ISSN Print: 2394-7489
ISSN Online: 2394-7497
IJADS 2018; 4(1): 03-05

www.oraljournal.com
Received: 02-11-2017
Accepted: 03-12-2017

Anil K Tomer
Professor and Head, Department of Conservative Dentistry & Endodontics D.J. College of Dental Sciences and Research, Modinagar, Ghaziabad, Uttar Pradesh, India

Ruchi Gupta
Professor, Department of Conservative Dentistry & Endodontics D.J. College of Dental Sciences and Research, Modinagar, Ghaziabad, Uttar Pradesh, India

Midhun Ramachandran
Post Graduate Student, Department of Conservative Dentistry & Endodontics D.J. College of Dental Sciences and Research, Modinagar, Ghaziabad, Uttar Pradesh, India

Ashvin G John
Post Graduate Student, Department of Conservative Dentistry & Endodontics D.J. College of Dental Sciences and Research, Modinagar, Ghaziabad, Uttar Pradesh, India

Afnan Ajaz Raina
Post Graduate Student, Department of Conservative Dentistry & Endodontics D.J. College of Dental Sciences and Research, Modinagar, Ghaziabad, Uttar Pradesh, India

Akankshita Behera
Post Graduate Student, Department of Conservative Dentistry & Endodontics D.J. College of Dental Sciences and Research, Modinagar, Ghaziabad, Uttar Pradesh, India

Nitish Mittal
Post Graduate Student, Department of Conservative Dentistry & Endodontics D.J. College of Dental Sciences and Research, Modinagar, Ghaziabad, Uttar Pradesh, India

Correspondence
Anil K Tomer
Professor and Head, Department of Conservative Dentistry & Endodontics D.J. College of Dental Sciences and Research, Modinagar, Ghaziabad, Uttar Pradesh, India

Comparison of the apical sealing ability of calcium hydroxide, MTA, and silicone based sealers

Anil K Tomer, Ruchi Gupta, Midhun Ramachandran, Ashvin G John, Afnan Ajaz Raina, Akankshita Behera and Nitish Mittal

Abstract
Introduction: Root canal obturation is the most important step in the root canal treatment that aims to obtain a complete hermetic seal and to prevent the re-growth of microorganisms in the root canal system. To accomplish this, many endodontic obturation materials and sealers are being used.
Aim: To evaluate and compare the apical microleakage of calcium hydroxide (Sealapex), Mineral Trioxide Aggregates (MTA Fillapex) and silicone based (Roekoseal) sealers.
Materials and Methods: Extracted human single rooted teeth were taken and decoronated at cemento-enamel junction. The access cavities and biomechanical preparation were performed using endodontic rotary system. The teeth were randomly divided into three groups with n=10; Group I - Guttapercha and Sealapex sealer; Group II - Gutta-percha and MTA Fillapex; Group III- Gutta-percha and Roeko Seal; and negative control group as empty root canal. All the specimens were stored at 37 °C with 100% humidity for one week. All root surfaces except the apical 2mm were covered with two layers of nail varnish and then immersed in an aqueous solution of 2% methylene blue dye for 72 hours. Roots were longitudinally split using a diamond disk. Linear apical dye penetration was measured under Stereomicroscope at 40X magnifcation.
Results: MTA Fillapex group showed maximum apical microleakage followed by Sealapex and Roeko Seal sealer.
Conclusion: The results concluded that Roeko Seal sealer showed minimal dye penetration followed by Sealapex and MTA Fillapex. Thus, concluding that Roeko Seal sealer is better in apical sealing than Sealapex and MTA Fillapex.

Keywords: Apical microleakage, sealapex, MTA fillapex, roeko seal

Introduction
The goal of root canal obturation is to obtain a three dimensional seal of the root canal system. An inadequate flling during obturation can results in re entry and re-growth of microorganisms in the root canal system which irritates the periapical tissue and compromises the treatment success [1].
Gutta-percha has been used as root canal filling material for almost 150 years, in addition to the use of sealer, essential for obtaining a fluid-tight seal between the dentinal wall and the gutta-percha [2].
In vitro evaluation of apical dye penetration is used to estimate the sealing ability which is corresponding to *in vivo* amount of micro leakage with particular sealer [3]. Many techniques were used to evaluate the leakage of sealers such as; colored dye penetration radio labeled tracer penetration dissolution of hard tissue clearing of teeth, spectrometry of radioisotopes electrochemical and gas chromatography. However, many studies showed no significant difference between these techniques [4].
The aim of this *in vitro* study was to evaluate and compare the apical microleakage of a Calcium hydroxide based sealer; Sealapex, MTA based sealer; MTA Fillapex and Silicone based sealer; RoekoSeal using dye penetration technique under Stereomicroscope at 40X magnifcation.

Materials and Methods
Freshly extracted human single rooted teeth were used as study samples. Teeth with root fracture, root caries, open apices, developmental anomaly and external and internal root

resorption were excluded from the study. These teeth were cleaned with hand scalers and soaked in 5.25% sodium hypochlorite for two hours and then stored in a solution containing thymol crystals. The teeth were decoronated using diamond disk at the cement-enamel junction uniformly and were then mounted in freshly mixed alginate in uniformly sized plastic containers. The root canal access was prepared using endo access bur and working length was determined using appropriate K-fle. Standardized wooden block was constructed for taking radiovisiograph, so as to maintain the standardization for all the study samples. Then the biomechanical preparation was done with the use of NiTi rotary protaper files till size F2. The irrigation protocol followed was use of 5.0% sodium hypochlorite in between each instrumentation and 17% Ethylenediaminetetracetic Acid (EDTA) was left in the root canals
for four minutes, followed by final rinsing with normal saline. The root canals were then dried with paper points. The teeth were randomly divided into three groups of 10 specimens each and negative control group. Obturation was done as follows:
Group I: Gutta-percha and Sealapex sealer.
Group II: Gutta-percha and MTA Fillapex.
Group III: Gutta-percha and Roeko Seal.

The tested materials were handled according to manufacturer's instructions. Sealapex sealer, MTA Fillapex and Roeko Seal was applied over the entire working length of the canal using lentulo spirals. The selected gutta-percha cone was lightly coated with sealer and placed slowly in the canal to full working length. Excess gutta-percha cone was seared off from the canal orifce using a heated instrument. After canal obturation, the teeth were radiographed to make sure the canals were fully obturated. The teeth were then stored at 37 °C with 100% humidity for one week to allow the sealers to get fully set. All the root surfaces, except the apical 2mm were covered with two layers of nail varnish. In negative control, the root surfaces including the apical foramen were completely coated with two layers of nail varnish, to test the impermeability of nail varnish to methylene blue. The sticky wax was then applied on the varnish area; teeth were immersed in 2% methelene blue dye and then were stored in an incubator for 72 h at 37 °C. The roots were rinsed in running water and dried with paper towels. The varnish and sticky wax coating was removed with a scalpel blade and a guide groove was prepared with a diamond disc in a crown-apex direction in middle of tooth till the depth of the canal. The roots were split longitudinally using a large spoon excavator. The linear dye penetration was measured from root apex to the most coronal extent under Stereomicroscope at 40X magnifcation. The depth of dye penetration was evaluated using criteria given by W.P. Saunders *et al*. [5] The whole study was repeated three times and the readings were calculated. The data obtained was then subjected to statistical analysis using SPSS software (version 20.0). The tests used for statistical analysis used were Shapiro-Wilks, Krusk Wallis test, Mann-Whitney.

Results

The apical microleakage for study groups was evaluated and results obtained were subjected to statistical analysis using SPSS software (version 20.0). The negative control showed no dye penetration by confrming the insulating capacity of the nail varnish and sticky wax. According to the dye penetration scores, the numbers of study samples was distributed for all the three study groups. The apical dye penetration was observed minimum in negative control group followed by Group III, I and II. The mean values for apical microleakage, according to dye penetration test for all the three study groups was calculated. The maximum mean was found in Group II followed by Group I, Group III, and least in negative control group.

Table 1: Mean and Standard deviation values of groups

Score	Group 1	Group 2	Group 3
Mean	0.601	1.162	0.511
Standard deviation	0.233	0.221	0.205
Group 1:Sealapex, Group 2:MTA Fillapex, Group 3:Roekoseal			

Table 2: Inter group comparison for dye

Group		Significane	
1 to 2	Z= -3.628	P<0.05	Significant
1 to 3	Z= -1.324	P>0.05	Not Significant
2 to 3	Z= -3.780	P<0.05	Significant
Group 1:Sealapex, Group 2:MTA Fillapex, Group 3:Roekoseal			

Discussion

Three-dimensional obturation of the root canal system with a fluid impervious seal is an important factor for successful endodontic therapy. The root canal filling should seal the canal both apically and coronally to prevent the passage of microorganism to apex or vice versa [6]. Most reliable method is the use of gutta-percha cones with sealer cement. A wide variety of root canal sealers is available commercially. Sealers based on Calcium hydroxide (Sealapex), MTA (MTA Fillapex) and Silicon (Roekoseal) were included in the present study.

In present dye leakage study, Roekoseal demonstrated least dye leakage in comparison with other experimental groups (Table 1).

The leakage was minimum with Roekoseal sealer and maximum with MTA sealer. Roekoseal sealer has the better sealing ability than the other sealers used in this study when used in conjugation with cold lateral condensation using gutta-percha. The negative control groups showed no leakage at all, indicating those two coats of nail varnish were efficient enough in preventing dye penetration.

Sealapex is a calcium hydroxide type sealer. Calcium hydroxide used as root canal sealer since it stimulates periapical tissues in order to maintain health or promote healing and secondly for its antimicrobial effects [7]. It has been observed in some studies that, calcium hydroxide sealers showed a signifcant volumetric expansion during setting because of water absorption, which increases its solubility. The present *in vitro* investigation indicated there was no significant difference between Sealapex and Roekoseal. (Table 2)

In this study, the apical microleakage of MTA Fillapex had the highest leakage. According to the manufacturers', this MTA-based sealer creates integrated, excellent and perfect seal and provides high biological regeneration.[8] However, more recent studies have shown conflicting results regarding this claim [8, 9]. MTA setting leads to hydration of inorganic oxide compounds, resulting in the production of calcium hydroxide and calcium silicate hydrate phases [10], which in turn lead to expansion at its margins, improving the seal and reducing microleakage [11]. The study period of present study was seven days, whereas it has been found MTA expands after 28 days. This might be the main reason for maximum dye leakage for MTA sealer.

Conclusion

In the this study, MTA Fillapex sealer had significantly more microleakage compared with Sealapex and Roekoseal sealer 1 week after filling. However, there was no significant difference between Sealapex and Roekoseal groups.

References

1. Gomes flho JE, Moreira JV, Watanabe S, Lodi CS, Cintra LTA, Junior ED, *et al*. Sealability of MTA and calcium hydroxide-contaning sealers. J Appl Oral Sci. 2012; 20(3):347-51.
2. Ørstavik D. Materials used for root canal obturation; technique, biological and clinical testing. Endod Topics. 2005; 12:25-38.
3. Veríssimo DM, do Vale MS. Methodologies for assessment of apical and coronal leakage of endodontic filling materials: A critical review. J Oral Sci. 2006; 48(3):93-8.
4. Cobankara FK, Adanir N, Belli S, Pashley DH. Aquantitative evaluation of apical leakage of four root-canal sealers. Int Endod J. 2002; 35(12):979-84.
5. Saunders WP, Saunders EM. The effect of smear layer upon coronal leakage of G.P. Root fillings. J Endod. 1992; 25:246-9.
6. Joseph R, Singh S. Evaluation of apical sealing ability of four different sealers using centrifuging dye penetration method: An *in vitro* study. J Contemp Dent Pract. 2012; 13(6):830-3.
7. Desai S, Chandler N. Calcium hydroxide-based root canal sealers: A review. J Endod. 2009; 35(4):475-80.
8. Assmann E, Bottcher DE, Hoppe CB, Grecca FS, Kopper PM. Evaluation of bone tissue response to a sealer containing mineral trioxide aggregate. J Endod. 2015; 41(1):62-6.
9. Braga JM, Oliveira RR, de Castro Martins R, Vieira LQ, Sobrinho AP. Assessment of the cytotoxicity of a mineral trioxide aggregatebased sealer with respect to macrophage activity. Dent Traumatol 2015; 31(5):390-5.
10. Camilleri J. Hydration mechanisms of mineral trioxide aggregate. Int Endod J. 2007; 40(6):462-70.
11. Storm B, Eichmiller FC, Tordik PA, Goodell GG. Setting expansion of gray and white mineral trioxide aggregate and Portland cement. J Endod. 2008; 34(1):80-2.