

How to Cite:

Shukla, J., Awinashe, V., Bhardwaj, A., Das, A., Alzunaydi, A., & Bhardwaj, S. S. (2022). Evaluation of fracture resistance of FRC posts, zirconia post and Parapost in endodontically-treated teeth. *International Journal of Health Sciences*, 6(S1), 2614–2619.
<https://doi.org/10.53730/ijhs.v6nS1.5293>

Evaluation of Fracture Resistance of FRC Posts, Zirconia Post and Parapost in Endodontically-Treated Teeth

Jyotsna Shukla

Professor & HOD, Department of Prosthodontics, Modern Dental College and Research Centre, Indore, Madhya Pradesh, India

Vaibhav Awinashe

Associate Professor, Department of Prosthodontics, College of Dentistry in Ar Rass, Qassim University, KAS

Atul Bhardwaj

Lecturer, Department of Prosthodontics, College of Dentistry, Majmaah University, Al Majmaah, 11952, Saudi Arabia

Abhisek Das

Associate Professor, Department of Conservative Dentistry and Endodontics Hitech Dental College, Bhubaneswar, Odisha, India

Ayoub Alzunaydi

General Dentist, Ministry of Health, Al Artawiyah General Hospital, Al Artawiyah, Riyadh Province

Smita Singh Bhardwaj

Assistant Professor, Pediatric Dentistry, Department of Preventive Dental Sciences, College of Dentistry, Majmaah University, Al Majmaah 11952, Saudi Arabia

Abstract---Objectives: To evaluate the fracture resistance efficacy of FRC posts and photo core, zirconia post and Parapost in endodontically treated teeth. **Materials and Method:** Thirty recently extracted mandibular first premolar teeth were randomly grouped in to 3 different groups with 10 samples in each group: FRC posts and photo core, zirconia post and Parapost. Fracture resistance in each group was estimated and compared. **Results:** The fracture resistance was 428.2, 432.1 and 232.5 for group I, II and III. The difference was statistically significant. The mean fracture resistance between group I to Group III and II with III was statistically significant (0.01). The

fracture resistance between Group I and II was not significant ($P>0.05$). *Conclusion:* Authors found that zirconia and FRC posts exhibited higher fracture resistance as compared to paraposts.

Keywords---Fibre reinforced posts, Fracture, Paraposts, zirconia post.

Introduction

In cases with fractured crown, post and core restorations can be placed. ¹Teeth with crown structure less than 50% can be restored with post and core. It is generally used to maintain the prosthetic crown and main aim is to maintain retentive and resistant form.² There are numerous posts available in the market. Metal posts possess higher hardness compared to fiber posts. Metal posts are more vulnerable to fracture than fiber posts. Hence alternative post types were tried. Fiber-reinforced composite (FRC) posts being identical hardness number to that of dentin and thus have optimal toughness.³

Composite core build-up materials have been undergoing modifications over couple of years. These materials require sufficient moisture control for better longevity. ⁴ The dowel is a post or other relatively rigid, restorative material placed in the root of a non-vital 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. Endodontic posts can be metallic and non metallic, preformed and custom made, stiff and flexible and esthetic and non-esthetic. ⁵ The present in vitro study was done to evaluate the fracture resistance efficacy of FRC posts and photo core, zirconia post and Parapost in endodontically treated teeth.

Materials & Methods

This study was conducted in the department of conservative dentistry and endodontics after obtaining approval from ethical committee of institute. Thirty recently extracted mandibular first premolar teeth due to orthodontic purpose were randomly grouped in to 3 different groups with 10 samples in each group; FRC posts and photo core, zirconia post and Parapost. Fracture resistance in each group was estimated and compared.

Samples in all groups underwent endodontic treatment following all standardized parameters with the step-back technique. Following root canal treatment, silicone impression material was applied on all roots to simulate the periodontal ligament and was mounted in cubic acrylic molds.

Post space preparation was done using peeso reamers (Mani, Tochigi-ken, Japan). In all cases three mm of the post was extended above the cemento-enamel junction and respective post were cemented into the prepared post space with cements. Based on manufacturer's instructions, intracanal posts were cemented into the canal using Panavia F2 resin cement. Over coronal extension of post, core built up was done to receive crown. The crowns were seated on the teeth in each group. Using universal testing machine, fracture resistance was calculated by

applying load at 45° angle to long axis of the tooth at a crosshead speed of 1 mm/min. The point where fracture occurred was recorded with the formula, shear bond strength (MPa) = Load (N)/Surface area (mm²). Statistical evaluation was done by a descriptive statistic using SPSS version 20.0 (USA). Student t test and one-way analysis and the level of significance was set below 0.05.

Results

Table 1 indicates Allocation of teeth in different groups. 10 samples were divided in each group. Table indicates Fracture resistance in various groups. The fracture resistance was 428.2, 432.1 and 232.5 for group I, II and III. The difference was statistically significant. Table 3 indicates comparison of fracture resistance among groups. The mean fracture resistance between group I to Group III and II with III was statistically significant (0.01). The fracture resistance between Group I and II was not significant ($P > 0.65$).

Discussion

Restoration of the mutilated endodontically treated tooth is of great concern. They can be restored with post and core. Esthetic, functional and structural rehabilitation of a pulpless tooth is critically important to ensure a successful restorative outcome.⁵ The use of prefabricated posts has brought special attention to core materials.⁶

Makade et al assessed the fracture resistance of endodontically treated teeth restored with different post core systems; cast post-core, stainless steel post with composite core, glass fiber post with composite core using adhesive resin cement and control group. They concluded that stainless steel post with composite core showed the highest fracture resistance among all the experimental groups.⁵

De Melo et al evaluated the influence of remaining coronal tooth structure on endodontically treated teeth restored with prefabricated posts and two different composites for core build-up. They concluded that highest values of fracture resistance were found in the group restored with light-cured resin.⁶

Yi-Bai Guo et al assessed fracture resistance of endodontically treated teeth with posts. They concluded that sixty percent of fractures were unrestorable for fiber-post-supported teeth, while in the fullcusp- coverage restoration group, 80-90% of fractures were restorable.⁷

Moyin et al valuated the fracture resistance strength of different post systems in endodontically treated teeth. They concluded that Zirconia posts show the maximum fracture resistance than the carbon posts and everStick posts.⁸ The results are similar to our findings.

Saritha et al evaluated the fracture resistance of carbon, glass fiber, and zirconia posts. They concluded that zirconia had good fracture resistance compared to glass fiber and carbon posts.⁹ The findings are similar to our results for zirconia.

Gaikwad et al evaluated the fracture resistance of endodontically treated teeth restored with light-cured composite resin core using two different designs of prefabricated metal posts. They concluded that fracture resistance of endodontically treated teeth with parallel post with coronal flare—i post and core buildup had better strength as compared with parallel post—EG post and core buildup.¹⁰

Izadi et al evaluated fracture resistance of endodontically treated teeth based on of three core building materials with fiber reinforced composite (FRC) posts and ParaPosts. It was found that maximum fracture resistance (423.7 ± 111.7) was seen with FRC posts + Core Max II with bonding agent while minimum (242.3 ± 73.4) was seen with ParaPosts + LuxaCore. There was no significant difference with the fracture resistance of other groups ($P > 0.05$).¹¹

Shahryarpanah et al evaluated the effect of Tetric Ceram, Photo Core, LuxaCore and CoreCem on fracture resistance of endodontically-treated teeth reinforced with quartz fiber posts.¹² The results revealed that there was non- significant difference in fracture resistance between Photo Core and LuxaCore. Asadzadeh et al showed that casting post and core group had the highest fracture resistance as compared to FRC post group.¹³ The choice of the posts is predetermined to the dimension of the root canal and restricted by the root length.¹⁴

The limitation of present study is small sample size. The variation if results may be due to type of tooth selected, amount and direction of force applied and root morphology, this study could not reproduce the oral conditions since it was *invitro* study, in contrast to masticatory forces in the mouth, samples were tested under static load.

The samples were not exposed to ageing, fatigue loading and thermal cycling, further *in vitro* studies required with larger samples size and with thermal cycling and fatigue loading for evaluation.

Conclusion

Authors found that FRC posts exhibited higher fracture resistance as compared to paraposts and fracture resistance was not dependent on type of material used.

References

1. Khamverdi Z, Kasraei S. Comparison of microleakage of amalgam, Core Max II and light cured composite in root canal treated teeth (in-vitro). *Majallah Dandan* 2006;18:43-8.
2. Agrawal A, Mala K. An in vitro comparative evaluation of physical properties of four different types of core materials. *J Conserv Dent* 2014;17:230-3.
3. Panitiwat P, Salimee P. Effect of different composite core materials on fracture resistance of endodontically treated teeth restored with FRC posts. *J Appl Oral Sci* 2017;25:203-10.

4. Akkayan B. An in vitro study evaluating the effect of ferrule length on fracture resistance of endodontically treated teeth restored with fiber-reinforced and zirconia dowel systems. *J Prosthet Dent* 2004;92:155-62.
4. 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
6. De Melo MP, Accácio Lins Do Valle², Jefferson Ricardo Pereira³, Wellington Cardoso Bonachela⁴, Luiz Fernando Pegoraro⁵, Gerson Bonfante⁵. evaluation of fracture resistance of endodontically treated teeth restored with prefabricated posts and composites with varying quantities of remaining coronal tooth structure. *J Appl Oral Sci* 2005; 13(2): 141-6
7. Yi-BaiGuo, WeiBai, Yu-HongLiang. Fracture resistance of endodontically treated teeth with cervical defects using different restorative treatments. *Journal of Dental Sciences* (IF 2.080) Pub Date : 2021-10-08 , DOI: 10.1016/j.jds.2021.09.017
8. 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 Bioall Sci* 2019;11:S236-9.
9. Saritha MK, Paul U, Keswani K, Jhamb A, Mhatre SH, Sahoo PK. Comparative evaluation of fracture resistance of different post systems. *J Int Soc Prevent Communit Dent* 2017;7:356-9.
10. Gaikwad AM, Naisargi Shah, 3Sabita M Ram. A Comparative Evaluation of Fracture Resistance of Endodontically Treated Teeth restored with Composite Resin Core using Two Different Designs of Prefabricated Metal Posts: An *in vitro* Study. *Journal of Contemporary Dentistry*, May-August 2017;7(2):97-102
11. Izadi A, Heidari B, Fotovat F, Shahbazi A, Allahbakhshi H, Roshanaei G, et al. Effect of photo core, LuxaCore, and core max II core building materials on fracture resistance of endodontically-treated teeth restored with fiber-reinforced composite posts and ParaPosts. *Dent Res J* 2020;17:244-50.
12. Shahryarpanah S. The Effects of 4 Different Core Materials on Fracture Resistance of Endodontically Treated Teeth Restored with Quarts Fiber Post. Masters Thesis. Kerman University of Medical Sciences; 2008.
13. Asadzadeh Aghadaee N, Goharian R, Asadollahi A. Effect of ferrule and cement type on fracture strength of post core crowned teeth. *JMDS* 2008;32:183-8.
14. Mayya A, Naik R, Mayya SS, Paul-MP. Fracture Resistance of Endodontically Treated Maxillary Premolars with a Longer Single Post and Shorter Double Posts of Different Sizes: An *In Vitro* Study. *J Int Soc Prev Community Dent*. 2020 Mar-Apr; 10(2): 183–184.

Legends for illustrations
Tables

Table 1 Allocation of teeth in different groups

Groups	Material used	Number
Group I	FRC posts and photo core	10
Group II	Zirconia posts	10
Group III	Parapost	10

Table 2 Fracture resistance in various groups

Groups	Mean (Newton)	SD	P value
Group I	428.2	42.4	0.01
Group II	432.1	32.4	
Group III	232.5	74.2	

ANOVA, $p < 0.05$, significance

Table 3 Comparison of fracture resistance among groups

Groups	Mean	SD	Student t	P value
Groups I- II	-3.9	8.1	6.2	0.67
Groups I- III	195.7	34.7	8.2	0.01
Groups II- III	199.6	12.4		

Student t test, $p < 0.05$, significance