Research Article

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Evaluation of Fracture Resistance of Three Different Core Build-Up Materials Using Nayyar Core Technique

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ABSTRACT

Background: The aim of this study was to determine the occlusal fracture resistance of three core build-up materials using the Nayyar Core Technique.

Material and Method: 30 human extracted maxillary premolars were decoronated till the cementoenamel junction (CEJ) followed by cleaning shaping and obturation. The gutta-percha was removed till the depth of 4 mm with Peso-reamers and were randomly divided into 3 groups. Group I was restored with Admixed Silver Amalgam Alloy (DPI), group II with MultiCore Flow (Ivoclear Vivadent), and group III with Tetric-N-Ceram (Ivoclear Vivadent). The fracture resistance strength of all the specimen groups was tested under a universal testing machine**.**

Result: The data of the study showed that the group II samples which were restored with MultiCore Flow (Ivoclear Vivadent) showed much higher fracture resistance strength compared to the other two groups. Statistically significant difference was noted between group II and other two groups. Difference between group I and III was not significant.

Conclusion: It can be concluded that the core buildup done with MultiCore Flow (Ivoclear Vivadent) composite offered better occlusal fracture resistance strength compared to Silver Amalgam alloy and Tetric-N-Ceram (Ivoclear Vivadent).

Keywords: Core buildup materials, corono-radicular buildup, Fracture resistance, MultiCore Flow, Nayyar cores.

INTRODUCTION

Root Canal Treatment is one of the most commonly done therapy in endodontic practice. It is obligatory for a dentist to restore the form and function of endodontically treated tooth. Earlier it was believed that success of root canal therapy was solely depended on quality of biomechanical preparation and obturation. The effects of poor coronal restorations on endodontic outcome received little attention. The success of root canal therapy depends on the tight seal not only at the apex but

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also at the orifice in the pulp chamber. It is important to realize that endodontically treated teeth are structurally different from the non-treated vital teeth. Major changes following treatment include altered tissue physical characteristics, loss of tooth structure, and possibly discoloration. It is critical to understand the implication of such features on tooth biomechanics, as they will largely influence the restorative approach and means. Most of the root canal treated teeth require a build-up which may be as simple as closing the access opening or restoring the complete tooth. The ideal properties of core build-up material should have adequate strength, must be biocompatible, exhibit a high level of resistance to bacterial leakage, and be dimensionally stable in the presence of oral fluids. [1]

Various techniques and special considerations are needed for restoration of root canal treated teeth to promote endurance as they have inadequate coronal tooth structure. [2] The deficient coronal tooth structure makes retention and stability of subsequent restorations more challenging.

Nayyar et al. suggested a technique using an amalgam dowel–core. In this technique, retention for the amalgam-core is derived from the remaining pulp chamber and the prepared canals by extending amalgam to these areas. [3] This technique involves the removal ofobturated gutta-percha to the depth of 2–4 mm from canal orifice and restoring with amalgam. The quality of root canal treatment and prosthodontic reconstruction are the two key factors which determine the longevity of grossly decayed tooth. [4] The aim of this study was to evaluate occlusal fracture resistance strength of the three different core materials using Nayyar technique.

MATERIAL AND METHODS

Thirty human extracted premolars were used for this study. Teeth were cleaned of surface deposits using ultrasonic scaler. All the samples were decoronated till the cementoenamel junction with the help of diamond disc under water spray. Access to pulp chamber was gained with the help of round bur. Patency was established and working length was taken by introducing 10 K file until the tip was seen at the apex working length radiograph was taken.

Fig 1: 30 premolars collected and decoronated up to cementoenamel junction.

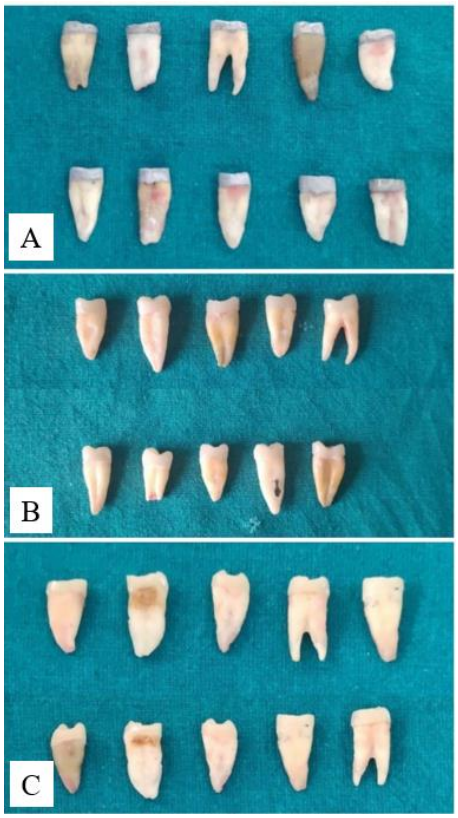


Fig 2: A-Samples of group 1 restored with Admixed Silver Amalgam alloy. B-Samples of group 2 restored with MultiCore Flow. C-Samples of group 3 restored with Tetric-N-Ceram.

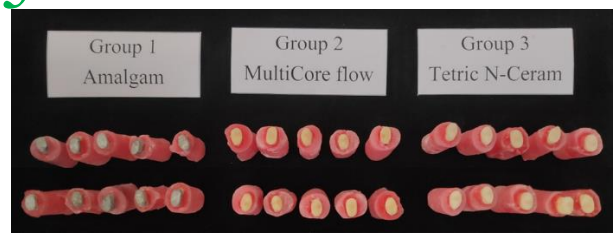


Fig 3: Samples mounted on acrylic block.

Fig 4: Samples placed in universal testing machine for measurement of fracture resistance.

Cleaning and shaping was done with AF Blue F one Single file system (Fanta Dental Materials) upto 30-04. Prepared samples were obturated with the corresponding gutta-percha cones (DiaDent). The gutta-percha was removed till the depth of 4 mm from coronal orifice with the help of no. 4 peso-reamers (Dentsply). Coronal 4mm of the canal was irrigated with normal saline to remove any gutta percha residue. The samples were then randomly divided into three groups (n=10).

The samples of group 1 were restored with Admixed Silver Amalgam alloy (DPI). The samples were mounted on a custom-made wax block and Tofflemaire retainer and universal matrix band was placed around the tooth. Silver Amalgam alloy was manipulated and filled incrementally. Alloy was condensed using round condenser between each increment to make sure that it reaches the depth of 4 mm of the prepared radicular space. Homogenous coronal build-up was done followed by carving and burnishing.

The samples of group 2 were restored with MultiCore Flow (Ivoclear Vivadent). MultiCore Flow is a dual cure, fluoride containing core build-up composite. Same procedure was followed for matricing as in group 1. The tooth surfaces were conditioned with phosphoric acid gel (Total Etch), left for 15 seconds and was rinsed thoroughly with a stream of water for 5 seconds. The surfaced was dried with compressed air until the etched enamel surfaces appear chalky. The surface was then scrubbed with dental adhesive for 20 seconds and was light cured for 10 seconds. MultiCore Flow is supplied in automix syringe. New mixing tip was placed on syringe and intraoral tip was attached to the mixing tip to allow the material to flow into the prepared radicular space. Material was injected directly into the coronal 4mm of the canal. Finger pluggers were introduced into the canal with to and fro movement to avoid any voids. It was cured for 30 seconds followed by coronal build-up.

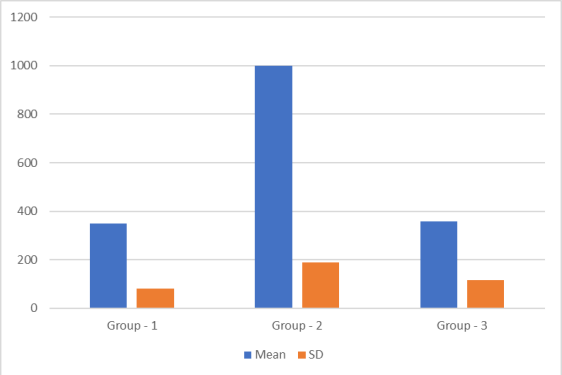
The samples of group 3 were restored with Tetric-N-Ceram (Ivoclear Vivadent). The sample were etched with phosphoric acid gel (Total Etch) and left for 15 seconds and was rinsed thoroughly with a stream of water for 5 seconds. The surfaced was dried with compressed air until the etched enamel surfaces appear chalky. The surface was then scrubbed with dental adhesive for 20 seconds and was light cured for 10 seconds. Tetric-N-Ceram Bulkfill composite was places in to 4mm canal space, condensation was performed with the help of finger plugger and cure for 30 seconds. Later coronal build-up was completed.

In all the samples tofflemaire retainer and band was removed and polishing was done. Radiograph was taken to confirm whether the material has filled coronal 4mm or not.

Periodontal ligaments were simulated for all the samples and mounted on an acrylic block. The samples were placed parallel to the long axis of the upper arm of the universal testing machine with tapering tip. A static load with 0.5mm speed was applied on the specimens to the point of fracture and values were noted. The noted values were analysed using one-way analysis of variance (ANOVA)

RESULT

One-way ANOVA comparison test revealed significant differences in the fracture resistance of core materials. The result of study showed higher occlusal fracture resistance in group 2. The mean fracture resistance of group 2 is 1001 N, which is much higher and statistically significant compared to that of other two groups. The mean fracture resistance of group 1 and 3 are 349.96 N and 358.62 N respectively. (Graph 1) There was no statistical significant difference between the fracture resistance of group 1 and 3.



Graph 1: Difference between mean and standard deviation of three groups

DISCUSSION

Restoration and appropriate reconstruction of the tooth structure is of utmost importance for the success of good root canal treatment. [5] Various scientific literature has advocated that endodontically treated teeth are more susceptible to fracture, than vital teeth. [6,7] A post and core build-up is suggested to provide adequate support, stability, foundation structure and retention to crown or extra coronal restoration in endodontically treated teeth. But it has been suggested that placing a post in a root canal treated teeth would pose extra risks to the fracture of the tooth itself. [8]

According to the current way of thinking, the most important factors against tooth fractures are the preservation of as much as possible sound tooth structure as well as the use of full coverage. The amalgam coronal-radicular dowel and core technique or Nayar core technique has been tested successfully in various in-vivo and in-vitro studies. The advantages for these techniques are that it requires less sound teeth structure removal, involves uniform material for both dowel and the core and is accomplished in single visit, if required it can be easily removed. [9] Therefore, proper understanding and knowing about the restorative techniques that could ensure the longevity of an already weekend tooth would prove beneficial for the dentist as well the patient. Thus, the aim of this study was to shed some light on Nayar core technique and various material which can be used to restore tooth with the help of this technique.

Ideal requirements of core buildup material are, it should exhibit satisfactory mechanical and physical properties including compressive and flexural strength, to resist intraoral forces which could result in core fracture or displacement during service. The materials used should also be biocompatible, easy to apply, with an ability to bond to tooth structure, and to pins or posts, if applied. [10] Core materials should be independently retentive, having a stable connection with the remaining tooth structure and properties similar to those of the tooth structure to be replaced.

In this study the samples of group 1 were restored with Silver Amalgam alloy. Amalgam has been considered to be the material of choice for cores. Both mechanical test and finite element analyses have indicated that amalgam cores have superior performances in comparison to resin composite cores. [11,12,13] In fatigue testing, amalgam cores have deformed less, produced smaller marginal gaps and applied lesser stresses to tooth structure than resin composite cores.[11,12,13] Amalgam cores are certainly to be preferred to glass ionomer, resin-modified glass ionomer, or glass ionomer cermet cores. The dark colour of amalgam is non-esthetic but provides sufficient contrast from tooth structure during tooth preparation. [14] The main disadvantage of using amalgam as a core build-up material is its slow setting time which does not allow immediate tooth preparation and prosthesis placement.[15] In this study the mean fracture resistance for amalgam core was found to be 349.96 N which is lower than other 2 groups. The reason for this low fracture resistance of amalgam core can be attributed to only mechanical bonding present between amalgam core and tooth structure.

The mean fracture resistance of Multicore Flow is 1001 N. Out of all the three groups the mean fracture resistance of MultiCore Flow is maximum. MultiCore Flow is a dual curing flowable core build-up composite available in four shades which provide optimum foundation for reconstruction of vital and non-vital teeth with part or mast of the clinical crown missing. MultiCore Flow achieves excellent mechanical strength by chemical self-curing alone, the additional light polymerization allows a dentist to immediately start with the preparation. The higher fracture resistance of MultiCore Flow compared to Amalgam can be attributed to its mechanism of adhesion to the dentin. Other advantages of MultiCore Flow over Amalgam are it esthetic appearance and shade selection and shorter setting time.

Tetric® N Ceram BulkFill is a nano-hybrid composite it has excellent aesthetic properties and available in various shades. In this study Tetric® N Ceram BulkFill showed mean Fracture resistance similar to Silver Amalgam alloy. This could be due to Nanohybrid technology and increased filler loading (77 wt %) and nanofiller dimensions in Tetric® N Ceram BulkFill. [16] Tetric® N Ceram BulkFill also has better aesthetic properties compared to Amalgam and MultiCore Flow.

This study has minimal sample size and was performed in-vitro, which could not mimic the exact intraoral conditions and the force used for fracture resistance was one directional. Despite above limitation the result provides a valuable information regarding fracture resistance strength of the three core materials tested. Further in-vivo studies may shed lighter on the properties of these materials as well as Nayyar Core Technique.

CONCLUSION

On the basis of this study, we can say that restoration of Endodontically treated tooth can be successfully done through Nayyar core technique. Nayyar et al. suggested use of amalgam for this technique. Amalgam provides good strength but has its limitation like mercury toxicity and poor aesthetics. Recently developed Core build-up composites like MultiCore Flow has higher strength compared to Amalgam as well as provides excellent aesthetics.

CONFLICTS OF INTEREST

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

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