

Original Research Article

Comparing the Sealing Ability of Zinc Oxide Eugenol and MTA Based Sealer to Root Canal Dentine Using Different Obturation Techniques- *In Vitro* Study

Dr. Pradnya Nikhade, Dr. Manali Saoji, Dr. Manoj Chandak, Dr. Nikita Oswal, Dr. Akash Agrawal
Sharad Pawar Dental College, Sawangi Datta Meghe, Wardha, Maharashtra, India

*Corresponding author

Dr. Manali Saoji

Email: manali.saoji26@gmail.com

Abstract: This in vitro study aims to evaluate the sealing ability of gutta percha root filling used with mineral trioxide aggregate [MTA], and zinc-oxide eugenol as sealer. Thirty freshly extracted single-root teeth were selected, decoronated and then instrumented. Samples were randomly divided into five experimental groups. In group 1, root canals were filled using single cone gutta percha technique, with MTA as a sealer. In group 2, root canals were filled using lateral condensation gutta percha technique with MTA. In group 3, root canals were filled using single cone gutta percha technique with Zinc oxide eugenol sealer. In group 4 root canals filled using lateral condensation gutta percha technique with zinc oxide eugenol cement and group 5 was the control group. Statistical differences in mean apical dye penetration between the three groups were found. But group 1 showed significantly less coronal dye penetration [$p < 0.001$] as compared to group 2, and group 3. And it was concluded that the single cone technique with MTA can provide favorable coronal and apical seal.

Keywords: sealing ability, endodontic filling materials, sealers, mineral trioxide aggregate

INTRODUCTION

Percepts of endodontic obturation include to efficiently seal the root canal system to prevent apical and coronal leakage. According to Gartner and Dorn an ideal material should seal the root canals apically and coronally and prevent leakage of micro-organisms along with their by-products into the peri-radicular tissues [1]. The material should be non-carcinogenic, nontoxic and biocompatible and dimensionally stable. And the moisture should not affect its sealing capability [2].

Because of the poor adhesiveness of gutta-percha (GP), it is used in combination with root canal sealers. To achieve this goal sealers are commonly used in routine endodontic procedures.

Mineral trioxide aggregate (ProRoot White MTA) was first described in 1998 by Mahamoud Torabinejad at Loma Linda and was approved for endodontic use by US food and drug administration in. It is a modified type of Portland cement. MTA comprises of fine powder of tricalcium silicate, diacalcium silicate, tricalcium aluminate, tetracalcium aluminoferrite and bismuth oxide that can be mixed with a liquid or gel.

Zinc Oxide –Eugenol was developed by Rickert in 1931. ZOE consists of fine powder of zinc oxide, Oleo resins and Thymol Iodide that is to be mixed with a liquid. ZOE has exceptional lubricating ability, bioactivity and ease of manipulation.

The role of obturation is to seal the canal periapically and coronally and hence sealers come into play.

AIM AND OBJECTIVES

Aim

“Comparing the sealing ability of Zinc oxide Eugenol and MTA based sealer to root canal dentine using different obturation techniques.”

Objectives

1. To evaluate the sealing ability of MTA plus based sealer using single cone obturation technique.
2. To evaluate the sealing ability of MTA plus based sealer using continuous wave obturation technique.
3. To evaluate the sealing ability of ZOE based sealer using single cone obturation technique.
4. To evaluate the sealing ability of ZOE based sealer using continuous wave obturation.

MATERIALS AND METHODS

Materials

- 30 freshly extracted single-rooted incisors teeth.
- 17% EDTA. (Pulpdent corporation, USA)
- 5.25% Sodium hypochlorite(Vishal Pvt. Ltd, India)
- Diamond blade.
- 10 number stainless steel endodontic file (flexo file)
- Nikel-titanium rotary instruments (Protaper files)
- Zinc Oxide Eugenol based sealer
- Mineral trioxide aggregate. (ProRoot white MTA, Dentsply)
- Stereomicroscope 30 X magnification

Methods

30 extracted single-rooted human teeth were selected. Criteria for tooth selection included a completely formed apex and the absence of root canal filling or resorption. The external surfaces of the teeth were cleaned with gauze and sodium hypochlorite (NaOCl) and were sectioned at the cement-enamel junction with a low-speed diamond blade, and then the roots were stored in saline.

The root canals were negotiated with a size 10 stainless steel endodontic file (FlexoFiles; Dentsply Maillefer, Johnson City, TN) until visualized at the apical foramen. The lengths were recorded, and the working length was established by subtracting 1 mm

from the recorded length. All canals were instrumented to the working length using Protaper files in sequence .

Canals were irrigated with 2.5% NaOCl throughout instrumentation with a side-vented needle at the working length. Final irrigation consisted of 3 mL 17% EDTA for 1 minute followed by 3 mL 2.5% NaOCl for 1 minute and then they were rinsed with 5 mL saline for 1 minute and dried with paper points. The specimens were stored in distilled water at 4°C. The canals were obturated either by single cone obturation technique or continuous wave obturation technique.

Obturation Technique

After cleaning and shaping, canals were isolated and dried with the help of paper points. Master cone selection was done and the canals were coated with sealer using lentulospiral. The master cone was then inserted till working length and a hand or finger spreader was inserted alongside the master cone to a level 1mm short of the working length. Placement of sequential accessory cones by continuous wave until complete obturation of the radicular pulp space was done.

In single cone obturation technique a master cone that matches the taper and size of final rotary instrument was selected and was coated with sealer and the canal was obturated.



Fig-1: 30 selected single rooted teeth



Fig-2: Teeth were sectioned at cemento-enamel junction



Fig-3: Root length 11mm

Table 1: the roots were randomly divided into 5 groups and were obturated as follows

SR.NO	GROUP	SAMPLE	MTA PLUS	ZOE based sealer	Single cone obturation	Continuous wave obturation
1	Group 1	N=10	*		*	
2	Group 2	N=10	*			*
3	Group 3	N=10		*	*	
4	Group 4	N=10		*		*
5	Group 5	N=10				

A radiograph was taken for each root to verify the absence of voids. The specimens were stored for 2 weeks at 37°C in 100% humidity to allow the sealers to set.

All the samples were then stored in 100% humidity at 37C for 7 days and then were again covered with a new layer of nail varnish so that only the apical foramen and canals orifice remains exposed. The negative controls however were completely covered.

All specimens were submerged in 1% methylene blue dye. The roots were then rinsed for one hour in tap water and dried at room temperature for 24 hours. After drying samples were split longitudinally

with high speed hand piece and were viewed under a stereomicroscope at 30 X magnification.

STATISTICAL ANALYSIS

Ordinal data was analysed by Kruskal-Wallis statistical test and Mann Whitney U-test at Significance level of $P \leq 0.005$.

RESULTS

According to the statistical analysis it was found that the sealing ability was highest with group I and group II followed by group III & IV. And statistically significant difference was seen between the control and other groups.

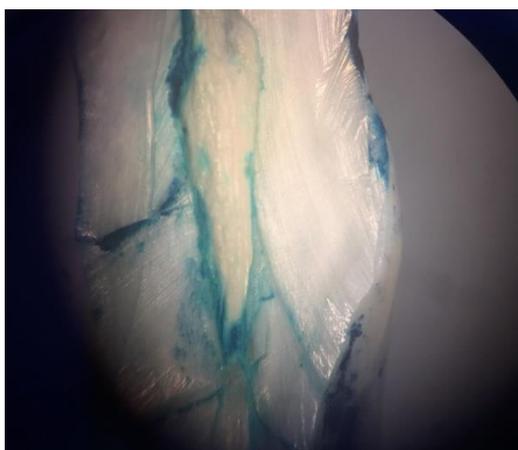


Fig-4: MTA Filapex sealed apically seen microscopically



Fig-5: Zinc oxide sealed apically seen microscopically

Table 2: Comparison of sealing ability of MTA based sealer with other four groups at middle third

Sealing Ability	Group I	Group II	Group III	Group IV	Control Group
Present	1	1	2	3	4
Absent	4	4	3	2	1
Total	5	5	5	5	5
χ^2 -value	-	0.00 p=1.00,NS	9.52 p=0.002,S	33.33 p=0.0001,S	90.17 p=0.0001,S

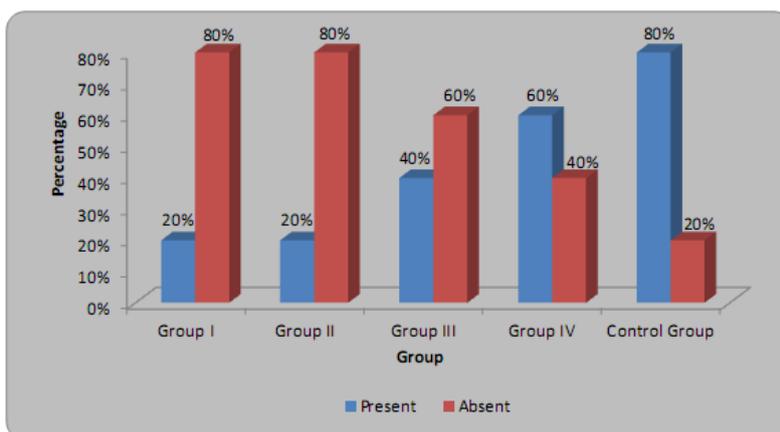


Fig-6: Comparison of sealing ability of MTA based sealer with other four groups at middle third

Table 3: Comparison of sealing ability of MTA based sealer with other four groups at apical third

Sealing Ability	Group I	Group II	Group III	Group IV	Control Group
Present	1	1	4	3	5
Absent	4	4	1	2	0
Total	5	5	5	5	5
χ^2 -value	-	0.00 p=1.00,NS	72.00 p=0.0001,S	33.33 p=0.0001,S	133.33 p=0.0001,S

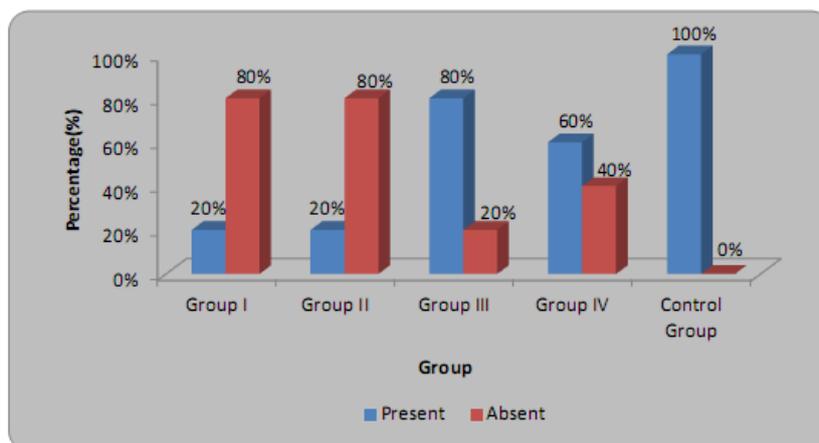


Fig-7: Comparison of sealing ability of MTA based sealer with other four groups at apical third

Statistical analysis was done by using descriptive and inferential statistics using chi square test and software used in the analysis will be Graph Pad Prism 6.0 version and $p < 0.05$ is considered as level of significance.

DISCUSSION

The primary goal of endodontic therapy is the complete removal of necrotic debris, microbes along with their by-products followed by sealing of the root canal by obturation. This produces a fluid-tight seal in order to avert microleakage and the entry of oral fluids and micro-organisms into the canal [3].

An ideal endodontic material when used to seal communication between the root canal system and periodontium should be biocompatible, dimensionally stable, adhere to dentin and remain in place under dislocating force [4].

The purpose of study is to compare the sealing ability of Mineral trioxide and Zinc oxide Eugenol during obturation technique.

Recent evidence emphasizes the significance of apical and coronal seal in the success of endodontic treatment [5]. MTA has proven to be an endodontic material of choice with potential for several clinical applications due to its superior sealing properties [6], for example its ability to set in the presence of moisture or blood and biocompatibility [7]. According to some authors, it has been suggested as an orthograde obturating material for the entire root canal system. Hui-min Zhou [8] studied the Physical Properties of 5 Root Canal Sealers to evaluate the pH change, viscosity and other physical properties of 2 novel root canal sealers (MTA Fillapex and Endosequence BC) in comparison with 2 epoxy resin-based sealers (AH Plus and ThermoSeal), a silicone-based sealer (Gutta-Flow), and a zinc oxide-eugenol-based sealer (Pulp Canal Sealer) during 1 day and 5 weeks and thus concluded that the tested sealers were pseudoplastic according to

their viscosities as determined in this study. The MTA Fillapex and Endosequence BC sealers each possessed comparable flow and dimensional [8] stability but higher film thickness and solubility than the other sealers tested

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