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ORIGINAL RESEARCH

Comparative evaluation of fracture resistance of Carbon fiber post and ceramic post in endodontically treated teeth: An in-vitro study

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ABSTRACT:
Background: In teeth with substantial hard tissue loss resulting from cavities or trauma, posts are often necessary for providing sufficient retention for the core material. Hence; the present study was undertaken for assessing and comparing the fracture resistance of Carbon fiber post and ceramic post in endodontically treated teeth. **Materials & methods:** A total of 50 freshly extracted maxillary second premolars were included. Deformed, carious and decayed tooth were excluded. Using lateral condensation technique, biomechanical preparation was done in all the samples. This was followed by commencement of obturation using gutta-percha points. After finishing of the endodontic therapy, all the specimens were sectioned from the cement-enamel junction. Post space preparation was done in all the specimens. After post space preparation, all the specimens were divided into two study groups as follows: Carbon fiber post group: 25 specimens in which carbon fiber post was inserted, and Ceramic post group: 25 specimens in which ceramic post was inserted. Cementation of the posts was done using adhesive resins. After cementation, all the posts were placed in universal force testing machine for testing fracture strength. **Results:** Mean force required for fracturing specimens of carbon fiber post group was found to be 464.8 N while mean force required for fracturing specimens of ceramic post was found to be 387.9 N respectively. While comparing statistically, significant results were obtained. **Conclusion:** Carbon fiber posts are more resistant to fractures in comparison to ceramic posts.
Key words: Carbon, Ceramic

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INTRODUCTION

Root canal–treated teeth with less tooth structure are often restored with the crowns. In teeth with substantial hard tissue loss resulting from cavities or trauma, posts are often necessary for providing sufficient retention for the core material. It has been suggested that endodontically treated teeth (ETT) are more brittle and may fracture more easily than vital teeth. The loss of tooth structure from caries or trauma also makes ETT more susceptible to fracture. To improve the fracture resistance of ETT, post and core techniques are clinically necessary to restore ETT. Because the choice of an appropriate post material is crucial to successful restoration, much research has been focused on this subject.[1-3]

The restoration of endodontically treated teeth requires the fabrication of a post and core to provide retention and support for the final crowns. Post and core protect or strengthen the tooth against intraoral forces by equally distributing torquing forces within the radicular dentin to supporting tissues thus dispersing forces along the root and providing retention for the core that replaced the lost coronal tooth structure and thus retain the restoration.[4, 5] Hence; the present study was undertaken for assessing and comparing the fracture resistance of Carbon fiber post and ceramic post in endodontically treated teeth.

MATERIALS & METHODS

The present study was planned in the department of conservative dentistry. A total of 50 freshly extracted

maxillary second premolars were included. Deformed, carious and decayed tooth were excluded. Using lateral condensation technique, biomechanical preparation was done in all the samples. This was followed by commencement of obturation using gutta-percha points. After finishing of the endodontic therapy, all the specimens were sectioned from the cement-enamel junction. Post space preparation was done in all the specimens. After post space preparation, all the specimens were divided into two study groups as follows:

Carbon fiber post group: 25 specimens in which carbon fiber post was inserted, and

Ceramic post group: 25 specimens in which ceramic post was inserted.

Cementation of the posts was done using adhesive resins. After cementation, all the posts were placed in universal force testing machine for testing fracture strength. All the results were recorded in Microsoft excel sheet and were analysed by SPSS software. Student t test was used for evaluation of level of significance.

RESULTS

In the present study, 50 freshly extracted maxillary second premolars were included. After post space preparation, all the specimens were divided into two study groups as follows: Carbon fiber post group: 25 specimens in which carbon fiber post was inserted, and Ceramic post group: 25 specimens in which ceramic post was inserted. Mean force required for fracturing specimens of carbon fiber post group was found to be 464.8 N while mean force required for fracturing specimens of ceramic post was found to be 387.9 N respectively. While comparing statistically, significant results were obtained.

DISCUSSION

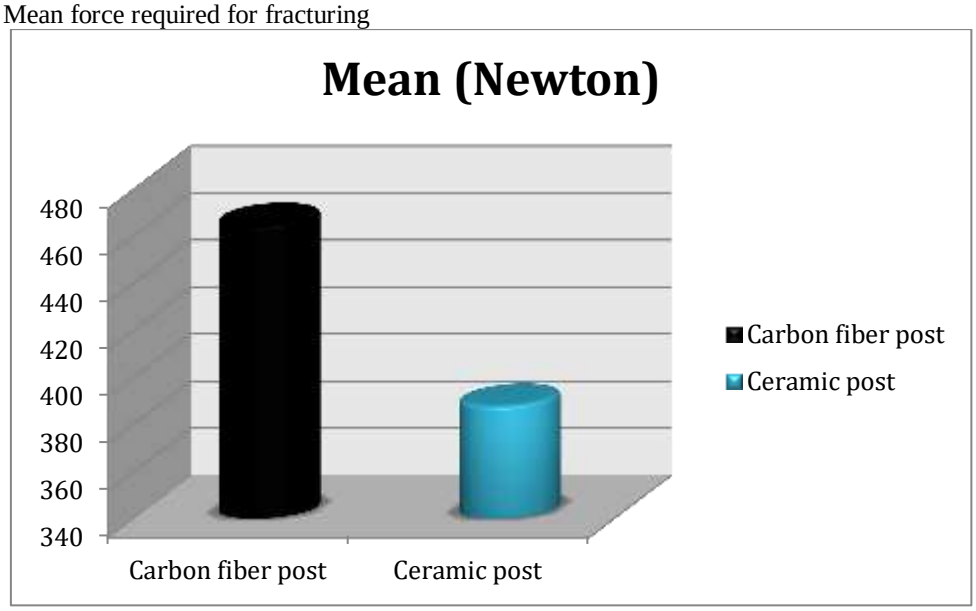
The post-core and crown restoration is a common prosthodontic method to preserve residual roots and crowns. Recently, fiber posts have become more and more popular because they have a modulus of elasticity similar to dentin, high tensile strength, good transparency and could be removed easily. However, not all endodontically treated teeth need post restoration. The most widely used method to evaluate the fracture resistance of ETT is load testing. In cases where most of the coronal portion is lost, a common method to restore such teeth is the use of a post and core, onto which a full crown is cemented. The dowel is a post or other relatively rigid, restorative material placed in the root of a nonvital tooth also retaining the core. The post functions primarily to aid the retention of the restoration and to protect the tooth by dissipating or distributing forces along the tooth.[6-8]

With increase in the demand for materials with improved esthetic and physical quality, various prefabricated tooth colored posts were developed with better strength and physical characters such as carbon, glass fiber-reinforced, composite, quartz, cerapost, and zirconia posts. Bondability of posts increases retention and stress distribution and reinforces the tooth structure. It can be achieved with recent prefabricated posts such as carbon, glass, quartz, and reinforced posts, but not with cast posts. Cast post and core are prone to corrosion and their elasticity is different compared to natural tooth structure, resulting into stress and chances of tooth fracture.[9, 10]

Table 1: Comparison of mean force required for fracturing

Group	Mean (Newton)	SD	U value	p- value
Carbon fiber post	464.8	36.8	428.6	0.00 (Significant)
Ceramic post	387.9	23.4		

Graph 1: Mean force required for fracturing



Hence; the present study was undertaken for assessing and comparing the fracture resistance of Carbon fiber post and ceramic post in endodontically treated teeth.

In the present study, 50 freshly extracted maxillary second premolars were included. Mean force required for fracturing specimens of carbon fiber post group was found to be 464.8 N while mean force required for fracturing specimens of ceramic post was found to be 387.9 N respectively. Moyin S et al evaluated the fracture resistance strength of different post systems in endodontically treated teeth. Freshly extracted 60 single-rooted first premolars were selected for this study. Conventional step-back technique was used to prepare a canal for all the teeth. All teeth were randomly divided into three groups of 20 samples in each group: Group I, teeth inserted with prefabricated carbon posts; Group II, teeth inserted with prefabricated zirconia posts; and Group III, teeth inserted with prefabricated everStick posts. The compressive strength of zirconia posts was highest with a mean of 796.10 ± 20.78 followed by carbon posts (628.22 ± 18.11) and lower compressive strength was exhibited by everStick posts (534.13 ± 19.98). An analysis of variance revealed a statistically highly significant difference ($P < 0.005$) among the different posts used, and a statistically significant difference between carbon posts vs. zirconia posts, carbon posts vs. everStick posts, and zirconia posts vs. everStick posts ($P < 0.05$). Zirconia posts show the maximum fracture resistance than the carbon posts and everStick posts.[9]

In the present study, while comparing the mean fracture strength among the specimens of the two study groups, significant results were obtained. Makade CS et al compared the fracture resistance and the mode of failure of endodontically treated teeth restored with different post-core systems. Root canal treatment was performed on 40 maxillary incisors and the samples were divided into four groups of 10 each. For three experimental groups post space preparation was done and teeth were restored with cast post-core (Group B), stainless steel post with composite core (Group C) and glass fiber post with composite core using adhesive resin cement (Group D). Control group (A) samples were selected with intact coronal structure. All the samples were prepared for ideal abutment preparation. All the samples were subjected to a load of 0.5 mm/min at 130° until fracture occurred using the universal testing machine. The fracture resistance was measured and the data were analyzed statistically. The fracture above the embedded resin was considered to be favorable and the fracture below the level was considered as unfavorable. For experimental group Vs control group the fracture resistance values showed significant differences ($P<.05$). For the mode of failure the chi-square value is 16.1610, which means highly significant ($P=.0009$) statistically. Endodontically treated teeth without post core system showed the least fracture resistance demonstrating the need to reinforce the tooth.[10]

CONCLUSION

Under the light of above obtained data, it can be concluded that carbon fiber posts are more resistant to fractures in comparison to ceramic posts.

REFERENCES

1. Torabi K, Fattahi F. Fracture resistance of endodontically treated teeth restored by different FRC posts: An in vitro study. Indian J Dent Res. 2009;20:282–7.
2. Makade CS, Meshram GK, Warhadpande M, Patil PG. A comparative evaluation of fracture resistance of endodontically treated teeth restored with different post core systems-An in-vitro study. J Adv Prosthodont. 2011;3:90–5.
3. Raju SR, Kilaru KR, Haridas KK, Naik B, Shetty K, Venkata SS. Evaluation of the flexural strength of carbon, quartz, and glass fiber-based posts. Saudi Endod J. 2014;4:109–14
4. Morgano SM, Milot P. Clinical success of cast metal posts and cores. J Prosthet Dent. 1993;69:11–6.
5. Fráter M, Forster A, Jantyik Á, Braunitzer G, Nagy K. Fracture strength of elastic and conventional fibre-reinforced composite intraradicular posts--An *in vitro* pilot study. Fogorv Sz. 2015;108:115–9.
6. Pollard MA, Curzon JA, Fenlon WL. Restoration of decayed primary incisors using strip crowns. Dent Update. 1991;18:150–2.
7. Sorensen JA, Engelman MJ. Effect of post adaptation on fracture resistance of endodontically treated teeth. J Prosthet Dent. 1990;64:419–24.
8. Viera CL, Ribeiro CC. Polyethylene fiber tape used as a post and core in decayed primary anterior teeth: A treatment option. J Clin Pediatr Dent. 2001;26:1–4.
9. Moyin S, Chaturvedi S, Alqahtani NM, Shariff M, Abdelmonem AM, Alfarsi MA. An In Vitro Evaluation of Fracture Resistance Strength of Different Post Systems in Endodontically Treated Teeth. J Pharm Bioallied Sci. 2019;11(Suppl 2):S236–S239.
10. Makade CS, Meshram GK, Warhadpande M, Patil PG. A comparative evaluation of fracture resistance of endodontically treated teeth restored with different post core systems - an in-vitro study. J Adv Prosthodont. 2011;3(2):90–95. doi:10.4047/jap.2011.3.2.90