Original Article

10.37821/ruhsjhs.4.4.2019.205-209

Comparative Evaluation of Apical Seal using Cention N and Mineral Trioxide Aggregate as Retrograde Filling Material

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ABSTRACT

Introduction: The study was done to compare and evaluate sealing ability of two retrograde filling materials namely mineral trioxide aggregate (MTA) and Cention N using stereomicroscope.

Methodology: A total of 40 single rooted freshly extracted teeth were collected and decoronated. They were randomly divided in two groups of 15 teeth each as group 1 and 2 and 5 teeth each in group 3 and 4 (control groups). Bio-mechanical preparation was then done till 30 size K file using step back technique. The teeth were obturated and 3 mm of each root apex was sectioned at a 90° angle. 3 mm retrograde preparation was performed with a short head bur attached to a high speed hand piece. Retrofillings were performed with MTA and Cention N in groups 1 and 2. Teeth were immersed in 1% methylene blue dye for 48 hours. The roots were rinsed and sectioned by diamond disc. The sections were evaluated under a stereomicroscope under 10X magnification.

Results: Group 2 (Cention N) exhibited least micro-leakage, however statistical results with ANOVA showed no significant difference in micro-leakage among groups 1 and 2 ($p = 0.847$).

Conclusion: Cention N can be an alternative to MTA as retrograde filling material however, further bio-compatibility tests to check the reactions of periapical tissues to the materials need to be evaluated.

INTRODUCTION

Surgical endodontic therapy is a viable alternative when conventional endodontic therapy is unsuccessful or contraindicated because of complexity of root canal systems, inadequate instrumentation, and presence of physical barriers.[1]

Success of endodontic surgery depends on case selection, instrumentation technique, and selection of retrograde filling material. The primary role of retrograde filling material is to perform the hermetic sealing. By hermetic sealing with a root end filling, prevention of the passage of microorganisms and their products into the periapical tissues can be achieved.[2]

The properties of the ideal root-end filling material are as follows: bio-compatibility, promotion of tissue regeneration without causing inflammation, ease of handling, low solubility in tissue fluids, bonding to dental tissue, non-absorbable, dimensional stability, radio-opacity, and no staining of surrounding tissues.[3] Many materials are currently being used, including amalgam, composite, super-EBA, IRM, and mineral trioxide aggregate as retrograde filling material. Among these materials, mineral trioxide aggregate is considered as the gold standard of retrograde filling material.[3] However, this biocompatible material presents certain drawbacks such as long setting time. Extensive porosity is also observed in mineral trioxide aggregate when it comes in contact with low pH solution which may lead to micro-leakage and may stand as an obstruction in the success of the treatment.

Composites were introduced in 1960s and have been available for nearly fifty years. Despite having good physical properties, the main shortcomings of composite resin materials are shrinkage resulting in marginal micro-leakage, postoperative sensitivity, and secondary caries.[4]

Cention N an "alkasite" restorative material which is a new category of filling material is essentially a subgroup of the composite resin with less setting time which can produce cost-effective way to deliver a high-quality, predictable retrograde seal. It is like compomer or

ormocer and is essentially a subgroup of the composite resin. It is an UDMA based, self curing powder/ liquid restorative with optional additional light-curing. The liquid comprises of dimethacrylates and initiators, whilst the powder contains various glass fillers, initiators, and pigments. It is radio opaque and contains alkaline glass fillers capable of releasing fluoride, calcium, and hydroxide ions to neutralize the low pH solution.[4]

The purpose of this in vitro study was to evaluate Cention N as a retrofill material compared with conventional retrofill material that is mineral trioxide aggregate (MTA) with respect to its sealing characteristics using stereo-microscope.

METHODS

In this study, forty single-rooted human premolar teeth extracted for several reasons were selected. Only those samples were selected which existed as paired teeth to avoid bias due to root canal anatomy. Figure 1 shows the total sample size. The teeth were maintained in 10% formalin solution for 24 hours and transferred to saline solution at the time of use. Then, they were cleaned and decoronated close to the cementoenamel junction with a carborundum disc. Specimens were randomly divided into four groups namely, group 1 and 2 comprising of 15 specimens each and control groups 3 and 4 comprising of 5 specimens each.

Group 1: Mineral trioxide aggregate ProRoot MTA (Dentsply International, Johnson City, TN, USA).

Group 2: Cention N (Ivoclarvivadent, *Schaan, Liechtenstein*).

Group 3 (Positive control): Tested for micro-leakage with no retrograde filling material.

Group 4 (Negative control): Retrograde filling given and nail varnish coated completely all around the tooth.

Step back technique of biomechanical preparation was followed; sodium hypochloride and EDTA were used as irrigants and shaped with 30 size K-file till working length. Then, the root canals were dried with absorbent points (dentsply) and obturated with gutta-percha (dentsply) and AH plus root canal sealer using lateral condensation technique. Radiographs were taken to verify the complete filling of the root canal.

The tip of each root was resected perpendicular to its long axis 3 mm from the apex with diamond bur using a high speed hand piece. Then apical cavities with the depth of 3 mm were prepared with burs attached to the high speed handpiece with the water coolant. Retrograde filling materials were mixed according to the manufacturer's instructions and placed in their respective groups. Specimens in group 1 which received mineral trioxide aggregate (MTA) were kept dipped in moist cotton for 48 hours to ensure the initial setting.

Cention N was used as retrograde filling material for group 2. In group 3 (positive control group), no retrograde filling material was used and in group 4 teeth were completely coated with nail varnish which served as negative control. The root surfaces were covered with two layers of nail varnish up to 2 mm from the apical foramen in groups 1, 2, and 3. Specimens were allowed to dry for 30 minutes.

After this period, the specimens were immersed in 1% methylene blue dye for 48 hours. After 48 hours, teeth were rinsed under running water for 5 minutes and allowed to dry. The roots were divided into two equal halves as shown in figure 2 along the long axis with diamond disc. The sections were observed under a stereomicroscope at 10X magnification (Leica MS5 Switzerland) (Figure 3).

The linear depth of dye penetration was measured on both sides of the retrograde filling material in all sectioned roots of all groups with IMAGE J analysis software**.** The mean and standard deviation of dye penetration depth were reported. One way ANOVA was used to compare micro-leakage among the groups. Tukey's test was applied for pairwise comparisons. All statistical analyses were performed using SPSS software (SPSS version 18, SPSS, Chicago, IL, USA).

RESULTS

Table 1 shows the mean and standard deviation of dye penetration depth (indicative of micro-leakage). As shown in table 1, the depth of penetration is more in group 1 (retro grade filled using mineral trioxide aggregate (MTA) when compared with group 2 (retrograde filled using Cention N). Statistical results with ANOVA have shown that there is no significant difference in micro-leakage among the groups 1 and 2 ($p=0.847$).

DISCUSSION

The mineral trioxide aggregate (MTA) was developed by Lee SJ et al[5] and several studies have shown its excellent capacity of marginal sealing when compared with other materials.[6-12]

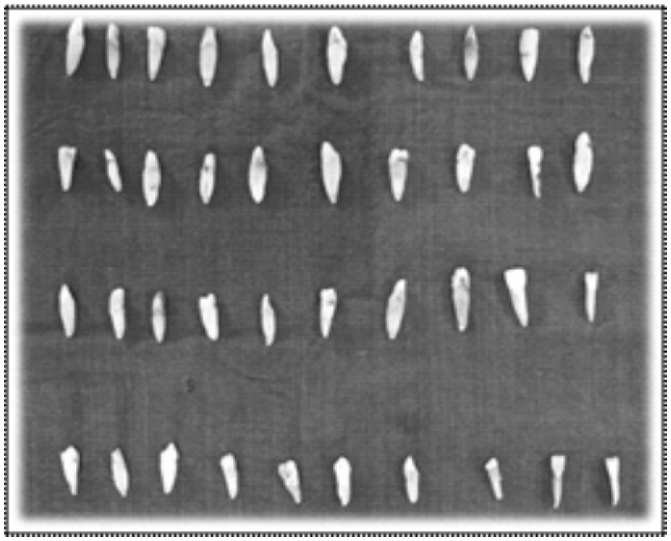

Figure 1: Total sample size.

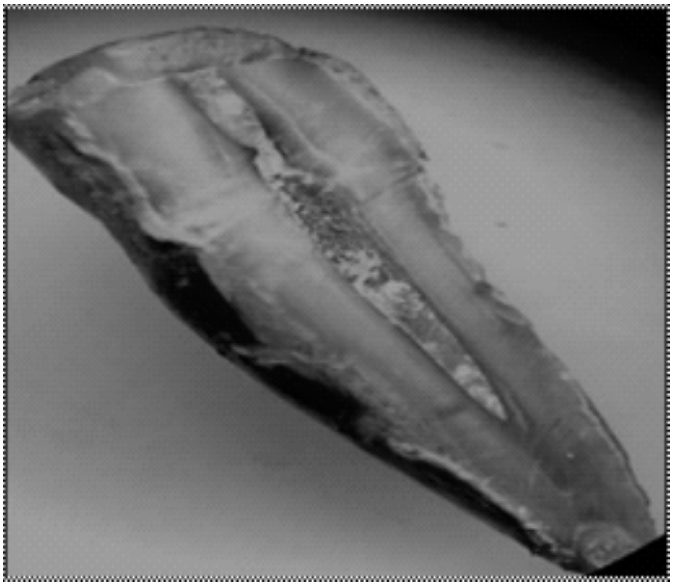

Figure 2: Sectioned tooth.

Figure 3: Stereomicroscope.

The major components of MTA are tri-calcium silicate, tricalcium aluminate, tricalcium oxide, and silicate oxide. The powder is composed of small hydrophilic particles and the hydration of the powder results in a colloidal gel that solidifies in the mineralized structure of the tooth[13] leading to a marginally satisfactory adaptation due to the possible expansion of this material in a humid environment.[14]

Watts JD et al[15] have reported that all white mineral trioxide aggregate (WMTA) samples show discoloration 3 days after placing the material into a mould that was in contact with phosphate buffered solution (PBS). The presence of Arsenicin MTA and release of arsenic into the tissue fluid scan potentially cause toxicity.[16]

MTA has long setting time which is one of the reasons that it should not be applied in one visit. This has been cited as one of the shortcomings of this material.[17]

Galhotra Vet al[18] conducted a study and compared micro-leakage of various retrograde filling materials like MTA, light curable GIC, and resin modified zinc oxide eugenol and concluded that MTA exhibited least micro-leakage. Whereas, Desai N et al[19] has compared MTA, Biodentine, and Bioaggregate and concluded micro-leakage is comparatively more with biodentine and bioaggregate. Despite its many advantages, long setting time and discoloration are the drawbacks of MTA. Efforts have been made to overcome these shortcomings; however, adding or removing various elements to alleviate these shortcomings can affect MTA's ideal characteristics. Introducing new compositions of MTA should await comprehensive investigations. New formulations should be tested in-vitro as well as in vivo before their application in humans.

To overcome the polymerization shrinkage, Cention N also includes special patented filler (Isofiller) which acts as a shrinkage stress reliever and due to its low elastic modulus this reduces polymerization shrinkage and micro-leakage.

Cention N is an ADA approved restorative material that can be used in small class I, II, III, and V cavities. Samanta S et al[20] designed a study in 2017 to compare and evaluate the micro-leakage in class V cavity filled with flowable composite resin, glassionomer cement, and Cention N. Dye leakage study was performed and the samples were evaluated under stereomicroscope. According to the results, flowable composite exhibited the highest micro-

Table 1: Showing mean values of micro-leakage

Group 1	Group 2	Group 3	Group 4
Root canal obturated wth Gutta-Percha and retro grade filling done with MTA	Root canal obturated with Gutta-Percha and retro grade filling done with Cention N	Micro-leakage tested in root canals without retro grade filling	Root canal obturated retro grade filling done and coated with nail varnish 2 mm around the apex
n 1 = 15	n 2 = 15	n 3 = 5	n 4 = 5
Mean = 0.787	Mean=0.773	Mean = 2.08	Mean = 0

leakage followed by glass ionomer and least micro-leakage was shown by Cention N.

Cention N has a setting time of just 4 mins while mineral trioxide aggregate has the setting time of 170 minutes. Cention N being a subgroup of composite resin exhibits least solubility in the oral fluids. In the present study Cention N showed less micro-leakage than MTA but not statistically significant.

1% methylene blue is used as dye in this study not only because it is the most common dye which is used in dye leakage studies to evaluate the micro-leakage but also because it exhibits a sensitivity surpassing even that of radioactive isotopes.[21]

CONCLUSION

Cention N can be an alternative to MTA as retrograde filling material however further biocompatibility tests to check the reactions of periapical tissues to the materials needs to be evaluated.

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