

Original Article

Comparative Study Evaluating the Action of MTA and Calcium Hydroxide in Endodontic Treatment

Kantem Dhathri¹, Durga Prasad .M², Tharangini pulivarthi³, Zafaerah sultana⁴, B.Tapaswi Singh⁵, Manasa Puli⁶

¹BDS, ^{2,4,5}PG 3rd year (MDS), Dept. of Pedodontics and Preventive dentistry, ^{3,6}Intern BDS, MNR Dental College and Hospital, Fasalwadi, Telangana, India

ABSTRACT

Background: An inappropriate filling while obturation results in re-entry and re-invasion of microorganisms into the root canal system that irritates the periapical area and compromises the success of treatment. The aim of the present study was to compare the apical microleakage of calcium hydroxide sealer and MTA based sealer. **Materials and Methods:** The present study was conducted in the department of endodontics for a period of 8 months. Decoronation of the teeth were done and then they were embedded in alginate containing containers. Preparation of the root canals was done using endo access bur and K files. NiTi pro taper rotary files were used for biomechanical preparation till size F2. Irrigation was done using 5.0% sodium hypochlorite and EDTA was kept in root canals for 4 minutes. The linear dye penetration was estimated from root apex to the most coronal level under Stereomicroscope. All the data thus obtained was arranged in a tabulated form and analyzed using SPSS software. Mann-Whitney test was used for statistical analysis. **Results:** 40% (n=12) teeth were lateral incisors, 33.3% (n=10) were central incisors. The mean penetration in group I was 0.64+/-0.22. The mean penetration in Group II was 1.14+/-0.21. On applying statistical analysis there was a significant difference between them as the p value was less than 0.05. **Conclusion:** The study showed that sealing capacity of calcium hydroxide was significantly better than that of MTA.

Key Words: Biomechanical, Decoronation, sealer

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Corresponding author: Dr. Kantem Dhathri, BDS, MNR Dental College and Hospital, Fasalwadi, Telangana, India

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INTRODUCTION

The aim of obturating root canal is to get a three-dimensional closure of the root canals. An inappropriate filling while obturation results in reentry and re-invasion of microorganisms into the root canal system that irritates the periapical area and compromises the success of treatment [1]. Gutta-percha is an ancient and still widely accepted root canal filling material since 150 years, and it is used as a sealer and is crucial for obtaining a fluid-tight seal between the walls. [2] Calcium hydroxide holds antibacterial action that can minimize or remove bacterial penetration and irritation of pulpal tissue. [3] The drawbacks of calcium hydroxide are that it does not have any inherent

adhesive actions and lacks proper seal, and the formulations that are self-cure are soluble and dissolve over time. [4] Mineral trioxide aggregate is made up of calcium oxide that is present as tricalcium silicate, tricalcium aluminate, dicalcium silicate and bismuth oxide that provides radiopacity. [5] Calcium hydroxide product of the reaction between mineral trioxide aggregate and water. The biocompatibility of mineral trioxide aggregate is due to the development of calcium hydroxide, that enhances pulpal repair. Apical dye penetration is used for in vitro evaluation of the sealing efficacy which is corresponding to the in vivo level of micro leakage with specific sealer. [6] Different techniques have been used to estimate the leakage ability of sealers like colored dye penetration,

penetration of radio labeled tracer, spectrometry of radioisotopes and electrochemical chromatography. However, various studies showed no significant difference amongst these techniques.⁷ The aim of the present study was to compare the apical microleakage of calcium hydroxide sealer and MTA based sealer.

MATERIALS AND METHODS

The present study was conducted in the department of endodontics for a period of 8 months. The study was approved by the institutional ethical board. The study included extracted single rooted teeth as samples. Teeth that had open apices, fractures, developmental anomaly, internal root resorption, caries etc were not included in the study. Hand scalers were used to clean the teeth and then they were soaked in 5.25% sodium hypochlorite and then stored in thymol crystals. Decoronation of the teeth were done and then they were embedded in alginate containing containers. Preparation of the root canals was done using endo access bur and K files. Standard wooden blocks were made and used for taking radiographs to maintain a standard protocol for all subjects. NiTi protaper rotary files were used for biomechanical preparation till size F2. Irrigation was done using 5.0% sodium hypochlorite and EDTA was kept in root canals for 4 minutes. This was followed by rinsing with saline. Drying of the canals was done using paper points. Teeth were randomly divided into two groups. In Group 1 calcium hydroxide sealer was used and in Group 2 MTA sealer was used. Radiographs were taken to ensure complete obturation. Teeth were stored at room temperature at 100% humidity for 1 week for sealers to set. Except for the apical 2 mm all the root surfaces were covered nail varnish. After applying sticky wax to varnish area, the teeth were stored in 2% methylene blue and then in an incubator for 72 hours. This was followed by rinsing of root with water and drying with paper towels. The splitting of the roots was done longitudinally using a spoon excavator. The linear dye penetration was estimated from root apex to the most coronal level under Stereomicroscope. All the data thus obtained was arranged in a tabulated form and analyzed using SPSS software. Mann-Whitney test was used for statistical analysis.

RESULTS

Table 1 shows the characteristics of the study. 40% (n=12) teeth were lateral incisors, 33.3% (n=10) were central incisors. There were only 26.7% (n=8) premolars. The mean length of root canal was 13.87+/-4.21 mm.

Table 2 shows the mean values of penetration length between two groups. The mean penetration in group I was 0.64+/-0.22. The mean penetration in Group II was 1.14+/-0.21. On applying statistical analysis there was a significant difference between them as the p value was less than 0.05.

Table 1: Demographic details of the study

Variable	Frequency
Lateral incisor	12(40%)
Central incisor	10(33.3%)
Premolar	8(26.7%)
Mean length of root canal	13.87+/-4.21

Table 2: Mean and standard deviation of the penetrability vales

Score	Group I	Group II
Mean	0.64	1.14
Standard deviation	0.22	0.21
P value		<0.05

DISCUSSION

Obturation of the root canal is a three dimensional system that creates a fluid impervious seal is a crucial factor in the success of endodontic therapy. The filling of root canal should completely seal the canal both in the apical side and coronal side to prevent the movement of microorganism towards the apex.⁸ Calcium hydroxide is used as root canal sealer and arouses periapical tissues for maintaining health and promote healing and it also exerts antimicrobial action.⁹ As per our study, 40% (n=12) teeth were lateral incisors, 33.3% (n=10) were central incisors. There were only 26.7% (n=8) premolars. The mean length of root canal was 13.87+/-4.21 mm. Some studies have shown that sealers based on calcium hydroxide show a great amount of volumetric expansion while setting as they absorb water, and hence increases its solubility. In this study, the mean penetration in group I was 0.64+/-0.22. The mean penetration in Group II was 1.14+/-0.21. On applying statistical analysis there was a significant difference between them as the p value was less than 0.05. As per the manufacturer's the MTA-based sealer leads to the formation of integrated, that is excellent and perfect and provides a high biological regenerating capacity.⁸ However, newer studies have shown the conflicting results respectively this issue.^{10,11} Setting of mineral trioxide aggregate leads to hydration of the inorganic oxide compounds, that result in the formation of calcium hydroxide and calcium silicate hydrate part¹², that lead to expansion of the margins, thus improving the seal and leading to decrease in microleakage.¹³ Drawbacks of MTA include high solubility and has a prolonged setting time of around 2 hrs and 45 min.¹³ Three studies on humans have shown no significant differences amongst mineral trioxide aggregate and calcium hydroxide for inflammation both superficial and deep, the formation of a dentinal bridge, and vitality of pulp.¹⁴ Few other human studies showed that MTA treatment was more efficient for pulp capping.¹⁵ However, these studies have few drawbacks like small sample size, as well as different methodologies. The histological studies showed minimal pulpal inflammation with a superior hard-tissue formation with MTA.

CONCLUSION

Root canal management requires a three dimensional seal of the canal that are impervious to the micro organisms. The present study compared MTA and calcium hydroxide as sealers. The study showed that sealing capacity of calcium hydroxide was significantly better than that of MTA.

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