POST OR NO POST*

CLINICAL TRIALS

*Bitter K, Noetzel J, Stamm O, Vaudt J, Meyer-Lueckel H, Neumann K, Kielbassa AM. **Randomized clinical trial comparing the effects of post placement on failure rate of postendodontic restorations: preliminary results of a mean period of 32 months.** *J Endod. 2009 Nov;35(11):1477-82. Epub 2009 Sep 18.*

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

*Ferrari M, Cagidiaco MC, Grandini S, De Sanctis M, Goracci C. **Post placement affects survival of endodontically treated premolars.** *J Dent Res. 2007 Aug;86(8):729-34.*

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

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

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

IN VITRO STUDIES

Garbin, CA, Spazzin, AO, Meira-Júnior, AD, Loretto, SC, Lyra, AM, Braz, R. **Biomechanical behaviour of a fractured maxillary incisor restored with direct composite resin only or with different post systems**. *Int Endod J. 2010 Dec;43(12):1098-107. doi: 10.1111/j.1365-2591.2010.01782.x. Epub 2010 Aug 18.*

Aim: To compare stress distribution between a fractured maxillary central incisor restored with direct composite resin only (CR) or associated with different post materials, using finite element analysis. Method: A three-dimensional model of a sound maxillary central incisor and supporting structures was constructed, using data from the dental literature. Changes were made in the crown region to create a tooth with a restored crown fracture. A composite resin restoration only and restorations associated with different tapered post systems (glass fibre, carbon fibre, titanium and zirconia ceramic) were also evaluated, resulting in six experimental models. A static chewing pressure of 2.16 Nmm (-2) was applied to two areas of the palatal surface of the tooth. Stress distribution was analysed under a general condition and in the structures of the models separately. Results: The maximum stresses were concentrated as follows: at the cemento-enamel junction in the model with a sound maxillary central incisor, restored with CR and with a composite resin restoration associated with fibre posts; in the enamel at the post-enamel interface on the palatal surface of the model with a titanium post; and in the post of the model with zirconia ceramic post. Conclusions: None of the restorations evaluated was able to recover the stress distribution of the sound tooth. The models restored with composite resin associated with a glass or carbon fibre post had similar stress dis-

tributions to that of the model restored with CR. The different post materials were shown to have a substantial influence on stress distribution, with less stress concentration when fibre posts were used.

AL-Omiri ,M. K., Abdelaziz Mahmoud , A., Ramadan Rayyan , M., Abu-Hammad, O. **Fracture resistance of teeth restored with post-retained restorations: An Overview.** *Journal of Endodontics Volume 36, Issue 9 , Pages 1439-1449, September 2010*

Introduction: Posts have been used efficiently to retain restorations for badly destructed teeth. This article critically analyzes the concerned topics related to the fracture resistance of teeth restored with dowel-retained restorations. **Methods:** A systematic review of PubMed/MEDLINE, Cochrane, and Scopus databases was completed (from 1960 to 2010). Single or combined key words were used to obtain the most possible comprehensive list of articles. Checking the references of the relevant obtained sources completed the review along with a manual search to locate related articles on the topic. In vivo and ex vivo (laboratory, computer-based finite element, and photo-elastic stress analysis studies) investigations related to the topic were included. Results: Many factors have been proposed to influence the fracture resistance of post-restored teeth. Recognizing the significance of these factors on the fracture resistance of teeth would aid in choosing the suitable treatment modality for every individual case. Fracture resistance was improved if tooth structure loss was limited, a ferrule was obtained, a post with similar physical properties to natural dentine was used, and adhesive techniques for post luting and coronal restoration were used. Adhesively luted resin/fiber posts with composite cores appear to be the best currently available option in terms of tooth fracture and bio-mechanical behavior. **Conclusions:** Most guidelines were based mainly on ex vivo studies and to a lesser extent on limited in vivo studies. The lack of long-term controlled randomized clinical studies was the main hindrance to reaching a conclusive and indisputable opinion regarding endodontic posts in terms of tooth fracture and bio-mechanical behavior.

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

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

Bandeca, M.C., El-Mowafy, O, Lima, J.P.M., Nadalin, M.R., Saade, E., Boaventura, J.M.C. Rastelli, A.N.S., Porto-Neto, S.T. **Fracture resistance of endodontically treated teeth after using intracoronal bleaching**. *J Dent Res. Vol 88 (Spec. Iss. A) Abstract # 610, 2009. (*www.dentalresearch.org*)*

Objectives: The aim of this study was to evaluate the fracture resistance and failure pattern of endodontically treated teeth after intracoronal bleaching with 35% hydrogen peroxide for 3 weeks with application of different restorative procedures. **Methods:** This study was performed on 80 mandibular incisors (n=80) and divided in 10 groups: G1: non-bleached teeth and restored with composite resin; G2: non-bleached teeth and luting of fiber-reinforced composite post (Everstick¨ Post, Sticktech) with Panavia¨ F 2.0 (Kuraray); G3: non-bleached teeth and luting of fiber-reinforced composite post with Breeze¨ (Pentral Clinical); G4: non- bleached teeth and luting of fiber glass post (Exacto¨, Angelus) with Panavia¨ F 2.0; G5: non-bleached teeth and luting of fiber glass post with Breeze; The groups G6 to G10 were the same materials of the anterior groups respectively, however the teeth were bleached. After 7 days storage in artificial saliva, the specimens were submitted to the fracture resistance test (kN) by a universal testing machine (Instron 4444) set at a speed of 0.5 mm/min and the data were submitted to the Tukey-Kramer multiple comparisons test. **Results:** No significant difference (p<0.05) was found between groups G1 to G10. The results suggest that intracoronal bleaching with 35% hydrogen peroxide did not significantly weaken the teeth. **Conclusion:** Among the application of different restorative procedures, the teeth restored with composite resin showed same values of resistance with those restored with non-metallic posts, however the failure pattern were predominately favorable to teeth restored with non- metallic posts. **IADR ABSTRACT ONLY**

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

The aim of this in vitro study was to evaluate the influence of endodontic therapy, veneer preparation, and their association on fracture resistance and deflection of pulpless anterior teeth and assess whether restoration with quartz fiber-reinforced post can influence these properties. Seventy-five freshly extracted human maxillary central incisors were selected. Teeth were randomly divided into 4 experimental groups (veneer preparation/endodontic therapy/endodontic therapy and veneer preparation/endodontic therapy, veneer preparation, and fiber post placement) and a control group (n = 15). Specimens were loaded to fracture recording crown deflection under load, and data were statistically analyzed. Veneer preparations and endodontic treatment did not significantly influence fracture resistance of

maxillary incisors. On the contrary, preparation for veneer significantly increased the deflection values of the specimens. **Conclusion:** Fiber post restorations seemed to significantly increase mean maximum load values for specimens prepared for veneers. A fiber-reinforced post restoration can be suggested when endodontic treatment is associated with veneer preparation. **PDF**

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

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

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

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

Li, Q, Yan, P, Chen, Z. **Fracture resistance and failure patterns of open apex root teeth with different posts after endodontic treatment**. *J Med Sci. 2011 Apr;31(2):271-6. Epub 2011 Apr 20.*

The aim of this study is to investigate the influence of different posts on the fracture mechanics of endodontically-treated teeth with open apex. Forty-eight human maxillary anterior teeth were collected, and the root was transversely sectioned 12 mm under the cement-enamel junction (CEJ). These samples were then randomly divided into two groups, i.e., minor diameter open apex root (group A) and major diameter open apex root (group B), with mineral trioxide aggregate (MTA) placed into the apical 4 mm in the root canals. Subsequently, both groups were respectively further divided into three subgroups as follows: fiber-post (subgroup 1), metal post (subgroup 2) and non-post (subgroup 3) group. Teeth were restored with a composite resin crown and tested by using a universal testing machine at the rate of 1 mm/min cross-head. Values of the maximum fracture resistance and failure patterns were recorded and compared among all subgroups. In addition, the changes of MTA properties were carefully examined via X-ray photography. Our results indicate that (1) In group A, the mean value of fracture resistance for teeth restored with fiber posts were statistically higher than that with either metal post or non-post; (2) In group B, there was no statistically significant difference in the mean value of fracture resistance among three subgroups; (3) No statistical significance in the mean value of fracture resistance was found between group A and group B; (4) The failure modes of most samples (58%) were irreparable; (5) MTA in two teeth developed cracks after loading tests. In conclusion, endodontically-treated teeth restored with fiber posts are more resistant to fracture than those restored with either metal posts or non-post, and most of the fracture modes are catastrophic in nature.

Mangold, JT, Kern, M..**Influence of glass-fiber posts on the fracture resistance and failure pattern of endodontically treated premolars with varying substance loss: An in vitro study.** *J Prosthet Dent. 2011 Jun;105(6):387-93*

Statement of problem: It is unclear how the amount of substance loss affects whether the fracture strength of endodontically treated and crowned teeth is increased by post placement. Purpose: The purpose of this in vitro study was to evaluate the influence of glass-fiber post placement on the fracture resistance of endodontically treated premolars with varying degrees of substance loss. Methods: Sixty-four extracted and endodontically treated mandibular premolars were divided into 4 test groups (n=16) depending on the number of residual coronal dentin walls that ranged from 3 to zero. Teeth in subgroups were either adhesively restored with composite resin (ClearFil Core) without a post (-) or with an adhesively luted glass-fiber post (ER Dentin-Post) (+). After receiving a 0.8-mm shoulder preparation, providing a ferrule of 0.5 mm, teeth were restored with complete metal crowns, which were cemented with glass ionomer cement. All specimens were subjected to dynamic loading in a masticatory simulator for 1.2 million loading cycles with a nominal load of 49 N at 1.2 Hz combined with thermal cycling (between 5 and 55°C, 30-second dwell time). Then specimens were quasi-statically loaded at 30 degrees in a universal testing machine until fracture. Data were analyzed with 2-way ANOVA, followed by multiple comparisons using Tukey HSD test (α=.05). Results: No specimen failed during masticatory simulation. Mean final fracture resistance

ranged from 335.6 ±39.7 N to 1064.9 ±211.8 N. Two-way ANOVA revealed that both the number of residual coronal walls and post placement had a significant influence on the fracture resistance (P<.001). However, pair-wise comparisons of groups showed that in groups with 2 or 3 cavity walls, the post effect was not statistically significant (P=.378 and P=.175, respectively). Conclusions: The fracture resistance of endodontically treated premolars was dependent on the number of residual coronal dentin walls. Placement of a glass-fiber post had a significant influence on the fracture resistance when fewer than 2 cavity walls remained but no significant influence when 2 or 3 walls were present.

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

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

Nam, SH, Chang, HS, Min, KS, Lee, Y, Cho, HW, Bae, JM. **Effect of the number of residual walls on fracture resistances, failure patterns, and photoelasticity of simulated premolars restored with or without fiber-reinforced composite posts**. *J Endod. 2010 Feb;36(2):297-301.*

Introduction: This study compared the fracture resistances and the failure patterns of 100 simulated mandibular premolars of a different number of coronal walls (zero to four walls) with or without fiber-reinforced composite (FRC) posts. In addition, the photo-elastic stress distribution was analyzed. **Methods:** The fracture resistance was measured at a 45 degrees angle with a crosshead speed of 1mm/min, and the failure patterns were observed. The photoelastic stress distribution of specimens with or without FRC posts was also evaluated. The fracture resistance was analyzed by analysis of variance and a Duncan's multiple range test ($p<0.05$). **Results:** In the no post groups, the fracture resistances decreased significantly in groups with two or fewer walls. The FRC post increased fracture resistances significantly, except for the zero-wall group, and optimized the failure patterns. A high stress concentration was observed along the canal space in the no post groups; stress seemed to be distributed in post groups in photoelasticity. **Conclusion:** Within the limitation of the experimental methods of this study, the FRC post was advantageous in lower premolars, especially with two or more walls in terms of the fracture resistance and stress distribution. **PDF**

Rosentritt, M., Sikora, M., Behr, M., Handel, G. **In vitro fracture resistance and marginal adaptation of metallic and tooth- colored post systems.** *J Oral Rehabil, 2004 Jul;31(7):675-81.*

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 with scanning electron microscopy using replica specimen 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. **PDF**

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

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

Salameh, Z, Sorrentino, R,. Ounsi, H, Goracci, C., Tashkandi, E, Tay, F, Ferrari, M. **Effect of different all-ceramic crown system on fracture resistance and failure pattern of endodontically treated maxillary premolars restored with and without glass fiber posts**. *J Endod 2007 July Volume 33, Issue 7, 848-85*1

Abstract: Endodontically treated teeth are traditionally restored with a crown to prevent fracture. The aim of this study was to compare the fracture resistance and failure modes of endodontically treated maxillary premolars treated with or without a fiber post and restored with different types of crowns. Eighty human maxillary premolars were selected. After root canal treatment, the teeth were embedded in resin blocks and divided into four groups. Samples received MOD cavity preparations and were divided into two subgroups: with and without fiber posts and restored using porcelain fused to metal, lithium disilicate, fiber- reinforced composite, or zirconia crowns. The specimens were vertically loaded in the central fossa using a universal loading machine until failure, and the maximum breaking loads were recorded. Samples were perfused with Indian ink to highlight the fracture lines and the mode of failure that was classified as restorable or non-restorable. Even without post, all crown designs resisted vertically applied forces beyond those that may be encountered in the mouth. Two-way analysis of variance revealed the use of a fiber post ($p = 0.007$) and the type of crown ($p < 0.001$) significantly affected the restorability of fractured teeth. The relationship between placing or not placing the post and the type of failure (restorable/non-restorable) was found to be significant ($\chi 2$ test, $p = 0.002$). Although post placement resulted in higher fracture resistance values, these were significant for Empress II crowns only. The results suggest that the posts could contribute to the reinforcement and strengthening of pulpless maxillary premolars. With respect to failure modes, placement of fiber posts improved the fracture from non-restorable to restorable patterns. This study suggests that the placement of fiber posts is necessary to improve fracture resistance even under full-coverage crowns. **PDF**

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

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

Salameh, Z., Sorrentino, R., Ounsi, H. et, al **The Effect of different full coverage crown systems on fracture resistance and failure pattern of endodontically treated maxillary incisors restored with and without glass fiber posts**. *J Endod 2008; 34:842-846.*

Abstract: The aim of this study was to compare the fracture resistance and failure pattern of endodontically treated maxillary incisors restored using composite resin with or without fiber-reinforced composite (FRC) posts under different types of full coverage crowns. The null hypothesis tested was that fracture resuistance and the failure pattern were not affected by thenuse of FRC posts or by the type of full coverage crown. One hundred twenty maxillary incisors were endodontically treated and divided into 4 groups of 30 each. Each group was divided into 2 sub-groups; restoration with or withoutfiber post. PFM crowns were placed in Group 1, Empress II crowns in Group 2, SR Adoro crowns in Group 3 and Cercon crowns in group 4. Fracture tests were performed by loading specimens to fracture. Data were analyzed with two-way analysis of variance ($\alpha = 0.05$). The type of crown was not a significant factor affecting fracture resistance ($\alpha = 0.04$). Both the presence of a post and the type of crown had a significant influence on the proportion of restorable versus UNrestorable fractures. Although prosthodontic textbooks do not generally advocate the placement of fiber posts in endodontically treated incisors, the results of this study indicate that the use of fiber posts in such teeth increases their resistance to fracture and improves the prognosis in the case of fracture. **PDF**

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

Background: Traumatized immature teeth present a unique challenge during treatment, both endodontically as well as restoratively. Hence, the purpose of this study is to evaluate the type and depth of restoration that would be effective in simulated immature maxillary anterior teeth in terms of fracture resistance and mode of failure. Methods: Seventy-five extracted human maxillary anterior teeth were used in this study that was standardized to a length of 13 mm. Instrumentation of the canals was performed after which a Peezo no. 6 was taken 1 mm past the apex to simulate an incompletely formed root. MTA apexification was simulated after which all the teeth were mounted and a 3-mm-diameter engineering twist drill extended the preparation 3 and 7 mm below the facial cemento–enamel junction (CEJ) to simulate Cvek's stage 3. These teeth were divided into seven different groups: Group 1: Negative control: intact teeth; Group 2: Positive control: 3 mm, no restoration; Group 3: Positive control: 7 mm, no restoration; Group 4: 3-mm composite; Group 5: 3-mm quartz fiber post; Group 6: 7-mm composite; Group 7: 7-mm quartz fiber post. Fracture resistance was performed at 130° to the long axis of the tooth with a chisel-shaped tip at the cingulum with a cross-head speed of 5 mm min, and the maximum load at which the fracture occurred was recorded. Results: Group 1 that was the negative control showed the highest fracture resistance. Among the experimental groups, 4 and 5 showed the highest fracture resistance, which were significantly different from groups 6 and 7, respectively. Conclusions: Within the limitations of this in vitro study, it can be concluded that using either dual-cure composite or a quartz fiber post with composite resin to a depth of 3 mm would significantly strengthen the roots in immature teeth. **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, St Egreve, France) In the fourth group, the weakened cervical area was reinforced with dual cure composite and cast post with similar morphologic properties. Access cavity in the last two groups were restored with composite resin, then all specimens were tested in an instron machine. Results: The mean fracture load for the 4 groups were 170.12, 71.40, 129.36, and 116.6 kgf respectively. The differences between first group and others (P value=0), second group and others (P value=0) were significant. There was no significant differences between third and forth group (P value =0.103), but the rate of restorable fractures (pattern of fracture) was significantly different between these two groups. Conclusions: It is concluded that the use of post, dentin bonding agent and a composite resin in a root with thin walls will reinforce the weakened tooth but the type of the post will influence on the final result. **IADR ABSTRACT ONLY**

Vadini, M, Deangelis, F, D'Amario, M, Marzo, G, Baldi, M, D'Arcangelo, C. **Conservative restorations of endodontically compromised anterior teeth in pediatric patients: physical and mechanical considerations.** *Eur J Paediatr Dent. 2012 Oct;13(3 Suppl): 263-7.*

Aim: Objective of this in vitro study was to evaluate the influence of fiber post placement on fracture resistance of pulpless anterior teeth restored with standardized Class III and Class IV resin composite fillings. Methods: One hundred and five human maxillary central incisors were selected and randomly divided into 7 (n=15) experimental groups (endodontic therapy/ endodontic therapy and one Class III resin composite filling/ endodontic therapy and one Class IV resin composite filling/ endodontic therapy and two Class III resin composite fillings/ endodontic therapy, fiber post and one Class III resin composite filling/ endodontic therapy, fiber post and one Class IV resin composite filling/ endodontic therapy, fiber post and two Class III resin composite fillings). Specimens underwent fracture strength test. Means (N) were calculated and data were analysed using 1-way ANOVA and Tukey multiple comparisons tests (p=0.05). Results: Concerning teeth with two Class III, fiber post placement significantly increased fracture strength values from 603.59 to 864.24 N. Specimens restored with one Class III (795.21 N without post, 936.68 N with post) showed higher fracture strength values if compared with specimens with two Class III, with significant differences just concerning specimens without a fiber post. Fracture strength was not significantly influenced by fiber post placement in Class IV groups (720.71 N without post, 799.69 N with post). Conclusion: Data suggest that fiber post placement may significantly improve anterior teeth fracture strength when at least two Class III composite fillings are associated to the endodontic treatment. No significant effect of fiber post placement could be recorded when just one Class III or one Class IV composite filling were present.

Vitalariu, AM, Comaneci, R, Tatarciuc, MS. **Prevention of root fracture using posts reinforced with fiber glass.** *Rev Med Chir Soc Med Nat Iasi. 2005 Apr-Jun;109(2):406-11*

The aim of this study was to evaluate the fracture strength and mode of failure of endodontically treated teeth reconstructed with glass fiber reinforced posts. Twenty maxillary central incisors, extracted for periodontal reasons, were divided in 2 groups: gr. 1 - glass fiber posts, and gr.2 - control (endodontically treated but without posts). All samples were embedded in resin bloks and mounted in stainless steel cylinders for the compressive test. The force was applied on oral surface of the crown, until the failure occurred. The compres-

sive loads at failure were recorded and compared with the statistical method Student t. The mode of failure of the specimens were also evaluated. The statistical analysis of the force values showed no significant difference between the groups. In conclusion, because of their low Young's modulus, the non-metallic posts made of resin composite reinforced with glass fibers have a protective effect on the dental tissues, the recorded mode of failure being very similar with the control group.

Yamamoto, M., Miura, H., Okada, D., Masuoka, D., Komada, W. and Suzuki, C. **Photoelastic stress analysis in different types of post and core**, *Dent Res. Vol 86 (Spec. Iss. A) Abstract #2617, 2007 (www.dentalresearch.org)*

Objectives: The aim of this study was to compare three types of post and core systems and analyze the stress magnitude within the root. Methods: Two-dimensional photoelastic simulation models of endodontic treated upper central incisors were fabricated with epoxy resin sheets (6 mm of thickness). Models were 10 times the life size. The post and core systems were divided in three different types, build-up method using only composite resin (R), build-up method using composite resin in combination with a glass fiber post (R+F), and a cast post and core (C). The equivalent ratio of elastic modulus for composite resin, dentin, glass fiber post, and metal were considered for all the parts (5:1). The models were observed in a transmission polariscope with the same loading force (400 N) on 45 degrees palatal direction. The measured points were the buccal margin area of the root and the surrounding area of the apex of the post, which used to present the higher stress concentration area. The isochromatic fringe patterns and the stress distribution in the tooth simulation models were analyzed. Results: In the buccal margin area of the root, R, R+F and C showed 3.1 fringe order, 1.4 fringe order, and 2.4 fringe order, respectively. For the surrounding area of the apex of the post, R, R+F and C showed 0.45 fringe order, 0.80 fringe order, and 1.0 fringe order, respectively. Conclusion: The stress concentration in the buccal margin area of the root had a higher distribution, compared with the surrounding area of the apex of the post. Resin + Fiber post model had the lowest stress concentration in the buccal margin area of the root. **IADR ABSTRACT ONLY**