International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2019): 7.583

Microscopic Evaluation of Two Different Sealers in Filling Artificial Internal Resorption Cavities in Mandibular Central Incisors - An in Vitro Study

Hitika P Doda[1], Vaishali V Parekh[2], Aashray A Patel[3], Nupur R Vasava[4], Dhruv J Thakor[5]

Department of Conservative Dentistry and Endodontics, Karnavati University, Gandhinagar, Gujarat, India

Abstract: ***Aim: To evaluate the root filling quality of two different sealers using thermoplasticised obturation technique in an artificial internal resorption cavity. Method: For this study, 20 mandibular central incisors with single canal were selected. After the biomechanical preparation, the roots were sectioned 7mm from apex. The internal resorption cavities were created on both the parts of sectioned root and then again approximated together. According to the sealer used, the teeth were divided into two groups with 10 teeth in each group and obturation was carried out using thermoplasticised injection technique. To check the obturation mesio-distal and bucco-lingual views were taken on radiograph and then after 7 days the sectioned roots were viewed and photographed under microscope for percentage evaluation of sealer, gutta percha and voids. The statistical analysis was performed using one way ANOVA test. Results: The MTA Fillapex group showed better filling ability with greater filling area and less number of voids than the CeraSeal group. Conclusion: MTA fillapex group showed superior results than the CeraSeal group.***

Keywords: internal resorption, bioceramic sealer

1. Introduction

The success of root canal treatment is based on three dimensional filling of the root canal with no voids. The filling material should be biocompatible and dimensionally stable. But the aim to achieve a good hermetic seal can be hampered by the pathologic processes such as root resorption.

Root resorption are of two types- internal and external which is dependant upon the lesion localization in refrence to the root surface. Internal resorption is a rare, pathological condition which starts in the pulpal space and spreads to the surrounding dentin. This spread is thought to begin from chronic inflammation of the coronal pulp caused by continuous bacterial stimulation. [1] Internal resorption was first reported by Bell in 1830. Pink tooth of Mummery (1920), so called due to the presence of a pink discoloration on the crown, is named after the anatomist Mummery.[3] The pulpal tissue is replaced by granulation tissue due to the clastic activity of odontoclasts and ultimately leads to the internal resorption.[1] It is more common in males than females.[4] The prevalence of internal root resorption due to inflammation is 0.01%-1% according to Haapasalo.[2] It is easier to diagnose the lesion in its classical form but requires advanced diagnostic methods in some instances.[2] Usually it is symptom free and only 2% cases are symptomatic.[5]

Radiographically, it appears as a well defined radiolucent area as if the canal is ballooning out. It is easier to diagnose and arrest the lesions in its earlier state than at a later stage where perforation may occur leading to sinus tract formation.[2] The prognosis of the treatment will depend upon the extent of the lesion. The progression of the lesion is affected by the amount of vital pulp tissue, necrotic pulp and the microbial stimulus.[5]

Since there is loss in the root canal morphology, it is required for the filling material to flow and fill the defect as well as the canal three dimensionally. There are many studies which compare the different obturation techniques for filling the internal resorption cavities but not many have compared the sealing ability of the sealer. Hence the aim of this in vitro study was to evaluate the filling ability of two different bioceramic sealers in sealing the internal resorption cavity.

2. Method

For the study, 20 freshly extracted (due to periodontal reasons) mandibular incisors with single root and single canal and closed apices were selected for the study. All teeth were kept in solution for 24 hrs and scaled. All the teeth were selected with a minimum length of 20 mm(fig1). Using a no 2 round bur a conventional access opening cavity was prepared(fig2) and biomechanical preparation was done upto # 20.06 Hershaper rotary file system(fig 4) Simultaneously irrigation was performed using 5.25% NaOCl and normal saline with a final rinse of 17% EDTA.

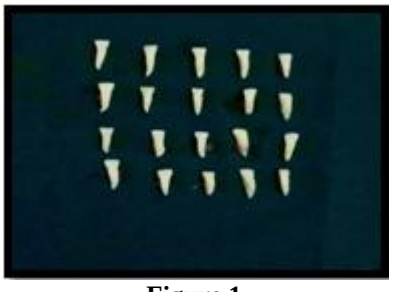

Figure 1

Figure 2

Figure 3

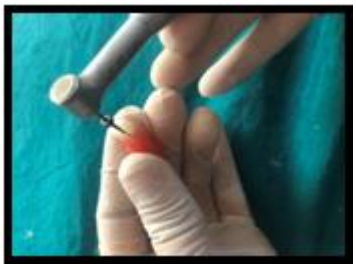

Figure 4

To create artificial internal resorption cavities, the teeth were sectioned 7mm from the apex horizontally by a fine diamond disc(fig5). Hemisphere cavities were created using number 2 round bur around the periphery of the opening of the root canal of each section.(fig6). The two sections were joined together using a cyanoacrylate glue on the dentin surface. The teeth were radiographed to view the artificially created internal resorption cavities(fig7).

Figure 5

Figure 6

Figure 7

The prepared teeth were randomly divided in two groups according to the sealer (MTA Fillapex and CeraSeal group) used with 10 teeth in each group. The sealer was coated on the root canal wall using a lentulospiral (fig8). After that all teeth were obturated using thermoplasticized gutta percha injection technique using obtura III system(fig9). The filling was checked with the help of radiograph and the teeth were then sectioned again for further evaluation (fig10).

Figure 8

Figure 9

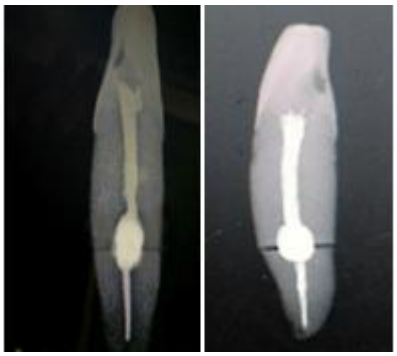

Figure 10

Scanning Electron Microscope (SEM) Evaluation:

All the samples were then viewed under scanning electron microscope at 25X to check the voids and calculate the filling area of the internal resorption cavity.

The Mann-Whitney U test was used for two independent groups. Statistical Package for Social Science (SPSS, IBM) version 22 was used for the analysis. The level of significance was set at 5%.

3. Results

MTA Fillapex (fig 11) showed better sealing area with lesser void percentage than the CeraSeal group.(fig 12)

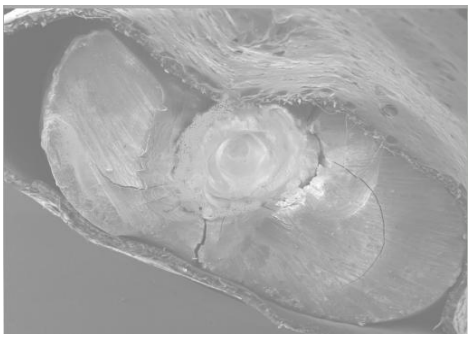

Figure 11

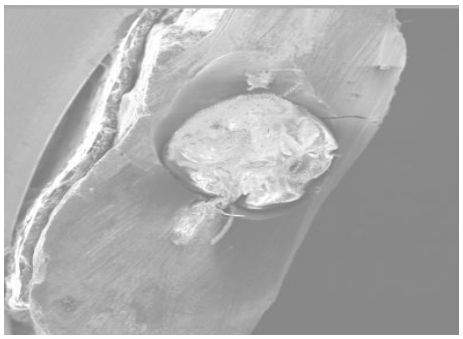

Figure 12

Table 1: Comparison of mean values of filling and voids areas between groups

Groups	Sample	Filling area (Mean ± SD)	Voids area (Mean ± SD)
Ceraseal	10	5.39 ± 0.17	1.61 ± 0.17
MTA fillapex	10	6.33 ± 0.20	0.69 ± 0.19
P Value		<0.001**	<0.001**

Table 2: Comparison of mean percentage values of filling materials and voids between groups

Groups	Sample	Filling area (Mean ± SD)	Voids area (Mean ± SD)
Ceraseal	10	77.17 ± 2.59	22.83 ± 2.26
MTA fillapex	10	89.44 ± 2.25	10.56 ± 2.25
P Value		<0.001**	<0.001**

4. Discussion

The most commonly affected teeth by internal resorption are incisors and mandibular molars[2]. Many studies have been conducted on maxillary incisors but not on mandibular incisors, hence mandibular incisors were selected.

Bioceramic sealers were selected because their biocompatibility is an advantageous property. They have calcium ion releasing property which results in chemical composition and crystalline structure similar to tooth and bone apatite materials, thus enhancing sealer-dentin bond. It also stimulates repair by deposition of mineralized tissue.[7] Also the calcium phosphate content helps to eradicate residual infections giving the sealers antimicrobial property.

For the obturation, thermoplasticized injection technique was used. Goldberg et al[8] in 2000 suggested that the obturation of root canal should contain more gutta percha and less sealer. Also the literature suggests that thermoplasticized obturation technique gives optimum results for obturation of teeth with internal resorption. Most of the internal resorption cases are found in middle third of the root hence the sections were made 7mm from the apex to create internal resorption cavities in the middle third of the root[9,10]. MTA fillapex showed better results than the CeraSeal group because Presence of MTA in the formula results in expansion on setting. Thus it has better sealing abilty and marginal adaptation and is able to cover greater area. Average overall dimensional change- 0.008%.

5. Conclusion

Within the limitations of this study, it can be concluded that MTA Fillapex was better in filling the artificial internal resorption cavities in mandibular incisors when compared to CeraSeal. The result obtained was statistically significant.

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