Comparative Evaluation of Fracture Resistance of Tooth after Lateral and Vertical Obturation Filled with Gutta-Percha and Resilon Obturating Material: An In Vitro Study

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Abstract

Introduction: Since long the obturating material and techniques have been discussed. The prime target of the material has always been to provide a three-dimensional obturation providing a monoblock concept thus strengthening the tooth.

Aim: The aim of the study was to evaluate the fracture toughness of the root canal treated teeth after being obturated with Gutta-Percha and Resilon by lateral and vertical compaction techniques.

Materials and Methods: A total of 75 human mandibular premolar teeth were taken and endodontically treated. All the teeth were divided into five groups with 15 samples in each. Access opening of all the teeth was done, and the cleaning and shaping were done up to 40 number file size. The samples were obturated with two materials which are Gutta-Percha and Resilon. All the teeth were subjected to compressive loading till the fracture occurred, and the readings were taken and compared. It was found that the teeth obturated with Resilon showed higher fracture resistance and that the obturating technique had no effect on fracture resistance.

Result: This study shows the relevant difference between the two groups and that the group with Resilon showed better fracture toughness when applied with universal testing machine.

Conclusion: This study concluded that Resilon is a better obturating material and that vertical condensation is better than lateral condensation.

Key words: Fracture resistance, Resilon, Vertical compaction and lateral compaction

INTRODUCTION

Endodontically treated teeth are widely considered to be more susceptible to fracture than are vital teeth.¹ ² The reasons most often reported have been the water loss and loss of collagen cross-linking,³ ⁴ excessive pressure during obturation and the removal of tooth structure during endodontic treatment.⁵ ⁶ The strength of an endodontically treated tooth is related directly to the method of canal preparation and to the amount of remaining sound tooth structure.⁷ It is commonly believed that the loss of dentin creates an increased susceptibility to fracture.⁷ Resin-based dental materials have been proposed as a means to reinforce an endodontically treated tooth in the form of adhesive sealers in the root canal system. Dentin thicknesses, the radius of canal curvature and external root morphology have been proposed as factors potentially influencing fracture susceptibility.⁸ ⁹ This study deals with the fracture resistance of the tooth after being obturated with lateral and vertical obturating technique with Gutta-Percha and Resilon as two different
MATERIALS AND METHODS

About 75 freshly extracted human mandibular premolars with fully formed apices, free of apical root resorption and caries were collected from the Department of Oral and Maxillofacial Surgery, Career Post Graduate Institute of Dental Sciences, Lucknow, Uttar Pradesh, India and were stored in 10% formalin.

List of materials used is as follows:

- Micro motor cord and straight piece
- Diamond disks
- Stainless steel files (10-40)
- Disposable syringe
- 5.25% sodium hypochlorite
- 17% EDTA
- Gates glidden drills
- Spreaders
- Plungers
- Lentulo Spiral
- Gutta-Percha
- AH 26 root canal sealer
- Resilon obturating materials (Pentron Clinical Technologies, Llc Wallingford, Ct).

The collected samples were cut at the cementoenamel junction (CEJ) with a diamond disk. The working length was established with 10 number file, 1 mm short to the apex. A crown down preparation technique was carried out in all the teeth. Preparations were irrigated between uses of each succeeding file with sodium hypochlorite (5.25%). After preparation the entire specimen were flushed with 1 mm short to the apex. Then, all the teeth were enlarged to 10 number file, 1 mm short to the apex. Then, all the teeth were enlarged to the size 40 number. Preparations were irrigated between uses of each succeeding file with sodium hypochlorite (5.25%).

Preparation for Mechanical Testing

The root specimens were then prepared for mechanical testing. Apical root ends were embedded individually in phenolic rings with acrylic resin, living 9 mm of each root exposed, this was done so as to eradicate any chance of overfilling and to make sure that the obturating material did not come out of the apical foramen. Carbide bur was used to remove temporary material and to shape the root canal access to accept the loading fixture. Mounted cylinders were vertically aligned in the machine which has a fixed top standardizing the mounting. The compressive load was applied with a loading fixture with a spherical tip (r = 2 mm) at a crosshead speed of 1 mm/min until the fracture of root occurred. This load was applied at the canal opening. The amount of load obturated teeth can take was noted and it was evaluated which group of teeth can take maximum loads.

RESULTS

Fracture resistance of tooth in groups is measured, and the mean and standard deviation values of the applied force (mpa) according to groups are given in Tables 1-4 (Figure 1).
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Comparison between materials:

- As compared to A0, A1, A2, A3, A4 by the tests; there is a significant difference in fracture resistance of the root (P < 0.05).

**DISCUSSION**

In this study, the force was applied along the long axis of the root with a rounded punch, which produced root fracture when contact was made between the punch and walls of the canal opening and the force is applied. The roots used were narrower, and the standardization was done by doing the biomechanical shaping up to file size 40.12,13 While going through results, we saw no differences between the lateral condensation and vertical condensation groups using the same material.14,15 Many studies have suggested that as removal of tooth structure increases, fracture resistance of the tooth decreases. Root canal instrumentation is an unavoidable step in endodontic treatment.16 However, it is understood that as dentin is removed during the instrumentation phase, a weakening effect on the root is inevitable. If we add the wedging forces of the spreader during lateral condensation or perform excessive dentin removal to facilitate pluggers for vertical condensation, the potential for root fracture is very real.17 The concept of dentin bonding in restorative dentistry has been introduced in endodontic treatment, and promising results have been reported in methyl methacrylate tributylborane, or mma/tbb-based resin sealer.18 The resin composed of 4-methacryloxyethyl trimellitate anhydride, or 4-meta, and mma-tbb—which is known commercially as super bond c&b or c&b metabond has been reported to produce consistently high bond strengths and has been successfully used clinically for 15 years.19 Some studies have suggested that the root canal sealer, especially glass ionomer cement, might strengthen root dentin.2 Few studies have evaluated the potential of using dentin bonding agent and resins as obturation materials in nonsurgical root canal treatment.20 Reasons for not using resins have centered on questionable results, difficult and
unpredictable methods of delivery into the root system and the inability to retreat the canal if necessary. However, these materials may have the potential to enhance the endodontic seal by reducing microleakage from both apical and coronal directions, thereby contributing to the success of orthograde endodontic treatment.\textsuperscript{8,10} Trope and Roy, using maxillary and mandibular canine roots, showed that ketacendo strengthened roots weakened by canal instrumentation.\textsuperscript{6} Lertchirakarn \emph{et al.} suggested that ketac endo strengthened endodontically treated roots and may be used for weak roots, which are likely to be susceptible to vertical root fracture.\textsuperscript{21}

**CONCLUSION**

This \emph{in vitro} comparison study of fracture resistance of root filled with Resilon and Gutta-Percha with lateral and vertical obturation in the same diameter of the canal.

The vertical obturating technique is better than the lateral obturating technique. Resilon increases the fracture resistance as compared to the Gutta-Percha and AH 26. Under the conditions of this study, Resilon with vertical condensation technique performs better than Gutta-Percha and AH 26 sealer and to the lateral condensation technique.

**REFERENCES**


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