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Original Research

Assessment of fracture resistance of endodontically treated teeth using two different coronal restorative materials: A comparative study

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ABSTRACT
Background: A core build- up refers to a restoration done in a poorly broken down tooth with the purpose of restoring the bulk of the coronal portion so as to facilitate the subsequent restoration by means of an indirect extra coronal restoration. Hence; we planned the present study to assess the fracture resistance of endodontically treated teeth using two different coronal restorative materials. **Materials & methods:** The present study included assessment and comparison of fracture resistance of endodontically treated teeth using different coronal restorative materials. A total 75 freshly extracted maxillary premolars were collected. All the teeth specimens were divided broadly into four study groups with 25 specimens in each group as follows: Group A: Controls (Unaltered teeth), Group B: Teeth in which MOD (mesial-occlusal-distal) cavities were prepared and final restoration was done using high copper amalgam (as per manufacturer's instruction), and Group C: Teeth in which MOD (mesial-occlusal-distal) cavities were prepared and final restoration was done using composite resin (as per manufacturer's instruction). Preparation of stainless steel cylindrical moulds was done with self-cure acrylic resin as filler. Testing of the fracture strength was done using universal force testing machine. **Result:** Mean Forces at fracture point (N) among specimens of Group A was 1250.80 N, while mean Forces at fracture point (N) among specimens of Group B and Group C was 680.28 N and 897.22 N respectively. Significant results were obtained while comparing the mean forces at fracture points among specimens of the three study groups. **Conclusion:** Fracture strength of the teeth restored with composite resin is significantly higher in comparison to the teeth restored with composite resin.

Key words: Endodontically, Fracture, Restorative

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INTRODUCTION

A core build- up refers to a restoration done in a poorly broken down tooth with the purpose of restoring the bulk of the coronal portion so as to facilitate the subsequent restoration by means of an indirect extra coronal restoration. A core restoration should provide satisfactory strength and resistance during crown preparation and impression procedures and therefore contribute to the retention and support of the temporary crown and in long term the definitive restoration.[1- 3] The core material should have compressive strength to resist intraoral forces and flexural strength to prevent core dislodgement during function. Materials used for core restoration after endodontic treatment include amalgam, glass ionomer, hybrid glass ionomer, and resin composites.[4- 6]

Studies suggest that complex amalgam restorations, complete cast coverage, cast restorations, and composite materials can all be used as postendodontic restorations.[7] Hence; under the light of above mentioned data, we planned the present study to assess the fracture resistance of endodontically treated teeth using two different coronal restorative materials.

MATERIALS & METHODS

The present study was conducted in the department of conservative dentistry and it included assessment and comparison of fracture resistance of endodontically treated teeth using different coronal restorative materials. Ethical approval was obtained from the institutional ethical committee and written consent was obtained after explaining in detail the entire research protocol. A total 75 freshly extracted maxillary premolars were collected. Exclusion criteria for selection tooth specimen for the present study included:

- Carious teeth,
- Teeth with presence of any anatomic deformity

Cleaning of all the tooth specimens was done with normal saline. All the teeth specimens were divided broadly into four study groups with 25 specimens in each group as follows:

Group A: Controls (Unaltered teeth).

Group B: Teeth in which MOD (mesial-occlusal-distal) cavities were prepared and final restoration was done using high copper amalgam (as per manufacturer's instruction).

Group C: Teeth in which MOD (mesial-occlusal-distal) cavities were prepared and final restoration was done using composite resin (as per manufacturer's instruction).

Storing of all the teeth was done in one hundred percent humidity at thirty seven degree centigrade for one week. Preparation of stainless steel cylindrical moulds was done with self-cure acrylic resin as filler. Mounting of teeth into the cylindrical moulds was done upto the level of 1 mm apical to cement-enamel junction. Testing of the fracture strength was done using universal force testing machine. All the results were recorded in Microsoft excel sheet and were analysed by SPSS software. Chi- square test was used for assessment of level of significance. P- value of less than 0.05 was taken as significant.

RESULTS

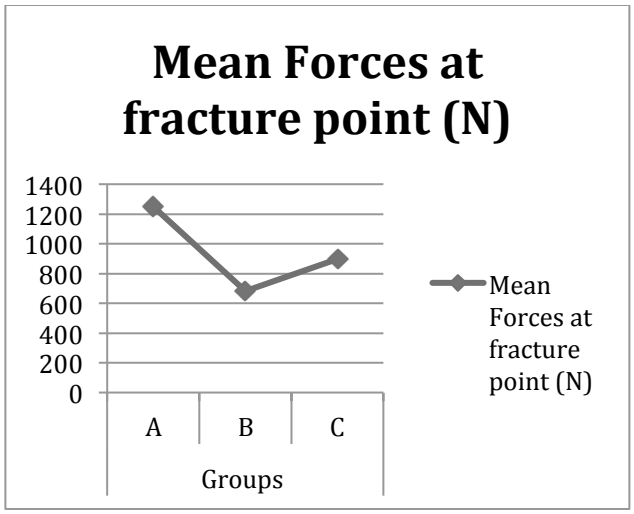
In the present study, a total of 75 tooth specimens were analysed. All the specimens were broadly divided into three study groups; Group A, Group B and Group C. Mean Forces at fracture point (N) among specimens of Group A was 1250.80 N, while mean Forces at fracture point (N) among specimens of Group B and Group C was 680.28 N and 897.22 N respectively. Significant results were obtained while comparing the mean forces at fracture points among specimens of the three study groups.

Table 1: Forces at fracture points

Forces at fracture point (N)	Groups			p-value
	A	B	C	
Mean	1250.80	680.28	897.22	0.02*
±SD	375.15	205.91	261.82	

*: Significant

Graph 1: Forces at fracture points



DISCUSSION

The primary goal of dental restorative material is to replace the biological, functional and esthetic properties of healthy tooth structure. Dental amalgam and gold alloys, which have a long record of clinical success, have been used as dental restorative materials for more than 100 years, especially in posterior teeth, because their mechanical properties match those of natural teeth; however, these metallic materials are not esthetic.[5- 7]

Through decades now, amalgam has been used as a posterior restorative material. However, when patients became more esthetic conscious, silicates and dimethacrylate materials were put to use. Silicate cement, owing to their poor mechanical properties, were used only in anterior teeth and overall also had a high failure rate. Composite resins were then introduced to over the disadvantages of the other cement.[7- 9]

Mandava J et al compared the microtensile bond strength of three bulk-fill restorative composites with a nanohybrid composite. Class I cavities were prepared on sixty extracted mandibular molars. Teeth were divided into 4 groups (n= 15 each) and in group I, the prepared cavities were restored with nanohybrid (Filtek Z250 XT) restorative composite in an incremental manner. In group II, III and IV, the bulk-fill composites (Filtek, Tetric EvoCeram, X-tra fil bulk-fill restoratives) were placed as a 4 mm single increment and light cured. The restored teeth were subjected to thermocycling and bond strength testing was done using instron testing machine. The mode of failure was assessed by scanning electron microscope (SEM). The bond strength values obtained in megapascals (MPa) were subjected to statistical analysis, using SPSS/PC version 20 software. The highest mean bond strength was achieved with Filtek bulk-fill restorative showing statistically significant difference with Tetric EvoCeram bulk-fill ($p<0.003$) and X-tra fil bulk-fill ($p<0.001$) composites. Adhesive failures are mostly observed with X-tra fil bulk fill composites, whereas mixed failures are more common with other bulk fill composites. Bulk-fill composites exhibited adequate bond strength to dentin and can be considered as restorative material of choice in posterior stress bearing areas.[6]

Dental resin-based composites are widely used in restorative dentistry since they have been introduced for the first time in the middle of 1960. Compared to dental amalgams, they have less safety concerns, have simple usability, and possess better aesthetic

properties. Nevertheless, amalgam still performs better mechanical properties than composite.[10- 12]

Monga P et al evaluated the in vitro effect of bonded restorations on the fracture resistance of root canal-treated teeth. One hundred twenty extracted, maxillary, permanent premolars were collected. After preparing the access cavity, the teeth were biomechanically prepared and obturated. Samples were divided into six groups based on the type of restorative material used to restore them. Teeth were embedded in acrylic resin and their fracture strength was measured using a Universal Testing Machine. Teeth restored with bonded amalgam and composite resin showed higher fracture resistance than those restored with conventional amalgam. Fracture strengths of bonded restorations and intact teeth were not statistically different. Conventional amalgam core showed the least fracture resistance whereas; composite resin and bonded amalgam core showed fracture resistance was similar to that of natural tooth.[13]

Jayanthi N et al compared the mechanical properties of materials used for direct core foundations. The differences between the compressive strength and flexural strength of Filtek Z350 nanocomposite with conventional core build up materials like Amalgam, Vitremer GIC and Fluorocore were tested. Cylindrical plexi glass split molds of dimension 6 ± 1 mm [height] x4 ± 1 mm [diameter] were used to fabricate 15 samples of each core material for testing the compressive strength and rectangular plexi glass split molds of dimension 25 ± 1 mm [length] x 2 ± 1 mm[height] x2 ± 1 mm [width] used for fabricating samples for flexural strength. The samples were stored a water bath at 250 °C for 24 h before testing. The samples were tested using a Universal Instron testing machine. The results of the study showed that Fluorocore had the highest compressive strength and flexural strength followed by Filtek Z350 [nanocomposite] Amalgam had the least flexural strength and Vitremer GIC had the least compressive strength.[14]

CONCLUSION

Under the light of above obtained results, the authors conclude that fracture strength of the teeth restored with composite resin is significantly higher in comparison to the teeth restored with composite resin. However; further studies are recommended.

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