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A retrospective clinical evaluation of success rate in endodontic-treated premolars restored with composite resin and fiber reinforced composite posts

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Abstract

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Background:

The aim of this retrospective study was to assess the survival rate and causes of failure of quartz fiber posts used to restore endodontically treated teeth.

Materials and Methods:

Thirty-eight patients with endodontically treated premolar and anterior teeth that were then restored with a coronoradicular quartz fiber post and extensive composite resin restorations were selected for participation in the study. The age of the restorations ranged from 1 to 6 years. Survival probabilities of the restorations as well as causes of failures were analyzed using the Kaplan-Meier analysis and the Logistic regression ($\alpha = 0.05$).

Results:

The overall cumulative survival rate (48.8%) was determined, while the survival probabilities after 1, 2, 4, 5, and 6 years of service were 88.37%, 60.95%, 45.71%, 32.65%, and 0%, respectively.

Conclusions:

The survival probability of endodontically treated teeth restored with a quartz fiber post and composite restorations is associated with the dental arch.

Keywords: Composite, endodontically treated, fiber reinforced composite post

INTRODUCTION

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The restoration of endodontically treated teeth represents a unique challenge for clinicians because the retention of the final restoration is dependent on the use of the hollow interior of the root coronal to the endodontic filling using a properly fitted retention post. It has been suggested that retention posts should have a similar modulus of elasticity to either the resin luting cement used, or the surrounding dentin structure in order to improve the performance of final composite resin restorations.[1] Placement of a fiber reinforced composite (FRC) post is one way to obtain a rather homogenous tooth post–core instead of using heterogeneous post and core materials for the rehabilitation of endodontically treated teeth.

It has been recognized that failures of the FRC posts are often salvageable because fiber posts distribute forces along the length of the post.[2] Therefore, coronal failures occur more frequently than root fractures. The difference in the failure mode may be a result of the greater amount of root canal dentin that must be removed for the placement of a metallic post.[3]

Several retrospective and prospective clinical studies have been conducted to evaluate the effect of fiber posts on the survival rate of adhesive restorations used to restore endodontically treated teeth.[4–14] Clinical success rate of fiber posts ranged from 89% to 98% in retrospective studies and from 92% to 99% in prospective studies. These clinical studies were short-term except for one that reported the performance of 7-11 year-old fiber posts used in combination with porcelain fused to metal restorations (56%), ceramic crowns (30%), and composite restorations (14%), as final restorations.[11]

Piovesan *et al*, evaluated the survival rates of endodontically treated teeth restored with fiber-reinforced custom posts and cores. The teeth were then restored with either complete cast crowns, or direct resin composite as final restorations. There were no differences found in survival rates between them with regard to tooth location and type of restorative material used.[15]

Preethi and Kala in a 1-year clinical study showed no difference among cast post core with carbon fiber reinforced and glass fiber reinforced composite in terms of recurrent caries detected at the crown margin, fracture of the restoration, fracture of the root and periapical and periodontal pathology.[16]

This retrospective clinical and radiographic study evaluated the clinical performance of a quartz fiber post used in combination with a direct resin composite onlay (premolar teeth) and extensive composite resin restorations (anterior teeth) as a definitive restorations in the endodontically treated teeth.

The null hypothesis of the study was that there is no association between treatment outcome (success vs failure) with the specific independent categorical variables; dental arch (maxilla vs mandible), occluding tooth (natural vs amalgam restoration), Tooth position within the arch (anterior teeth vs premolars), and age of the restoration (1--6 year-old restorations).

MATERIALS AND METHODS

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Forty-three quartz fiber posts (RTD, St. Egreve, France) were placed following endodontic treatment between February 2004 and July 2010. A total of 38 volunteer subjects from a private dental practice were treated. A single operator placed all of the posts. The frequency of the type of tooth treated is shown in Table 1. The anterior teeth and premolars were chosen to be recalled for long-term evaluation.

Table 1

Frequency of the type of tooth treated

After at least 48 h following endodontic treatment, the roots were prepared for receiving a FRC post. Then the post were bonded in the prepared root canals using dual cured resin cement; Panavia F (Kuraray, Med Company, Tokyo, Japan) in strict accordance with the manufacturer's instructions.. The final restorations for the premolar teeth were fabricated using a packable composite resin (Filtek P60, 3M,-ESPE, Minneapolis, MN, USA) to create direct composite resin onlays. Synergy composite resin (Coltene Whaledent, Altstätten, Switzerland), was used as a final restoration for anterior teeth. The anterior teeth contained at least two Class III cavity preparations in combination with one access preparation used to carry out the endodontic treatment.

The clinical examinations were carried out independently by two experienced operators. The observers were not blinded during the clinical examination, as this was not possible. The treatment outcome and rate of success were assessed by clinical and intraoral radiographic examinations. The outcome was considered successful if the post and core were *in situ*, without clinical or radiographic signs of technical failures, loss of retention, root fracture, post fracture, or periapical lesion. Data from the dental records were available at the time of examinations.

Survival functions of restorations were analyzed using the Kaplan--Meier test at a 95% significance level. In addition, a Logistic regression model was applied to the recall data to identify the joint effect of variables evaluated at the time of recall that could modify the occurrence of failures in restorations ($\alpha = 0.05$). Treatment outcome (success vs failure) represented the dichotomous dependent variable, whereas the independent variables consisted of: dental arch (maxillary vs mandibular), occluding tooth (natural vs amalgam restoration), tooth position within the arch (anterior teeth vs premolars), and age of the restoration (1-6 year-old restorations).

RESULTS

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The mean overall survival estimate of both the post and definitive restoration was 46.3 (± 4.09) months (95% CL: 38.62-54.65) Among the 43 restorations evaluated in the study, 11 were in mandibular teeth (25.5%), and the remaining 32 (74.5%) were in maxillary teeth. A total of 36 teeth (83.7%) in the study occluded with natural teeth while 7 teeth (16.3%) occluded with existing amalgam restorations.

One tooth was extracted after 24 months due to severe periodontitis. This diagnosis had been noted at the time of the post preparation and placement of the restoration. Despite the unfavorable periodontal status of this tooth, the patient wanted to preserve it as long as possible. Among the subject teeth, two posts were fractured, while two restorations experienced bulk fracture in the composite resin portion of the restoration. One tooth showed periapical lesion and three restorations had marginal chipping while marginal discoloration was detected in 10 teeth and only 3 restorations showed recurrent caries. The remaining; 48.84% (21 teeth) were classified as successful.

The age of the restoration and the dental arch were found to be a significant factor for the failure event and could serve as possible predictors for failure (Wald test $P < 0.05$). Restorations in maxillary teeth showed a greater propensity to fail than restorations in mandibular teeth [Table 2].

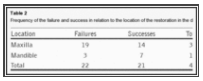

Table 2

Frequency of the failure and success in relation to the location of the restoration in the dental arch

Survival functions of the restorations were analyzed using the Kaplan--Meier analysis ($\alpha = 0.05$) and displayed according to the age of restoration (independent variable).[Table 3]

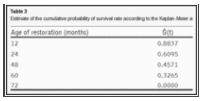

Table 3

Estimate of the cumulative probability of survival rate according to the Kaplan-Meier analysis

A restoration survival analysis over time based on Kaplan--Meier data showed that of all restorations only 21 were censored (48.84%).

DISCUSSION

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This study found the primary reason for failure of the composite restorations was due to marginal discoloration (23% of all failures). One prospective study also determined that among 88 composite restorations, the main reason for replacement of defective restorations was marginal discoloration (*n* = 53, 60.2%).[17]

In a recent study Asghar *et al*, found secondary caries to be the most frequent reason for replacement of composite restorations.[18] Ferrari *et al*, found the most frequent type of failure to be debonding of the post. They claimed that the most important factor for debonding of the post is loss of a ferrule.[11]

In the present study, two bulk fractures and three instances of marginal chipping in were detected. They were occluded with natural teeth. Malferrari *et al*. claimed that one reason for bulk fracture of posterior composite restoration may be due to either a bubble embedded in the composite resin or a result of insufficient polymerization.[8] In one case, the composite resin fractured after 4 years of clinical service and another fractured after 6 years. This variation might be due to each case being subjected to different forces depending on location in the mouth, texture of the diet, oral habits, bruxism, occlusal relationships, or restoration design.

One *in vitro* study suggested that forces in an endodontically treated tooth restored with a fiber post are apparently absorbed by the core and post and not transferred to the root structure itself.[9] This is likely due to either the similarity of the modulus of elasticity of the post and root canal dentin or the use of a resin-based dental adhesive to lute the fiber post in root canal, so that no root fracture was observed.[10–13,19]

Previous studies reported that placement of fiber posts in prepared root canals are less likely to cause vertical root fractures compared with stainless steel posts.[19,20] Some studies showed that when failures occurred, the type of fracture is usually repairable when a fiber post was used and catastrophic if other types of posts were used.[21,22] However, Gordan *et al*, claimed that repairing defective composite restorations had no significant effect on the longevity of restorations when compared with alternative treatments and no reparative treatment.[17]

The results of the present clinical outcome study were not consistent with the findings of previous retrospective studies.[10–13] The survival rates of the tested FRC posts in those studies were found in the range of 89-98%, while in the present study the overall cumulative survival rate was estimated to be 48.84%. However, the survival rate significantly diminished with time as was demonstrated with 6-year-old restorations with survival rate of 0%. Recent longevity data regarding resin-based composite restorations indicate that such restorations only have a life span of seven years.[23,24] The probable reason for this outcome is due to the lack of protection of the coronal portion of the teeth when a full coverage crown is not used to provide a reinforcement factor. Aquilino and Caplan found a strong association between crown placement and the survival of the endodontically treated teeth.[25] However, two recent short-term clinical trials and *in vitro* studies have confirmed the validity of the use of the direct onlay composite resin restoration as a definitive restoration for endodontically premolars even though those studies were not more than one year in duration.[26,27]

A ninthly seven month retrospective study on endodontically treated teeth done by Piovesan *et al*. found that regardless of whether complete cast crowns or direct resin composite were used, both demonstrated high survival rates.[14]

Previous retrospective studies evaluated the success rate of teeth restored with crowns after insertion of a post in the root canal.[10–13] FRC posts were found to be superior to conventional cast posts in terms of secondary caries, loss of retention, root fracture and post fracture. While in the present retrospective study, fracture of the post, recurrent caries, and fracture of the composite were respectively listed as the main reasons that endodontically-treated teeth had to be crowned. Gordan *et al*. stated that a restoration has to be sealed, or repaired if marginal staining, roughness or bulk discoloration is detected.[17]

It would appear that crown placement probably alters the direction of the stresses that applied to the post after loading. Since, FRC posts have an elastic limit similar to dentin, they are not likely to cause root fracture, but rather decementation of the post will most likely occur. Such an event could be in combination with total detachment of the core and crown. While without crowning, stresses act in an opposite manner and could be transferred to the coronal restoration causing marginal chipping or bulk fracture, similar to what happened in the present study.

In this retrospective study, only one periapical lesion was detected. This was probably caused by a failure in seal by the gutta percha, adhesive materials used for the restoration, or by the presence of an accessory apical canal as possibilities for the lesion development. This finding was similar to that demonstrated by previous retrospective and prospective studies.[7,8,10–12]

Ray and Trope evaluated the relationship between the quality of the coronal restoration and the quality of the root canal filling by examining the radiographs of endodontically treated teeth.[28]

In the present study, a strong association was found between the dental arch in which the restored teeth were located and the success rate. Since the chance of failure for maxillary restorations was more than those in mandibular teeth, the null hypothesis that there is no association between treatment outcomes (success vs failure) with the specific defined independent categorical variables of this study was not accepted. This result agrees with Ferrarri *et al*, who found that maxillary posterior teeth are more likely to fail than similarly restored mandibular teeth.[11] However, in the present study there was no association between tooth type and the cumulative success rate of restorations. One prospective study done by Glazer has demonstrated a similar finding.[4]

The Wald statistical analysis revealed that the probability for failure of restorations in maxillary arch is as much as 5.94 times greater than restorations located in the mandibular arch. Furthermore restorations that are only 1 month older have an increase of 1.03 times the probability of failure . These findings have not been reported by previous research.

The most important finding in this study was the significant decrease in the cumulative survival rate of restorations after 2, 4, 5, and 6 years, with 0% survival rate in 6-year-old restorations. The results also demonstrated that an overall cumulative survival rate of 48.84% that is much lower than that obtained in previous studies.

As a result, the direct composite onlay restorations in premolars and extensive composite restorations in anterior teeth did not survive as well as FRC post and core-crowned teeth, or restorations consisting of a cast post and core crowns in endodontically treated teeth.

An important limitation of this study was the limited frequency of endodontically treated teeth restored by these methods which was less than that evaluated in previous studies. Therefore, further long-term prospective studies

are needed to evaluate the clinical outcome of extensive composite resin restorations.

CONCLUSIONS

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The survival probability of endodontically-treated teeth restored with a quartz fiber post and composite restorations is associated with the dental arch in which a restoration is located and as well as the age of the restoration. Survivability decreases significantly with time especially for maxillary restorations.

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Footnotes

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REFERENCES

Go to:

1. Bateman G, Ricketts DN, Saunders WP. Fiber-based post systems: A review. Br Dent J. 2003;195:43–8. [PubMed]

2. Newman MP, Yaman P, Dennison J, Rafter M, Billy E. Fracture resistance of endodontically treated teeth restored with composite post. J Prosthet Dent. 2003;89:360–7. [PubMed]

3. Sorrentino R, Monticelli F, Gorraci C, Zarone F, Tay FR, Garcia-Godoy F, et al. Effect of post-retained composite restorations and the amount of coronal residual structure on the fracture resistance of endodontically treated teeth. Am J Dent. 2007;20:269–74. [PubMed]

4. Glazer B. Restoration of endodontically treated teeth with carbon fiber posts.A prospective study. J Can Dent Assoc. 2000;66:613–8. [PubMed]

5. Ayna B, Celenk S, Atakul F, Uysal E. Three year clinical evaluation of endodontically treated anterior teeth restoration with a polyethylene fiber reinforced composite. Aust Dent J. 2009;54:136–40. [PubMed]

6. Naumann M, Sterzenbach G, Franke A. Randomized controlled clinical pilot trial of titanium as glass fiber prefabricated posts: Preliminary Results After up to 3 years. Int J Prosthodont. 2007;20:499–503. [PubMed]

7. Shmitter M, Rammelsberg P, Gabbert O, Ohlmann B. Influence of clinical baseline findings on the survival of 2 post systems: A randomized clinical trial. Int J Prosthodont. 2007;20:173–8. [PubMed]

8. Crysanti Cagidiaro M, Rodovic I, Simonelli M, Tay F, Ferrari M. Clinical performance of fiber post restorations in endodontically treated teeth: 2 year results. Int J Prosthodont. 2007;20:293–8. [PubMed]

9. Malferrari S, Monaco C, Scotti R. Clinical evaluation of teeth restored with quartz fiber-reinforced epoxy resin posts. Int J Prosthoodont. 2003;16:39–44. [PubMed]

10. Naumann M, Blankenstein F, Kiessling S, Dietrich T. Risk factors for failure of glass fiber- reinforced composite post restorations: A prospective observation clinical study. Eur J Oral Sci. 2005;113:519–24. [PubMed]

11. Ferrari M, Cagidiaco MC, Goracci C, Vichi A, Mason PN, Radovic I, et al. Long-term retrospective study of the clinical performance of fiber posts. Am J Dent. 2007;20:287–91. [PubMed]

12. Ferrari M, Vichi A, Mannocci F, Mason PN. Retrospective study of the clinical performance of fiber posts. Am J Dent. 2000;13:9B–13B. [PubMed]

13. Ferrari M, Vichi A, García-Godoy F. Clinical evaluation of fiber-reinforced epoxy resin posts and cast post and cores. Am J Dent. 2000;13:15B–18B. [PubMed]

14. Fredriksson M, Astbäck J, Pamenius M, Arvidson K. A retrospective study of 236 patients with teeth restored by carbon fiber-reinforced epoxy resin posts. J Prosthet Dent. 1998;80:151–7. [PubMed]

15. Piovesan EM, Demarco FF, Cenci MS, Pereira-Cenci T. Survival rates of endodontically treated teeth restored with fiber-reinforced custom posts and cores: A 97-month study. Int J Prosthodont. 2007;20:633–9. [PubMed]

16. Preethi GA, Kala M. Clinical evaluation of carbon fiber reinforced carbon endodontic post, glass fiber reinforced post with cast post and core: A one year comparative clinical study. J Conserv Dent. 2008;11:162–7. [PMC free article] [PubMed]

17. Gordan VV, Garvan CW, Blaser PK, Mondragon E, Mjör IA. A long-term evaluation of alternative treatments to replacement of resin-based composite restorations: Results of a seven-year study. J Am Dent Assoc. 2009;140:1476–84. [PubMed]

18. Asghar S, Ali A, Rashid S, Hussain T. Replacement of resin-based composite restorations in permanent teeth. J Coll Physicians Surg Pak. 2010;20:639–43. [PubMed]

19. Asmussen E, Peatzleldt A, Heitmann T. Stiffness, elastic limit and strength of newer types of endodontic posts. J dent. 1999;27:275–8. [PubMed]

20. Pegoretti A, Fanbri I, Zappini G, Bianchetti M. Finite element analysis of a glass fiber reinforced composite endodontic post. Biomaterials. 2002;23:2667–82. [PubMed]

21. Salameh Z, Sorrentino R, Papachini F, Ounsi HF, Tashkandi E, Ferrari M. Effect of fiber post and resin core restorations on fracture resistance and pattern of endodontically treated mandibular molars. J Endod. 2006;32:752–5. [PubMed]

22. Eliasson S, Bergstrom J, Sanda A. Periodontal bon loss of teeth with metal posts.A radiographic study. J Clin Periodontol. 1995;22:850–3. [PubMed]

23. Tyas MJ. Placement and replacement of restorations by selected practitioners. Aust Dent J. 2005;50:81–9. [PubMed]

24. Bernardo M, Luis H, Martin MD, Leroux BG, Rue T, Leitão J, et al. Survival and reason for failure of amalgam versus composite posterior restorations placed in a randomized clinical trial. J Am Dent Assoc. 2007;138:775–83. [PubMed]

25. Aquilino SA, Caplan DJ. Relationship between crown placement and the survival of endodontically treated teeth. J Prosthet Dent. 2002;87:256–63. [PubMed]

26. Cetin AR, Unlu N. One-year clinical evaluation of direct nanofilled and indirect composite restorations in posterior teeth. Dent Mat J. 2009;28:620–6. [PubMed]

27. Mendonça JS, Neto RG, Santiago SL, Lauris JR, Navarro MF, de Carvalho RM. Direct resin composite restorations versus indirect composite inlays: one-year results. J Contemp Dent Pract. 2010;11:25–32. [PubMed]

28. Ray HA, Trope M. Periapical status of endodontically treated teeth in relation to technical quality of the root filling and coronal restoration. Int Endod J. 1995;28:12–8. [PubMed]