of the forms of root reconstruction with dental posts improved root strength, and the incremental technique was suggested as being the most recommendable, since the type of fracture that occurred allowed the dental remainder to be repaired. **Conclusion:** The results of this in vitro study suggest that the healthy remaining radicular dentin is more important to fracture resistance than the different root reconstruction protocols.

Salvio, L., Gonini,A. Jr. Moura, S.K.Chaves, M.D. Lopes, M.B. **Resin cement and glass fibre accessories posts: photoelastic analysis.** *J Dent Res. Vol 88 (Spec. Iss A) Abstract 1840 2009 (www.dentalresearch.org)*

Objective: This study assessed the stress generated by resin cement on the walls of the prepared root with or without insertion of principal and/or accessory pre-fabricated glass fibre posts through photoelastic technique. **Methods:** The specimens were made of photoelastic resin discs with an inner orifice (2 mm*f*Ö and 4 mm height). The specimens were sandblasted with aluminum oxide and coated with an adhesive layer (Scotchbond Multi-purpose), and photoactivated by 20s. The specimens were divided into 5 groups (n=5) according to section of post used: Group 1 (G1) (control) - cement resin BiFix, Group 2 (G2) -one principal glass fibre post (Reforpost), Group 3 (G3) - 1 principal and 2 accessory glass fibre posts (Reforpin) Group 4 (G4) -5 accessories posts. After polymerization the specimens were analysed and the visual representation of stress were measured through the program Imagetool using the isocromatic ring of order 1. The data were converted into MPa through a proper equation and the data submitted to ANOVA and Tukey's test (5%). **Results:** G1 (3.48 °" 0.23) did not differ from G2 (3.27 °" 0.26), but both differ from G3 (2.82 °" 0.14) and G4 (2.80 °" 0.18), which did not differ among each other. **Conclusion:** The inclusion of accessories posts can contribute to reducing the contraction stress on the walls of the root canals.

Silva, G.R., Santos-Filho, P.C., Simamoto-Júnior, P.C., Martins ,L.R., Mota, A.S,, and Soares, C.J. **Effect of post type and restorative techniques on the strain and fracture resistance of flared incisor roots,** *Braz Dent J. 2011;22(3):230-7.*

Restoring flared endodontically treated teeth continues to be a challenge for clinicians. This study evaluated the effect of post types and restorative techniques on the strain, fracture resistance, and fracture mode of incisors with weakened roots. One hundred five endodontically treated bovine incisors roots (15 mm) were divided into 7 groups (n=15). The two control groups were (C) intact roots restored with Cpc (cast posts and core) or Gfp (glass fiber posts). The five experimental groups were (F) flared roots restored with GfpAp (Gfp associated with accessory glass fiber posts), GfpRc (anatomic Gfp, relined with composite resin), and GfpRcAp (anatomized Gfp with resin and accessory glass fiber posts). All teeth were restored with metal crowns. Mechanical fatigue was performed with 3x10(5)/50 N. Specimens were loaded at 45º, and the strain values (μS) were obtained on root buccal and proximal surfaces. Following that, the fracture resistance (N) was measured. One-way ANOVA and Tukey's HSD tests (α=0.05) were applied, and failure mode was checked. **Conclusion:** No significant difference in strain values among the groups was found. Cpc presented lower fracture resistance and more catastrophic failures in flared roots. Gfp associated with composite resin or accessory glass fiber posts seems to be an effective method to improve the bio-mechanical behavior of flared roots.

Zogheib, LV, Saavedra, Gde S, Cardoso, PE, Valera, MC, Araújo, MA. **Resistance to compression of weakened roots subjected to different root reconstruction protocols.** *J Appl Oral Sci. 2011 Nov-Dec;19(6):648-54.*

Objective: This study evaluated, in vitro, the fracture resistance of human non-vital teeth restored with different reconstruction protocols. **Methods:** Forty human anterior roots of similar shape and dimensions were assigned to four groups (n=10), according to the root reconstruction protocol: Group I (control): non-weakened roots with glass fiber post; Group II: roots with composite resin by incremental technique and glass fiber post; Group III: roots with accessory glass fiber posts and glass fiber post; and Group IV: roots with anatomic glass fiber post technique. Following post cementation and core reconstruction, the roots were embedded in chemically activated acrylic resin and submitted to fracture resistance testing, with a compressive load at an angle of 45º in relation to the long axis of the root at a speed of 0.5 mm/min until fracture. All data were statistically analyzed with bilateral Dunnett's test (α=0.05). **Results:** Group I presented higher mean values of fracture resistance when compared with the three experimental groups, which, in turn, presented similar resistance to fracture among each other. None of the techniques of root reconstruction with intraradicular posts improved root strength, and the incremental technique was suggested as being the most recommendable, since the type of fracture that occurred allowed the remaining dental structure to be repaired. **Conclusion**: The results of this in vitro study suggest that the healthy remaining radicular dentin is more important to increase fracture resistance than the root reconstruction protocol. **PDF**