Research Article

JRAD Journal of Research and Advancement in Dentistry

J Res Adv Dent 2019;10:1s:347-350.

To Compare Fracture Resistance of Root Canals Obturated with Different Obturating Systems

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ABSTRACT

Background: Endodontic treatment results in a reduction of fracture resistance of teeth. It is generally accepted that the strength of an endodontically treated tooth is directly related to the amount of remaining sound tooth structure. The present study was conducted to compare the fracture resistance of root canals obturated with different obturating systems.

Material and methods: The present study was conducted to compare the fracture resistance of root canals obturated with different obturating systems in 80 freshly extracted single-rooted anterior teeth. All debris and remaining tissues were removed from the teeth, and the teeth were disinfected with 5% sodium hypochlorite solution and then kept in normal saline solution. All specimen were randomly divided into two experimental groups and two control groups. All prepared teeth were vertically set in self-cure acrylic resin blocks Fracture resistance was evaluated in a Universal Testing Machine. The force necessary to fracture each tooth was recorded in Newtons. Statistical analysis was done using software SPSS (version 20.0) The post hoc Tukey-HSD test were used for analysis of data. P-value of less than 0.05 was considered statistically significant.

Results: The result showed that the mean difference of fracture resistance in Group II (+ve control) was statistically significantly lower than all other groups. There was no significant difference between Group II and Group IV. On the basis of the above assessment, the following order of fracture resistance was observed in the different groups: Group I > Group III > Group IV>Group II.

Conclusion: Our study concluded that the fracture resistance was maximum in group I that were Negative control group. Teeth obturated using cold lateral compaction technique showed better fracture resistance than teeth obturated using injection-molded thermoplasticized technique with C-fill system.

Keywords: Fracture resistance, C-fill, cold compaction.

INTRODUCTION

Endodontically treated teeth are structurally different from unrestored vital teeth and require specialized restorative treatment. It is generally accepted that the strength of an endodontically treated tooth is directly related to the amount of remaining sound tooth structure.[1,2] Vertical root fractures are often associated with poor prognosis, resulting in the extraction of the involved tooth. Apart from predisposing factors such as caries with extensive tissue loss, trauma, root canal

Received: Nov. 3, 2019: **Accepted**: Jan. 2, 2020
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pISSN 2278-0076
eISSN 2321-9270

configuration and anatomy, dehydration, craze lines, loss of bone support; iatrogenic factors such as over instrumentation, prolonged use of calcium hydroxide, effect of irrigation solutions, condensation pressure exerted during obturation, and intracanal postplacement are also among the etiological factors causing vertical root fractures in endodontically treated teeth.[2-9] There are major differences between an endodontically treated tooth and an intact tooth. Dentine loss in anatomic structures such as cusps, shoulders and pulp chamber roof [10] reduction in dentine elasticity[11] and loss of water content[12] predispose teeth to fracture. The present study was conducted to compare the fracture resistance of root canals obturated with different obturating systems.

MATERIAL AND METHODS

The present study was conducted to compare the fracture resistance of root canals obturated with different obturating systems in 80 freshly extracted single-rooted anterior teeth. Before the commencement of the study ethical approval was taken from the Ethical Committee of the institute. Teeth with single canal of similar root sizes, root curvature, free from caries, cracks, restoration, fracture, dilacerations, root resorption, or open apices were selected for the study. All debris and remaining tissues were removed from the teeth, and the teeth were disinfected with 5% sodium hypochlorite solution and then kept in normal saline solution. Teeth were decoronated at the level of cementoenamel junction using a diamond disc and obtained a standardized root length of 14 mm . Root length was established with size #15 K-files. Working length was determined 1.0 mm shorter than the actual root canal length. All teeth, except those in control group, were instrumented using Mtwo rotary files up to size #25/0.06 using a step-back technique. Root Canals were irrigated with 10 ml of 5% NaOCl and then with 3 ml of 17% Ethylenediaminetetraacetic acid to remove the smear layer. Then, a final flush with 1 ml of 5% NaOCl followed by 5 ml of normal saline was done. The biomechanical preparation was done under constant irrigation. Samples were then dried with sterile paper points of size #25/0.06. All specimen were randomly divided into two experimental groups and two control groups.

- Group I (n = 20): Negative control group – teeth were neither instrumented nor obturated
- Group II (n = 20): Positive control group – instrumentation was done, but no obturation was performed
- Group III (n = 20): Obturation was done using cold lateral compaction technique

In all the groups, a master gutta-percha cone size #25/0.06 taper was selected and adjusted to fit with tug back at working length. The master gutta-percha cone was coated with RSA and inserted into the canal, and a RVG for each sample was taken. Accessory cones (0.02 taper) were coated with sealer and placed in the canal. The excess gutta-percha cone was seared off at the canal orifice with heated instrument 1 mm below the CEJ. The access opening was then sealed with Cavit (3M ESPE).

Group IV (n = 20): Obturation was done using injection-molded thermoplasticized technique with C-fill system.

The C-fill obturation system consists of cordless obturation pen and cordless obturation gun. Gutta-percha pellet was inserted into the gutta-percha slot of the cordless obturation gun by pulling out the plunger. Turn on the power button and adjusted the temperature at 200°C. After 3 min, the warm gutta-percha flow out. The master gutta-percha cone (size #25/0.06 taper) that matched with prepared root canal and confirmed the tug back was coated with RoekoSeal sealer and inserted into the canal. The excess gutta-percha was cut by heated obturating pen tip. The heated pen tip with gutta-percha was inserted to 4 mm short of the working length. The warmed gutta-percha was compacted with hand plugger. Again obturating pen tip was heated and inserted gutta-percha to half of the working length of the root canal. Compaction was done with bigger plugger. Rest of the canal was filled with obturating gun and compacted with bigger plugger, and canal opening was sealed with Cavit. All teeth were then stored at 37°C in 100% humidity for 1 week. All prepared teeth were vertically set in self-cure acrylic resin blocks with a dimension of 20 mm in height and 40 mm in diameter. The apical 8 mm of each root was kept exposed. After 24 h, the acrylic resin was set and the blocks were stored in 100% humidity before mechanical tests. Fracture resistance was evaluated in a Universal Testing

Machine. A cross-head speed of 1 mm/min at an angle of 90° was set, and the compressive load was applied perpendicular to the long axis of the tooth at the canal orifice until fracture occurred. The force necessary to fracture each tooth was recorded in Newtons (N). Statistical analysis was done using software SPSS (version 20.0) The post hoc Tukey-HSD test were used for analysis of data. P-value of less than 0.05 was considered statistically significant.

RESULTS

The result showed that the mean difference of fracture resistance in Group II (+ve control) was statistically significantly lower than all other groups. There was no significant difference between Group II and Group IV. On the basis of the above assessment, the following order of fracture resistance was observed in the different groups: Group I > Group III > Group IV>Group II.

Table 1: fracture resistance of the groups.

Groups	Mean± SD	p-value
Group I	785.26±158.675	<0.001
Group II	4.02±79.786	
Group III	586.67±157.789	
Group IV	410.56±89.689	

DISCUSSION

Endodontic procedures such as access preparation, instrumentation, use of calcium hydroxide as intracanal medicament and even irrigation with NaOCl and EDTA leads to a reduction in the fracture resistance of endodontically treated teeth. A study concluded that enlarged but unfilled roots are significantly weaker than filled roots and are thus more susceptible to fracture.[13] Endodontically treated teeth have significantly different physical and mechanical properties when compared to vital teeth.[14] Fractures in endodontically treated teeth have been understood to be multifactorial in origin. The causes of fracture in endodontically treated teeth can be broadly classified as iatrogenic and noniatrogenic. Iatrogenic causes being tooth structural loss, effect of chemicals and intracanal medicament, and effects of restorative procedures and restorations. Noniatrogenic causes can be a history of recurrent pathology, anatomical position of the tooth, and the effect of aging of dental tissues.[14]

The result showed that the mean difference of fracture resistance in Group II (+ve control) was statistically significantly lower than all other groups. There was no significant difference between Group II and Group IV. On the basis of the above assessment, the following order of fracture resistance was observed in the different groups: Group I > Group III > Group IV>Group II.

Lertchirakarn *et al.*, 1999;[15] Lindauer *et al.*, 1989[16]; concluded that the fracture resistance of the roots reduced due to excessive removal of dentin to facilitate the usage of pluggers in heat condensation technique with vertical compaction and with spreaders in cold lateral condensation technique.

Saw and Messer compared the forces applied to the roots during the lateral condensation, Obtura and Thermafil techniques and concluded that the maximum force occurred during lateral compaction and minimum with Obtura. They also reported that more thermal intensity occurred in Thermafil and Obtura groups particularly in the coronal region while during cold lateral compaction technique more tension occurred, especially in the apical region.[17]

CONCLUSION

Our study concluded that the fracture resistance was maximum in group I that were Negative control group. Teeth obturated using cold lateral compaction technique showed better fracture resistance than teeth obturated using injection-molded thermoplasticized technique with C-fill system.

CONFLICTS OF INTEREST

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

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