ISSN No: 2455-7803

Index Copernicus value (ICV) = 68.10

ORIGINAL ARTICLE

Evaluation of fracture resistance of teeth restored with composite

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***ABSTRACT*:**
Background: Endodontically treated teeth are more prone to fracture than vital teeth. The present study was conducted to assess fracture resistance of teeth restored with composite resins. **Materials & Methods:** The present study was conducted on 60 non carious periodontically weak mandibular premolars. Teeth were divided into 3 groups. The specimens were mounted in an universal testing machine and subjected to an axial compression load applied parallel to the long axis of the tooth. **Results:** In group I, teeth were restored with direct composite resins. In group II, teeth were restored with indirect composite resins and group III teeth were control. Each group had 20 teeth. Fracture resistance of group I teeth was 1.42 KN, group II was 1.87 KN and group III was 1.92 KN. The difference was non- significant (P> 0.05). **Conclusion:** Authors found that both direct and indirect composite resins had equal fracture resistance.
Key words: Fracture, Composite resin, Vital.

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This article may be cited as: Bhat SA. Evaluation of fracture resistance of teeth restored with composite. Int J Res Health Allied Sci 2017;3(3):61-63.

INTRODUCTION

Restoring non vital teeth represents a major challenge for clinicians. Endodontically treated teeth are more prone to fracture than vital teeth, particularly in the posteriors where the stress generated by normal functional forces can lead to fracture of undermined tooth structure.[1] Post endodontic restoration plays an important role in the success of root canal treated teeth. Many in-vivo studies have highlighted endodontic treatment as the major etiological factor for tooth fracture.[2]Posterior teeth have an anatomic shape that makes them more likely to fracture the cusps under occlusal load. Additionally, these teeth when treated endodontically can be easily fractured because of pulp chamber roof removal, mainly when the marginal ridge is thin or totally removed.[3]

Dental restorative composites have been widely used over the past decade to restore posterior teeth. Occlusal wear and secondary caries are the predominant causes of failure in direct posterior composite fillings. However, fracture has also been reported to be a common reason for replacement.[4] Mesioocclusodistal cavity preparation brings about a significant reduction in tooth strength due to the loss of marginal ridges and microfractures caused by applied occlusal forces.

The introduction of composites and dentinal adhesives has been a significant contribution to the fracture resistance of teeth because it can reinforce the dental structure as a result of bonding to the tooth; in addition, the adhesive type has a significant effect on the fracture resistance.[5] The present study was conducted to assess fracture resistance of teeth restored with composite resins.

MATERIALS & METHODS

The present study was conducted in the department of Endodontics. It comprised of 60 non carious periodontically weak mandibular premolars. All were informed regarding the study. Ethical approval was obtained from institute prior to the study.

All teeth were stored under natural 10% neutral buffered formalin for 72 hours. Teeth were then cleaned with pumice and viewed under microscope for any pre- existing cracks or fracture. Teeth were divided into 3 groups. In group I, teeth were prepared and restored with direct composite resins. In group II, teeth were prepared and restored with indirect composite resins and group III teeth were unprepared and unrestored (Control).

After 48 hours of storage, the specimens were mounted in an universal testing machine and subjected to an axial compression load applied parallel to the long axis of the tooth. The load required to cause fracture of the specimens was expressed in Newtons as registered by the machine. Results thus obtained were subjected to statistical analysis. P value less than 0.05 was considered significant.

RESULTS

Table I: Distribution of teeth

Groups	Group I	Group II	Group III
Material	Direct composite resins	In direct composite resins	Control
Teeth	20	20	20

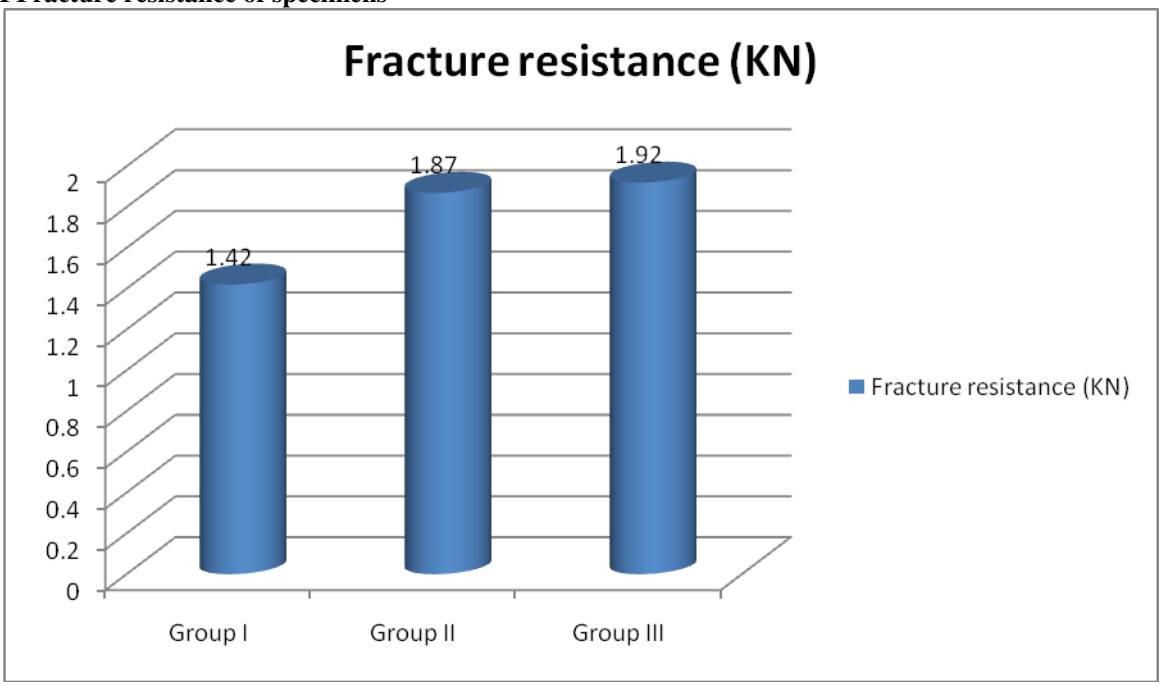
Table I shows that in group I, teeth were restored with direct composite resins. In group II, teeth were restored with indirect composite resins and group III teeth were control. Each group had 20 teeth.

Table II Fracture resistance of specimens

Groups	Fracture resistance (KN)	P value
Group I	1.42	0.51
Group II	1.87	
Group III	1.92	

Table II, graph I shows that fracture resistance of group I teeth was 1.42 KN, group II was 1.87 KN and group III was 1.92 KN. The difference was non- significant (P> 0.05).

Graph I Fracture resistance of specimens



DISCUSSION

Commonly practiced method to regain fracture resistance is to use fiber reinforced resin based composite posts with composite core build up, especially in esthetic zone as premolars. Main advantages over the other post and core system are minimal tooth structure removal during canal shaping, greater post to canal adaptation in the apical and coronal half of the canal, good retention, modulus of elasticity equal to dentin which minimizes incidence of root fracture etc.[6] The present study was conducted to assess fracture resistance of teeth restored with composite resins.

In present study, in group I, teeth were restored with direct composite resins. In group II, teeth were restored with indirect composite resins and group III teeth were control. Each group had 20 teeth. Sedgley and Messer[7] studied the biomechanical properties of non-vital teeth in tests of tenacity, microhardness and shear and fracture resistance. They concluded that these properties do not change, suggesting that cumulative loss of dental structure by caries, trauma, restorative and endodontic procedures lead susceptibility to fracture. It has been suggested that cusp elongation due to cavity preparation may be the major factor in fracture susceptibility, mainly in endodontically treated upper premolars whose anatomy tends to separate the buccal and palatal cusps under occlusal load.

Fennis et al[8] compared the fracture resistance of premolars restored with three forms of composite resins, beta quartz inserts, horizontally and obliquely layered was compared and observed the maximum fracture resistance in the oblique-layered method. They demonstrated that beta quartz inserts act as mega filler, thereby reducing the polymerization shrinkage and resulting in a higher fracture resistance compared with the horizontally layered technique.

We found that fracture resistance of group I teeth was 1.42 KN, group II was 1.87 KN and group III was 1.92 KN. Gelb et al[9] in their study, divided teeth into group A (control), sound teeth; group B, wide MOD cavities prepared and the pulp chamber roof removed and restored with resin composite without cusp coverage; group C, same as Group B with 2.0 mm of buccal and palatal cusps reduced and restored with the same resin. The teeth were included in metal rings with self curing acrylic resin, stored in water for 24 h and thereafter subjected to a compressive axial load in a universal testing machine at 0.5 mm/min. The mean fracture resistance values ± standard deviation (kgf) were: group A: 151.40 ± 55.32, group B: 60.54 ± 12.61, group C: 141.90 ± 30.82. Statistically significant differences were found only between Group B and the other groups.

Hansen[10] conducted a study in which specimens were restored in Groups 1, 2, and 3 with Filtek P60 and in Groups 4, 5, and 6 with Nulite F. After being stored 24 hours at 37◦C, a 4mm diameter steel sphere in a universal testing machine was applied on tooth buccal and lingual cusps at a cross-head speed of 5 mm/min until fracture occurred. Groups 3 and 6 showed higher fracture resistance than Groups 1, 2, 4, and 5. Among the placement techniques, the fiber insert method had a significant effect, but the type of composite was ineffective. The insertion technique in contrast to the type of material had a significant influence on the fracture resistance of premolar teeth.

CONCLUSION

Authors found that both direct and indirect composite resins had equal fracture resistance.

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