

Comparison Of Fracture Resistance In Roots Of Endodontically Treated Teeth Using Different Root Filling Materials: An In Vitro Study

Abstract

Aim : The aim of this study was to evaluate and compare the fracture resistance of endodontically treated teeth with Resilon, Guttapercha and Obtura II.

Materials and Methods : A total of 80 human maxillary central incisors were collected and their anatomical crown was sectioned at the CEJ. After gaining root canal access, the teeth were biomechanically prepared by step back technique. Samples were randomly divided into four groups: Group I- With no obturation, Group II- Lateral Condensation with Guttapercha, Group III- Lateral Condensation with Resilon and Group IV- Obturation with Obtura II. Teeth were embedded in an acrylic resin block and their fracture strength was measured using a universal testing machine. Statistical data was evaluated using One Way Analysis Of Variance test.

Results : Teeth obturated with Resilon (Group III) showed the highest fracture resistance than those with Group I, Group II & Group IV. Fracture strength of Group I & Group II and Group II & Group IV were statistically insignificant.

Conclusion : The result of this study showed the highest fracture resistance in Resilon filled roots, almost 75% more as compared with Control (Group I), GuttaPercha (Group II) & Obtura II (Group IV).

Key Words

Fracture Resistance, Obturation, Resilon, Obtura II.

Introduction

Endodontically treated teeth are widely considered to be more susceptible to fracture than are vital teeth. The reasons most often reported have been the dehydration of dentin after endodontic therapy, excessive pressure during obturation and the removal of tooth structure during endodontic treatment.^[1]

Gutta - Percha has been the filling material of choice for root canals for years. AH 26 is a representative of epoxy resin sealers and is commonly used with Gutta -Percha.^[2] Obtura II system utilizes warm vertical compaction. It consists of; a control unit, a handheld gun that contains a chamber surrounded by a heating element into which a pellet of gutta percha is loaded and heated to a temperature of minimum 160°C. When plasticized, the gutta percha is injected through the silver needles into the prepared root canals.^[3]

In recent years, an endodontic obturation material based on polyester chemistry and containing bioactive and radiopaque fillers has been developed and tested (Resilon, Resilon Research, North Brandford, Conn.). Resilon may be used by either lateral or warm vertical

compaction techniques^[3]. Therefore, in order to verify the manufacturer's claims regarding better resistance to fracture with Resilon, we conducted a study. In our study, we compared the fracture resistance of endodontically treated roots with Resilon, Gutta percha and Obtura II system.

Materials And Methods

80 freshly extracted Human maxillary central incisors were selected. The teeth were sectioned at the cemento enamel junction with a diamond disc. Root specimens that were at least 14mm in length were included in the study. All the canals were instrumented to no. 40 K flexofile at the working length in sequential order using "Step Back Technique" and as described by Weine. During the preparation all teeth were irrigated alternatively with 10 ml of 5.25% sodium hypochlorite & 17% EDTA. The 80 roots were randomly divided into four experimental groups of 20 teeth each as follows:-

Group I :- Control

Group II :- Lateral condensation with gutta percha

¹ Nagpal Ravi

² Goel Mahima

³ Sharma Shalini

¹ Post Graduate Student
Dept of Conservative Dentistry & Endodontics

² Post Graduate Student
Dept of Oral & Maxillofacial Surgery

³ Reader
Dept of Conservative Dentistry & Endodontics
D.J College of Dental Sciences & Research,
Modinagar (U.P.) India.

Address For Correspondence:

Dr. Ravi Nagpal,
Flat No A 1
Dev Bhoomi Apartments,
Green Valley, Deonghat,
Solani, (Himachal Pradesh).

Submission : 10th February 2012

Accepted : 19th April 2012

Quick Response Code



Group III :- Lateral condensation with Resilon

Group IV :- Obturation with Obtura II system.

Teeth from all the groups were sealed coronally using cavite. The specimens were then prepared for fracture strength testing. The apical root ends were embedded in metal rings with autopolymerising resin leaving 9mm of each root exposed. The fracture strength of various samples were measured using Universal testing Machine. A metal instrument with a round tip (known as Rounded Punch) of radius 2mm (CIPET AMRITSAR), at a crosshead speed of 1.0 mm per minute was used to apply force vertically down along the long axis of the tooth until fracture occurs. The variable of interest was the load at failure measured in Newtons.

Results

The mean force at fracture, and the SD for each group are presented in Table I. The maximum force at fracture was found with Resilon (**Group III with p value <0.001**). The comparison among all four

groups was done by ONE WAY ANOVA test at 5% level of significance.

Groups	N	Mean +/-_S.D
Group I	20	406.48+/_163.9
Group II	20	492.16+/_175.87
Group III	20	752.24+/_277.89
Group IV	20	459.36+/_177.51

It can be safely concluded that Resilon has higher strength almost 75% more as compared to Obtura II (**Group IV**),control (**Group I**) and Gutta percha (**Group II**).

Discussion

It is widely accepted that endodontically treated teeth are more susceptible to fracture than vital teeth. Several factors should be considered when selecting a material or a combination of materials to fill a root canal. One is to select a material that has the potential to reinforce the root structure and protect it against fracture. It would be advantageous if the root canal obturation, in addition to providing an adequate seal, could contribute to the reduction in the incidence of vertical root fractures.^[4]

Several factors should be considered when selecting a material or a combination of materials to fill a root canal. One is to select a material that has the potential to reinforce the root structure and protect it against fracture. It would be advantageous if the root canal obturation, in addition to providing an adequate seal, could contribute to the reduction in the incidence of vertical root fractures.^[5]

Gutta percha is the most commonly used material for root canal obturation and has been regarded as the 'gold standard' with which new materials or techniques are compared. However, the latter materials fail to provide a predictable seal against prolonged bacterial challenge.^[3]

Resin-based dental materials have been proposed as a means to reinforce an endodontically treated tooth, through bonding to dentin.^[3]

In the early 2000s, a new resin based thermoplastic root canal filling material was marketed as Resilon. (Penron Clinical Technologies, Wallingford [CT],US). The dentin bonding system or sealer for Resilon is called Epiphany. This material could be cured using a curing light for 30 seconds.

Lateral and vertical Gutta percha compaction techniques have ardent advocates in endodontic community. When extracted human teeth are used for

this type of study, the potential for large uncontrollable variations in strength exist. Each group of root specimens that we used consisted of randomly selected teeth from a collection of maxillary central incisors.^[1]

In the present investigation, care was taken to standardize the experimental teeth and balance them with respect to shape and dimensions.^[1] We controlled some dimensions of the specimens, such as root length or bucco-lingual diameter. We measured these and chose teeth to eliminate these variations in dimension. In addition, the diameter of the root canal near the apex prior to instrumentation was approximately compatible with size 15 in all the teeth.^[1]

We instrumented the roots with the same technique (Step back technique) producing a uniform canal to 9 mm below the cervical area of the root. Thus, we selected teeth that were as similar as possible and assigned them into groups randomly.

The irrigation procedure was also standardized for all the filling techniques. We used a final rinse with EDTA followed by NaClO, as has been used in a similar study by Fabricio Teixeira et al (2004)

In our study, as in other mechanical studies, the force was applied along the long axis of the root, i.e at an angle of 0° with a rounded punch having a diameter of 2mm at tip and crosshead speed of 1mm/min, which produced root fracture when contact was made between the punch and the walls of the canal opening.^{[6], [7], [8]}

Under the conditions of this in vitro study, use of Resilon to increase root fracture resistance in endodontically treated roots is appropriate.^[5] Clinical long term studies are necessary to collect evidence based data to support the confident use of these materials, in order to assess whether or not Resilon reduces the incidence of vertical root fractures clinically.

Conclusion

Resilon filled roots displayed significantly higher fracture loads than the Gutta Percha groups independently of the filling technique used ($P < 0.001$).

References

1. Fabricio.B.Teixeira, Erica Teixeira, Jeffrey Thompson and martin Trope;

Fracture resistance of Endodontically Treated roots with a new resin filling material. Journal of American Dental Association, 2004; 135; 646-652

2. Atasoy Ulysoy, Ozgur Genc and Seda Arslan; Fracture resistance of roots obturated with three different materials; Oral Surg Oral Med Oral Pathol 2007; 104(5); 705-707.

3. Mariusz Lipski; In Vitro Infrared Thermographic Assessment of Root Surface Temperature Generated By High-Temperature Thermoplasticized Injectable Gutta Percha Obturation Technique. Journal of Endodontics; 32(5); 438-441

4. Cora Hiu-Wan Ko, Gary Shun Pan Cheung, Alex Wai-Kwok Chan; A review of a resin based root canal filling material; Hong Kong Dental Journal 2008; 5: 38-44

5. M.Karapinar, Kazandag, H.Sunay, Tanalp & G.Bayirli; Fracture resistance of roots using different canal filling systems; International Endodontic Journal, 42, 705-710

6. Edgar Schafer, Tannaz Zandbiglari and Jens Schafer; Influence of resin Based adhesive root canal fillings on the resistance to fracture of endodontically treated roots: an in vitro preliminary study; Oral surgery, Oral medicine, Oral Pathology, Oral Radiology and Endodontology, Feb 2007, Vol 103(2), 274-279.

7. Jake Collins, BS, MS, Mary P Walker; A Comparison of Three Gutta Percha Obturation Techniques to Replicate Canal Irregularities. Journal of Endodontics; Aug 2006, 32(8), 761-765

8. M.A.A De Bruyne and R. J.G De Moor; Long-term sealing ability of Resilon root end fillings; International Endodontic Journal, 2009, 884-892

9. Trope M, Ray HL; Resistance to fracture of endodontically treated roots; Oral Surg Oral Med Oral Pathol, 1992, Vol 73(1), 99-10

10. Vasundhara Shivanna, Prashanth B.R.; Analysis of percentage of gutta-percha filled area using single cone, continuous wave compaction, Thermafil and Obtura II in 0.06 taper prepared root canals; Endodontology, June 2009, 68

Source of Support : Nil, Conflict of Interest : None declared