



Fracture Resistance Of The Two Different Core Materials Used Such As Everx Posterior And Filtek Z250

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Abstract

Introduction: Restoration of the endodontically treated tooth is complicated by the fact that much or all of the coronal tooth structure which normally would be used in the retention of restoration has been destroyed by caries, previous restorations, trauma, and the endodontic access preparation itself. The dentist must employ the principle of substitution, using a dowel in the root canal itself, or pins in the surrounding tooth structure, by core build-up as a replacement for the missing coronal tooth structure. Only then can the tooth be restored.

Aim & Objective: To evaluate the fracture resistance of two different core materials Ever X posterior and Filtek Z250 among the three different teeth in Class I, class II, and in MOD Preparation.

Materials and methods: A comparative experimental in-vitro study with two different core materials such as Ever X posterior and Filtek Z250 materials among the three different teeth such as Maxillary Premolar, Maxillary Molar, and Mandibular Molar in three different preparations of Class I, Class II, and MOD.

Result: The results revealed that Ever X Posteriors were stronger in fracture resistance in Maxillary Premolar and Mandibular Molar in both Class I and II preparations. Also, in MOD Preparation it was stronger with Maxillary Molar Mandibular Molar teeth.

Discussion: Plenty of core materials are used in dentistry which includes amalgam, resin composite, titanium, reinforced resin composite, lanthanide, and reinforced composite, glass-ionomers, heat-pressed ceramics, and cast gold. A lot of skill in selecting the most appropriate material and technique is required, as the strength demanded of such a foundation varies according to the amount of tooth structure lost, as well as its location. Ever X posterior and Filtek Z250 are hybrid composite materials available and have shown good performance.

Conclusion: The results revealed that Ever X Posteriors were stronger in fracture resistance in Maxillary Premolar, maxillary molar, and Mandibular Molar in both Class I and II preparations. Also, in MOD Preparation it was stronger with Maxillary Molar, Mandibular Molar teeth.

Keywords: Ever X Posteriors, Filtek Z250, Maxillary Premolar, Maxillary Molar and Mandibular Molar, Fracture resistance.

INTRODUCTION

Restoration of the endodontically treated tooth is complicated by the fact that much or all of the coronal tooth structure which normally would be

used in the retention of restoration has been destroyed by caries, previous restorations, trauma, and the endodontic access preparation itself. The

dentist must employ the principle of substitution, using a dowel in the root canal itself, or pins in the surrounding tooth structure, by core build-up as a replacement for the missing coronal tooth structure¹. Only then can the tooth be restored. A lot of skill in selecting the most appropriate material and technique is required, as the strength demanded of such a foundation varies according to the amount of tooth structure lost, as well as its location².

Functionally, a core should withstand all occlusal loads applied and distribute equally to the remaining portion of the tooth. The ability of the core to prevail against masticatory forces and remain firmly seated in the tooth is critical to the sustenance of restoration. Failure of core material can result in crown failure and fractures³. A comparative evaluation of microleakage among newer composite materials tested with forty-five extracted healthy premolars with standard Class II cavities revealed that Group C (ORMOCER – Admira) presented with the least microleakage followed by Group B (Tetric N-Ceram) followed by Group A (Tetric Ceram)⁴. Therefore one should be careful in selecting the material with good fracture resistance to avoid microleakage while selecting appropriate material for endodontic treatment. Plenty of core materials are used in dentistry which includes amalgam, resin composite, titanium, reinforced resin composite, lanthanide reinforced composite, glass-ionomers, heat-pressed ceramics, and cast gold. Ever X and Filtek are hybrid composite materials available currently and have shown good performance⁵. Ever x posteriors a fiber-reinforced composite material. Filter Z250 are hybrid composites. Both of these resins are of higher molecular weight and therefore have fewer double bonds per unit of weight. The higher molecular weight of the resin results in less shrinkage reduced aging and a slightly softer resin matrix. Additionally, these resins impart a greater hydrophobicity and are less sensitive to changes in atmospheric moisture an attempt is made in this study to use these materials as restorative material instead of a core⁶. Based on various literature reviewed, the author decided and conducted a comparative quasi-experimental invitro study⁹ intending to study the fracture resistance of the Ever X Posterior and Filtek Z250 using three different cavity designs in three different teeth with the hypothesis that there will be a significant difference in the fracture resistance of the two

different materials when used on three different cavity designs in three different teeth. There is a significant difference in the fracture resistance between Ever X Posterior and Filtek Z250 in three different teeth such as Maxillary Premolar, Maxillary Molar and Mandibular Molar in three different preparations of Class I, Class II and MOD”

MATERIALS AND METHODS

This comparative study was done in 2014 January to December, at the Department of Prosthodontics Crown and Bridge, Rajah Muthaiah Dental College, Annamalai University A comparative quasi-experimental in-vitro study with two different core materials such as Ever X posterior and Filtek Z250 materials among the three different teeth such as Maxillary Premolar^{15,16}, Maxillary Molar and Mandibular Molar in three different preparations of Class I, Class II and MOD.

In this study, the intact, normal human teeth, three of maxillary premolar, maxillary molar, and mandibular molar teeth were chosen, following the extraction for orthodontic and periodontal reasons. The overlying tissue and the teeth were immersed in 2% hydrogen peroxide for 2 hours later cleaned with a pumice and rubber brush. The teeth were kept in distilled water until required for the study. Access cavity preparation was done on one of the maxillary premolars using a high-speed rotary cutting headpiece (Panair, NSK, Japan) and round diamond cutting bur, under adequate water coolant. Coronal preparation was started with a Gates-Glidden bur (Gates Drills 32, Mani, Japan). Care was taken to maintain the integrity of the pulpal floor. The apical gap was determined with a K type no. 10 reamers (K-Reamer, Medin, Czech Republic)¹⁰. Then the canals were prepared using the step-back technique from 1 mm short of the apical end up to no 35. During the preparation after each reaming 5% NaOCl (sodium hypo chloride), an irrigation solution was used. When the preparation process was finished the canals were irrigated with 2 ml saline physiologic. The canals were dried with paper points (Absorbent Paper Points, Gapadent, Germany), the cavity was obturated with gutta-percha (Gutta Percha Points, Aceonedent, Korea) and AH-26 root canal filling material (Root Canal Sealing and Filling Materials, Dentsply, Germany) were used for the filling by using cold lateral condensation technique. This cavity

design was treated as class I¹¹. A similar procedure was followed for the other two maxillary premolars except for the cavity design. A class II design with a distal- and occlusal extension was prepared on the second and mesio- occlusal- distal extension on the third maxillary premolar¹². To make a class II disto-occlusal cavity the access cavity was extended to the proximal side by first making a ditch cut using straight fissure diamond bur (Mani, Japan), followed by removal of the distal wall with an enamel hatchet. Similarly, the mesial wall was removed for the mesio- occlusal- distal. The same procedure was followed on the maxillary and mandibular molars with class I, class II (DO), and class II mesio-occlusal-distal cavity configurations. A total of nine teeth were prepared in this manner. 30 duplicates of each tooth with the coronal cavity preparation were done in clear auto polymerizing resin (DPI, India), using rubber base impression material (Zeta plus, Zenmark, Sweden). A total of 270 specimens were obtained. The duplicated specimens were mounted in PVC pipe with auto polymerizing resin of diameter of 1.5 cm, cut to a length of 2 cm. The specimens were divided into two groups X and Y of 90 in each group with N=180. Each group consisted of three subgroups, 30 specimens each of maxillary premolar (1), maxillary molar (2), and mandibular molar (3). Further, each subgroup was divided into three subdivisions randomly, ten specimens of class I (A), class II -disto- occlusal (B), and mesio- occlusal-distal (C) each. All the specimens were acid etched with 36% phosphoric acid (GC) for 15 seconds each, washed, and air dried¹³. GROUP X (EVER X POSTERIOR): Group X was allocated to Ever X posterior material. Two layers of G- bond adhesive agent (GC, USA) were applied to the cavity surface with an applicator brush provided by the manufacture. After light air drying, polymerization was carried out using a 1200mW/cm² strength LED light source for 10 seconds (Light Emitting Diode-

Results

Based on the objective of the study analyzed data are presented in figures and tables which revealed that Everex X posterior had higher fracture resistance (in newtons) than Filtek Z250.

EliparFreelight, 3M ESPE, Germany). Missing walls of the cavity were first built with Ever X posterior (GC, USA) and light-cured for 10 seconds on each side. 4mm increment was added and cured of occlusal surface for 10 seconds. G-aenial Posterior (GC, USA) was added as an enamel replacement layer and light-cured for 10 seconds. GROUP Y (FILTER Z250): Group Y was allocated to Filtek Z250 material. Two layers of Adper Single Bond 2 adhesive agent (3M ESPE, USA) were applied to the cavity surface with a brush. Using a light air spray, the adhesive was spread in the cavity and was polymerized using a 1200mW/cm² strength LED light source for 10 seconds. Then for the restorative core material, Filtek Z250 (3M ESPE, USA), posterior composite, was placed and condensed into the cavity and polymerized with LED light for 20 seconds. The core composite was applied with an incremental technique for a height of 4 mm.

Fracture testing

Universal Testing Machine^{5,14} UNITEK 94100 (FIE-Bluestar, India) with Trapeziumx operating software was used for the load testing. The active tip of the machine (made from tungsten carbide, blunt in shape with a diameter of 3mm) was positioned at the center of the specimen. Compressive load under a crosshead speed of 0.5mm/min was applied¹⁰ and maximum fracture loads were recorded for analysis.

Statistical analysis

The data was analyzed using Statistical Package of the Social Sciences (SPSS) version 23.0 (SPSS Inc., Chicago IL). The mean fracture resistance values in newtons (N) were calculated to describe the fracture resistance between Ever X posterior and Filtek Z250. A t-test was used to compare the difference between the two materials in three different teeth such as with maxillary premolar, maxillary molar, and mandibular molar in Class I, Class II, and MOD preparations.

Figure 1: Mean Fracture resistance of Ever X posteriors and Filtek Z250 in Class-I Preparation N = 180

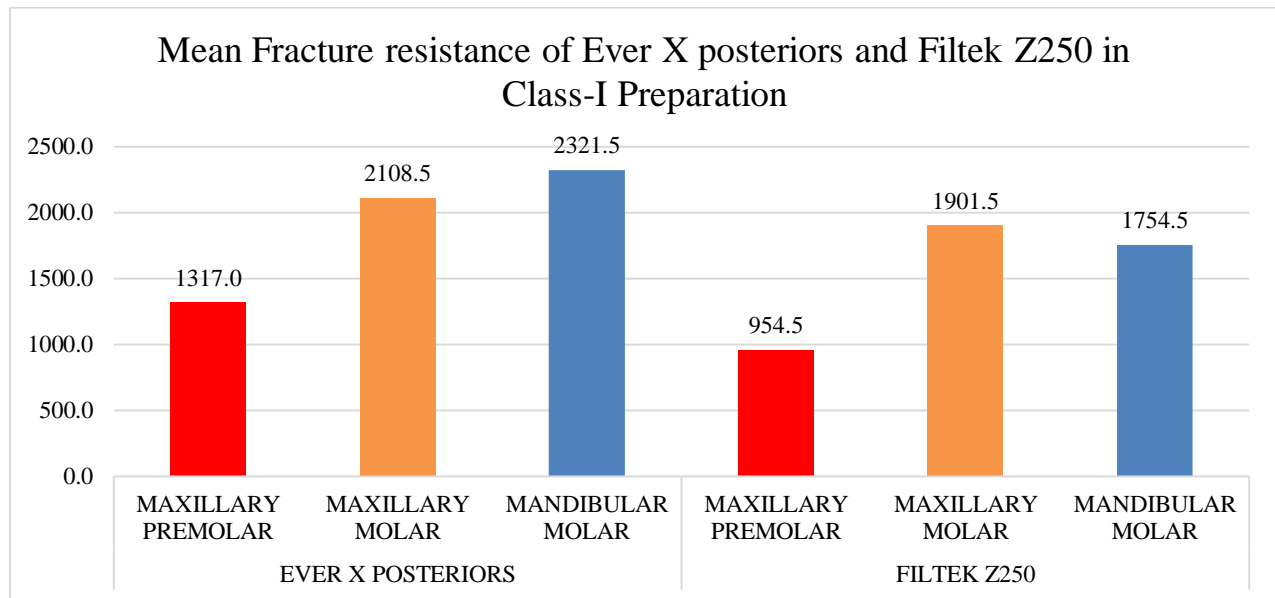


Figure 1 shows that the mean fracture resistance value in Class I preparation of all three types of teeth. Fracture resistance was found to be higher with Ever X posterior in class 1 preparation with maxillary premolar, maxillary molar, and mandibular molar which suggested that ever X posterior was stronger material in fracture resistance than Filtek Z250.

Figure 2: Mean Fracture resistance of Ever X posteriors and Filtek Z250 in Class-II Preparation N = 180

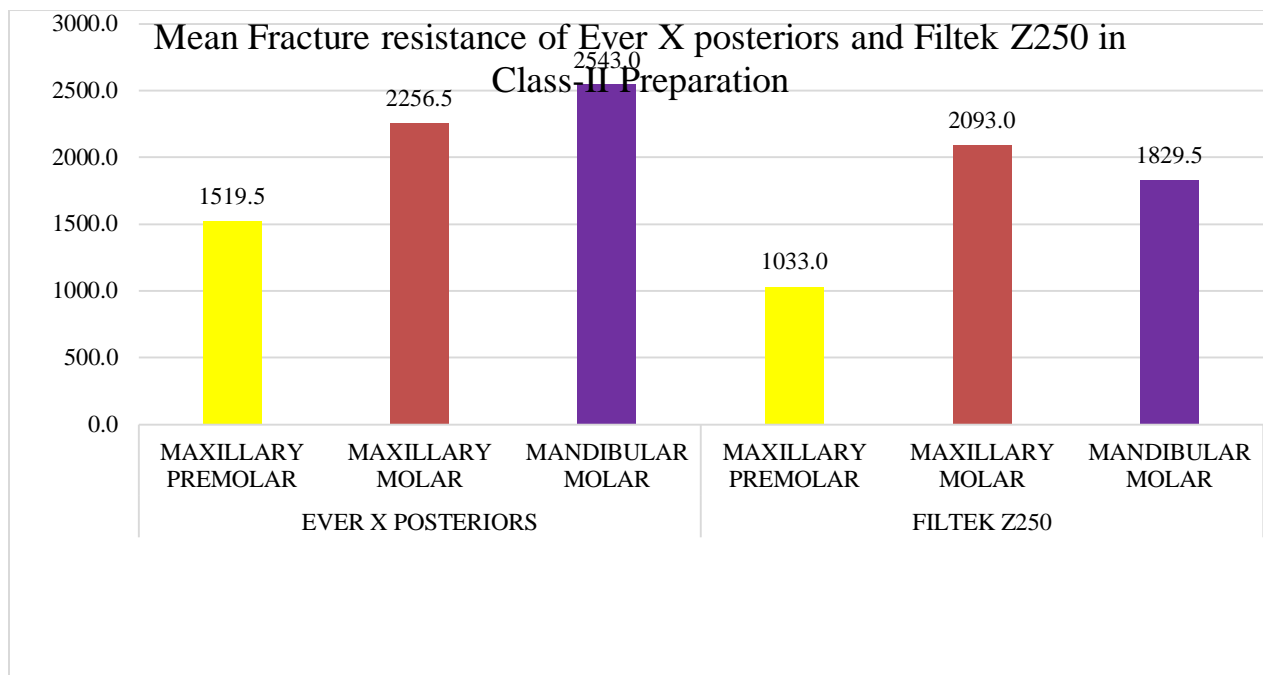


Figure 2 shows that the mean fracture resistance value in Class II preparation of all three types of teeth. Fracture resistance was found to be higher with Ever X posterior in class II preparation with maxillary premolar,

maxillary molar, and mandibular molar which suggested that ever X posterior was stronger in fracture resistance than Filtek Z250

Figure 3: Mean Fracture resistance of Ever X posteriors and Filtek Z250 in MOD Preparation N=180

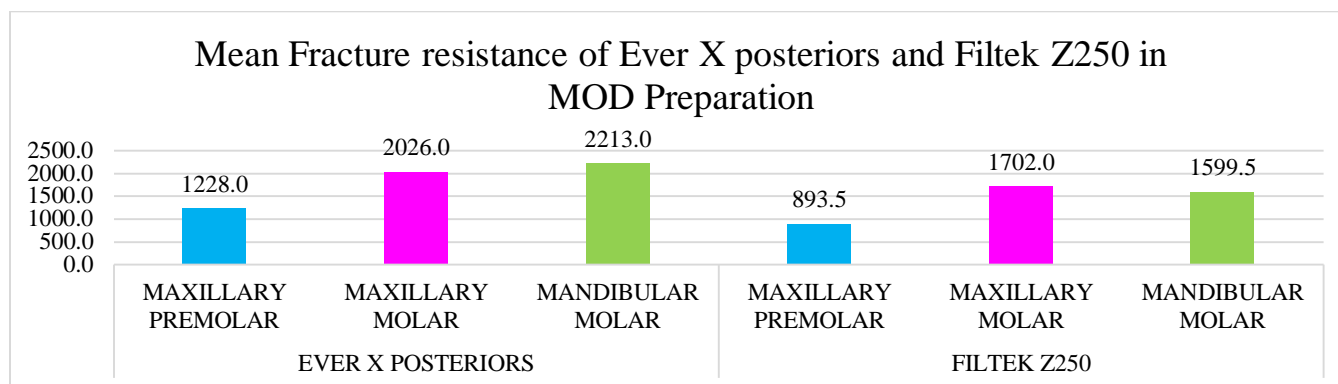


Figure 3 shows that the mean fracture resistance value in MOD preparation of all three teeth was found to be higher with Ever X posterior which suggests that ever X was stronger in fracture resistance in MOD preparation in the maxillary premolar, maxillary molar, and mandibular molar.

Table 1: Mean comparison of Ever X Posterior and Filtek Z250 between the three teeth in class I Preparation N = 180

Variables	N =180	Mean (N)	Std. Deviation	Mean Difference	t value	p-value
Ever X Posteriors Maxillary Premolar	30	1317.0	405.4	362.5	2.35	0.043*
Filtek Z250 Maxillary Premolar	30	954.5	161.9			
Ever X Posteriors Maxillary Molar	30	2108.5	405.2	207.0	1.79	0.108
Filtek Z250 Maxillary Molar		1901.5	241.0			
Ever X Posteriors Mandibular Molar	30	2321.5	386.6	567.0	3.61	0.006**
Filtek Z250 Mandibular Molar	30	1754.5	256.6			

* Significant P<0.05 level

** Significant at P< 0.01 level

Table 1 reveals that in Maxillary premolar the mean difference was 362.5 with a t value of 2.35 (p = 0.044) which showed a significant difference at p< 0.05 level and in Mandibular molar the mean difference was 567.0 with a t value of 3.61 (p = 0.006) which showed statistically significant difference at P< 0.01 level which means

Ever X was stronger in fracture resistance in Maxillary premolar and mandibular molar teeth in class I preparation.

Table 2: Mean comparison of Ever X Posterior and Filtek Z250 between the three teeth in class II Preparation N = 180

Variables	N =180	Mean (N)	Std. Deviation	Mean Difference	t value	p-value
Ever X Posteriors Maxillary Premolar	30	1519.5	350.0	486.5	3.76	0.004**
Filtek Z250 Maxillary Premolar	30	1033.0	359.0			
Ever X Posteriors Maxillary Molar	30	2256.5	630.6	163.5	0.69	0.506
Filtek Z250 Maxillary Molar		2093.0	597.0			
Ever X Posteriors Mandibular Molar	30	2543.0	404.5	713.5	3.39	0.008**
Filtek Z250 Mandibular Molar	30	1829.5	378.0			

* Significant P<0.05 level ** Significant at P< 0.01 level

Table 2 reveals that in Maxillary premolar the mean difference was 486.5. with t value of 3.76 (p = 0.004) which showed statistically significant difference at p< 0.01 level and in Mandibular molar, the mean difference was 713.5 with t value of 3.39 (p = 0.008) also showed statistically significant difference at P<0.01 level which means Ever X was stronger in fracture resistance in Maxillary premolar and Mandibular molar teeth in class II preparation.

Table 3: Mean comparison of Ever X Posterior and Filtek Z250 between the three teeth in MOD Preparation N = 180

Variables	N =180	Mean (N)	Std. Deviation	Mean Difference	t value	p-value
Ever X Posteriors Maxillary Premolar	30	1228.0	408.4	334.5	2.12	0.063 N.S
Filtek Z250 Maxillary Premolar	30	893.5	189.2			
Ever X Posteriors Maxillary Molar	30	2026.0	319.3	324.0	2.58	0.030* S
Filtek Z250 Maxillary Molar	30	1702.0	338.4			
Ever X Posteriors	30	2213.0	348.2	613.5	4.73	0.001***

Mandibular Molar						S
Filtek Z250 Mandibular Molar	30	1599.5	192.7			

* Significant P<0.05 level ***

*Significant at P< 0.001 level

Table 3 reveals that in Maxillary Molar the mean difference was 324.0 with a t value of 2.58 ($p = 0.030$) which showed statistically significant difference at $P < 0.05$ level and in Mandibular molar mean difference was 613.5 with t value of 4.73 ($p = 0.001$) showed statistically highly significant difference which means Ever X was stronger in fracture resistance in Maxillary Molar and mandibular molar teeth in MOD preparation.

DISCUSSION

Dental composite resin recently became the material of choice for most patients and dental practitioners¹⁵. However, volumetric shrinkage and fracture are still considered major concerns with dental composites¹⁶. According to the results obtained in the current study, Ever X Posteriors was found to be stronger in fracture resistance in Maxillary Premolar and Mandibular Molar in both Classes I and II preparations. Also, in MOD Preparation it was found to be stronger with Maxillary Molar and Mandibular Molar teeth.

A similar study was conducted to compare the material strength of SureFil SDR, ClearFil Majesty, Ever X, TetricEvo Ceram bulk fill, and Filtek Z350. The result showed that the Flexural strength, flexural modulus, and hardness properties of Ever X and Z350 were almost similar. The compressive strength value of Ever X was high compared with the other four composites⁶. Among the Maxillary premolar, the mean fracture resistance difference was 362.5 with a t value of 2.35 ($p = 0.044$) which showed a significant difference at $p < 0.05$ level and in Mandibular molar the mean fracture resistance difference was 567.0 with a t value of 3.61 ($p = 0.006$) which showed statistically significant difference at $P < 0.01$ level which showed that Ever X posterior was stronger in fracture resistance in Maxillary premolar and mandibular molar teeth in class I preparation. A study was conducted to evaluate the fracture resistance of three different core materials used for the Nayyar dowel-core technique in restoring endodontically treated teeth. The fracture resistance of coronal-radicular restorations was made from three different restorative materials using human mandibular molars. Fifteen natural teeth were used as a control group. The results of the study revealed that the natural teeth were having the highest fracture resistance values⁸. Panitiwat P, Salimee P(2017)⁵ stated that among the cores used in their study, the composite core with

high filler content tended to enhance fracture thresholds of teeth restored with fiber posts more than others⁵. An in-vitro study was conducted to evaluate the Fracture resistance of endodontically treated maxillary premolars with a longer single post and shorter double posts of different sizes. The fracture resistance of the specimen was measured using a universal testing machine revealed no significant difference between the fracture resistance of endodontically treated maxillary first premolars restored with size 3 single post of longer length and size 1 double posts of shorter lengths¹⁷. Whereas in the present study, among the Maxillary premolar the mean fracture resistance difference was 486.5 with a t value of 3.76 ($p = 0.004$) which showed statistically significant difference at $p < 0.01$ level and in Mandibular molar the mean fracture resistance difference was 713.5 with t value of 3.39 ($p = 0.008$) also showed a statistically significant difference at $P < 0.01$ level. Therefore it was evident that Ever X posterior was stronger in fracture resistance in Maxillary premolar and Mandibular molar teeth in class II preparation. A study conducted on Assessment of Fracture Resistance Capacity of Different Core Materials with Porcelain Fused to Metal Crown, showed that the dual-cured composite resin had maximum resistance to fracture compared with other core build-up materials on teeth that were endodontically treated¹⁰. A similar study was conducted to compare the material strength of SureFil SDR, ClearFil Majesty, Ever X, Tetric Evo Ceram bulk fill, and Filtek Z350. The result shows that the Flexural strength, flexural modulus, and hardness properties of Ever X and Z350 were almost similar. The compressive strength value of Ever X was high compared with the other four composites¹⁸. Lakshmi Nidhi Rao, Mithra N. Hegde, Aditya Shetty (2017) demonstrated that short glass fiber reinforced composite resin every Posterior showed lower polymerization shrinkage compared to Filtek Z350.

Evers Posterior showed comparatively less shrinkage than Filtek Z350 which can be attributed to the presence of silanated e-glass fibres^{19,20} as it becomes imperative for the clinician to choose composite resin with lower polymerization shrinkage rates for the success of the restoration²¹. Maxillary Molar the mean difference was 324.0 with a t value of 2.58 ($p = 0.030$) which showed statistically significant difference at $P < 0.05$ level and in Mandibular molar mean difference was 613.5 with t value of 4.73 ($p = 0.001$) showed statistically highly significant difference which means Ever X was stronger in fracture resistance in Maxillary Molar and mandibular molar teeth in MOD preparation. According to Cheng TH (1993) et al, the fiber length acts as effective reinforcement for polymers, stress transfer from the polymer matrix to the fiber is essential which is achieved by having a fiber length equal to or greater than the critical fiber length²².

Evers Posterior has a fiber length of 1mm to 2mm thus exceeding the critical fiber length. This contributes to substantial improvements in its physical properties²⁰. During placement into the cavity, the fibers orientate into a horizontal plane within the cavity. Due to strong adhesion between resin and silanated fibers in every posterior the direction of the fibers minimizes polymerization shrinkage²³. This can be attributed to the strong adhesion between resin and silanated e-glass fibers¹⁶. Additionally, the direction of the fibers minimizes shrinkage in the horizontal plane after placement. This could derive better performance and durability in posterior restorations²⁴ Lakshmi Nidhi Rao, Mithra N. Hegde, Aditya Shetty (2017) demonstrated that short glass fiber reinforced composite resin EverX Posterior showed lower polymerization shrinkage compared to Filtek Z350. Evers Posterior showed comparatively less shrinkage than Filtek Z350²⁹. Due to strong adhesion between resin and silanated fibers in every posterior the direction of the fibers minimize polymerization shrinkage^{23,25}. This could be the reason for many of the dentists to prefer using EverX Posterior and Filtek Z250²³. According to the results obtained in the current study, Ever X Posteriors is stronger in fracture resistance in Maxillary Premolar and Mandibular Molar in both Classes I and II preparations. Also, MOD Preparation is stronger with Maxillary Molar and Mandibular Molar teeth. This could be the reason that polymerization shrinkage

compromises the success and longevity of the restoration. An In Vitro Study conducted on Fracture Resistance of Endodontically Treated Teeth restored with 2 different fiber-reinforced composite and 2 Conventional Composite Resin Core Buildup Materials, Sixty noncarious unrestored human maxillary premolars were collected, endodontically treated (except group 1, negative control), and randomly divided into 5 groups ($n = 10$). Group 2 was a positive control. The remaining 40 prepared teeth were restored with various direct core buildup materials as follows: group 3 teeth were restored with dual-cure composite resin, group 4 with posterior composite resin, group 5 with fiber-reinforced composite resin, and group 6 with short fiber-reinforced composite resin. Fracture strength testing was performed using a universal testing machine. Fracture patterns for each sample were also examined under a light microscope to determine the level of fractures. The mean fracture resistance values (in newtons) showed that Group 6 with shorter fiber-reinforced composite showed the highest mean fracture resistance value, which was significantly higher than the other experimental groups than all the other groups, and all the fractures occurred at the level of enamel. With their limitations, the authors had quoted that a short fiber-reinforced composite can be used as a direct core buildup material that can effectively resist heavy occlusal forces against fracture and may reinforce the remaining tooth structure in endodontically treated teeth¹⁷. Based on the above results of this study, the Hypothesis stated that “there is a significant difference in the fracture resistance between Ever X Posterior and Filtek Z250 in three different teeth such as Maxillary Premolar, Maxillary Molar and Mandibular Molar in three different preparations of Class I, Class II and MOD” was accepted as it was evident that Ever X Posterior had higher fracture resistance than Filtek Z250 in Maxillary Premolar and Mandibular Molar in both Classes I and II preparations. Also, in MOD Preparation it was stronger with Maxillary Molar and Mandibular Molar teeth.

CONCLUSION

The present study concludes that Ever X Posterior was found to be stronger material in fracture resistance in Maxillary Premolar and Mandibular Molar in both Classes I and II preparations. Also, in

MOD Preparation it was stronger with Maxillary Molar and Mandibular Molar teeth. Therefore it is recommended that similar studies can be conducted on large scale to support the current study.

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