Research Article

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Comparative Assessment of Fracture Resistance of Teeth Restored with Different Restorative Materials: An In vitro Study

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ABSTRACT

Background: Fracture resistance of an endodontically treated tooth is less when compared with natural tooth as in root canal treated tooth. The present study was conducted to compare fracture resistance of teeth restored with different restorative materials.

Materials & Methods: The present study was conducted on 60 non carious, single-canal human lower first premolars of both genders. Teeth were randomly divided into 4 groups of 15 teeth each. Group I was Control group (no alteration done). Group II teeth were restored with silver amalgam after endodontic therapy. Group III teeth were restored with posterior composite after endodontic therapy and group IV: teeth were restored with posterior GIC after endodontic therapy.

Results: The mean fracture resistance (Newton) in group I was 1027, in group II was 858.2, in group III was 942.5 and in group IV was 639.2. The difference was significant (P< 0.05).

Conclusion: Authors found that fracture resistance of composite was maximum followed by amalgam and GIC.

Keywords: Composite, Fracture, GIC.

INTRODUCTION

Fracture resistance of an endodontically treated tooth is less when compared with natural tooth as in root canal treated tooth, there will be dehydration and loss of dentin after the procedure, and also some of the vital structures, such as cusps, ridges, and roof of the pulp chamber that provide the support for the natural tooth are distracted.[1] Hence, restoring the tooth to gain strength is important to protect against fracture.[2] Hence post endodontic restoration plays an important role in the success of root canal treated teeth. In addition, restoring root canal treated tooth is necessary to maintain esthetics, function, anatomy of tooth structure, and prevent micro leakage.[3]

Fractures are even more frequent in root-filled teeth. Excessive removal of coronal and radicular dentin during the root canal treatment (RCT) and lower residual moisture reduce the strength and increase tooth's fragility.[4] Loss of axial walls, quite common in teeth that require RCT, also significantly weaken the hard dental tissues. A need for removal of the marginal ridges widens the cavity even further into the interproximal space. Resistance of dental structures reduces by 2.5-fold. This results in an overall 46% reduction in its mechanical resistance. In case when both marginal ridges are affected, the resistance decreases by 63%. [5]

Several materials have been suggested as intracoronal restorative materials, such as glass ionomer cement (GIC); composite resins; miracle mix, coremax, and Hi-Dens, which are metal-reinforced GICs.[6] The present study was conducted to compare fracture resistance of teeth restored with different restorative materials.

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MATERIALS & METHODS

The present study was conducted in the department of Endodontics. It comprised of 60 non carious, single-canal human lower first premolars of both genders. Ethical approval of the study was obtained before starting the study.

Teeth were randomly divided into 4 groups of 15 teeth each. Group I was Control group (no alteration done). Group II teeth were restored with silver amalgam after endodontic therapy. Group III teeth were restored with posterior composite after endodontic therapy and group IV: teeth were restored with posterior GIC after endodontic therapy. Endodontic access cavity and biomechanical preparation was done followed by obturation with gutta-percha and AH-plus root sealer using cold lateral compaction technique. After obturation, the access cavity was restored by different restorative materials. Self-cure acrylic blocks of 4×4 cm were fabricated onto which the teeth were mounted. A universal testing machine was used to assess the fracture strength (Newton) of root canal treated tooth. Results were tabulated and subjected to statistical analysis. P value less than 0.05 was considered significant.

RESULTS

Table I: Distribution of teeth based on restorative material.

Groups	Group I	Group II	Group III	Group IV
Material	Control	Silver amalgam	Posterior composite	Posterior GIC
Number	15	15	15	15

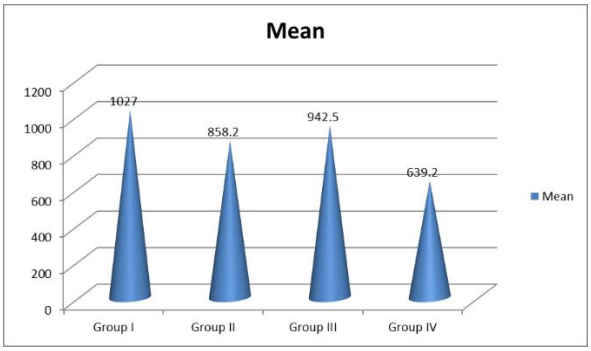
Table I shows distribution of teeth based on restorative material in respective groups. Each group had 15 teeth.

Table II: Fracture resistance of teeth.

Groups	Mean	SD	P value
Group I	1027	137.2	0.01
Group II	858.2	48.5	
Group III	942.5	52.7	
Group IV	639.2	63.2	

Table II, graph I shows that mean fracture resistance (Newton) in group I was 1027, in group II was 858.2, in group III was 942.5 and in group IV was 639.2. The difference was significant (P< 0.05).

Graph I Fracture resistance of teeth



DISCUSSION

Dental amalgam is a restoration of choice by many clinicians, but it has a mechanical adhesion to the tooth and also requires proper cavity preparation which may be difficult to consider for a tooth considered for endodontic purpose.[7] Also, studies have reported micro crack propagation under fatigue loading; hence, it may not provide good fracture resistance of the remaining tooth.[8] Recently, there are great advancements in adhesive restorative technology, which bonds to the tooth in a conservative and aesthetic manner resulting in good bond strength. Recently, posterior GICs have been claimed to have good strength.[9] The present study was conducted to compare fracture resistance of teeth restored with different restorative materials.

In present study, in group I no alteration was done (control), in group II teeth were restored with silver amalgam, group III with posterior composite and group IV teeth with posterior GIC. Mincik et al[10] compared the effect of various restorative materials on fracture resistance in maxillary premolars. The specimens were randomly divided into 8 groups, 8 specimens each: group A intact teeth, group B unfilled cavity, group C composite made by oblique layering technique, group D composite with 2 mm cusp coverage, group E bulk filled posterior composite, group F glass-ionomer, group G amalgam, and group H composite with proximal boxes. The specimens were subjected to an axial compression load with the mean values of fracture resistance in group A: 1289 N, group B: 181.75 N,

group C: 445.38 N, group D: 645.88 N, group E: 355.13 N, group F: 352.00 N, group G: 191.38 N, and group H: 572.00 N. There was no significant difference between groups B and G, between C and D, E, and F, and between group D and H. All other measurements were statistically significant.

We found that mean fracture resistance (Newton) in group I was 1027, in group II was 858.2, in group III was 942.5 and in group IV was 639.2. Sangwan et al[11] in their in vitro study on seventy-five freshly extracted, non carious, single-canal human lower-first premolars divided teeth to five groups with 15 teeth. Group I is control group (no alteration done), group II is restored with silver amalgam after endodontic therapy, group III is restored with posterior composite after endodontic therapy, group IV is restored with posterior glass ionomer cement (GIC) after endodontic therapy, and group V is restored with miracle mix after endodontic therapy. The mean fracture resistance of control group showed highest fracture resistance with a mean Newton of 1083.33±136.78. Among the restorative material, the highest fracture resistance was shown by teeth restored by composite (845.46±47.36), followed by silver amalgam (845.46±47.36). There was statistically significant difference among all the restorative materials compared with the control group ($p< 0.05$).

Dalpino et al[12] showed that mesio-occluso-distal (MOD) cavity design measuring half of the intercuspal distance, rounded internal angles, and either convergent or divergent angulation of internal walls weakens the remaining tooth structure. Relatively wide MOD cavities restored with amalgam frequently develop cusp fractures due to continuous functional occlusal forces. This is mainly caused by the inability of amalgam to strengthen weakened cusps.

The shortcoming of the study was small sample.

CONCLUSION

Authors found that fracture resistance of composite was maximum followed by amalgam and GIC.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

REFERENCES

1. Daneshkazemi AR. Resistance of bonded composite restoration to fracture of endodontically treated teeth. J Contemp Dent Pract 2004 Aug;5(3):51-58.

2. SteeleA,JohnsonBR.In vitro fracture strength of endodontically treated premolars. J Endod 1999 Jan;25(1):6-8.

3. Ashika Riswana N, Kumari VA. Comparison of fracture resistance of endodontically treated tooth with composite and GIC as entrance filling– an in vitro study. J Pharm Sci Res 2015;7(11): 984-986

4. Ranga B, Chole DG, Shashank K. Resistance to fracture of endodontically treated premolars restored with glass ionomer cement or acid etch composite resin: an in vitro study. J Int Clin Dent Res Organ 2010;2(3):106-112.

5. Sores PV, Santos-Filho PC, Gomide HA, Araujo CA, Martins LR, Soares CJ. Influence of restorative technique on the biomechanical behavior of endodontically treated maxillary premolars. Part II: strain measurement and stress distribution. J Prosthet Dent 2008 Feb;99(2):114-122.

6. Belli S, Erdemir A, Ozcopur M, Eskitascioglu G. The effect of fibre insertion on fracture resistance of root filled molar teeth with MOD preparation restored with composite. Int Endod J 2005 Feb;38(2):73-80.

7. Sagsun B, Cobankara FK, Orucoglu H. Effect of a new restoration technique on fracture resistance of endodontically treated teeth. Dent Traumatol 2008 Apr;24(2):214-219.

8. Kishen A. Mechanisms and risk factors for fracture predilection in endodontically treated teeth. Endod Topics 2006 Mar;13(1):57-83.

9. Monga P, Sharma V, Kumar S. Comparison of fracture resistance of endodontically treated teeth using different coronal restorative materials: an in vitro study. J Conserv Dent 2009 Oct;12(4):154-159

10. Mincik J, Urban D, Timkova S, Urban R. Fracture resistance of endodontically treated maxillary premolars restored by various direct filling materials: an in vitro study. International Journal of Biomaterials. 2016; 4.

11. Sangwan B, Rishi R, Seal M, Jain K, Dutt P, Talukdar P. An in vitro Evaluation of Fracture Resistance of endodontically treated Teeth with Different Restorative Materials. J Contemp Dent Pract 2016;17(7):549-552.

12. Dalpino, C. E. Francischone, A. Ishikiriama, and E. B. Franco. Fracture resistance of teeth directly and indirectly restored with composite resin and indirectly restored with ceramic materials. American Journal of Dentistry 2002; 15 (6): 389–394.