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Original Research

Assessment of antimicrobial efficacy of calcium hydroxide based sealer and mineral trioxide aggregate based sealer against E. faecalis: A comparative study

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ABSTRACT

Background
The successful endodontic treatment in infected teeth depends on the elimination of the microbial load by the chemomechanical preparation of the root canals. Enterococcus faecalis is Gram-positive bacterium that can mostly resist endodontic therapy and has been frequently found in root canal-treated teeth with signs of chronic apical periodontitis. Hence; the present study was conducted for assessing and comparing the antimicrobial efficacy of calcium hydroxide based sealer and mineral trioxide aggregate based sealer against E. faecalis.

Materials & Methods
Two type of sealers were used in the present study; Calcium hydroxide based (Sealapex), and Mineral trioxide aggregate based (MTA Fillapex) against E. faecalis. In agar plates, two wells were made at equidistant points and filled with freshly mixed respective root canal sealers. This was followed by incubation with E. faecalis. Subculture of the microorganisms was done for confirming their purity. On two petri dishes, aliquots of the suspension containing E. faecalis were spread. This was followed by incubation of the media at thirty seven degrees centigrade for 72 hours under aerobic condition. Measurement of zone of inhibition was done at 24 hours, 48 hours and 72 hours. Measurement of the diameter of the growth inhibition zones was measured.

Results
Mean diameter of calcium based sealers at 24 hours, 48 hours and 72 hours was found to be 15.1 mm, 21.9 mm and 12.1 mm respectively. Mean diameter of MTA based sealers at 24 hours, 48 hours and 72 hours was found to be 7.5 mm, 5.1 mm and 0 mm respectively. Significant results were obtained while assessing the individual activity of Calcium hydroxide based sealer and Mineral trioxide aggregate based sealer against E. faecalis.

Conclusion
Maximum bacterial inhibition zone against E. faecalis is seen with calcium hydroxide-based sealer in comparison to MTA based sealer. However; further studies are recommended.

INTRODUCTION

The successful endodontic treatment in infected teeth depends on the elimination of the microbial load by the chemomechanical preparation of the root canals. However, the complete elimination of microorganism from the root canal system is not possible in all the cases. Endodontic infections are polymicrobial, and more than 150 species of bacteria and other microorganisms are present that are responsible for the primary or persistent infection. Enterococcus faecalis is a commonly isolated

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species that may play a role in persistent endodontic infections. Studies report a prevalence of E. faecalis up to 77% in teeth with failed endodontic treatment.[1- 4]

Enterococcus faecalis is Gram-positive bacterium that can mostly resist endodontic therapy and has been frequently found in root canal-treated teeth with signs of chronic apical periodontitis. When lodged in the dentinal tubules of the canal, it is difficult to remove these species through root canal medicaments.

Many studies have been performed to assess the antibacterial activity of different endodontic sealers by different methods. There is little information available about the comparison of the antibacterial properties of the materials.[5- 7] Hence; the present study was conducted for assessing and comparing the antimicrobial efficacy of calcium hydroxide based sealer and mineral trioxide aggregate based sealer against E. faecalis.

MATERIALS & METHODS

The present study was conducted with the aim of assessing and comparing the antimicrobial efficacy of calcium hydroxide based sealer and mineral trioxide aggregate based sealer against E. faecalis. Two type of sealers were used in the present study; Calcium hydroxide based (Sealapex), and Mineral trioxide aggregate based (MTA Fillapex) against E. faecalis. In agar plates, two wells were made at equidistant points and filled with freshly mixed respective root canal sealers. This was followed by incubation with E. faecalis. Subculture of the microorganisms was done for confirming their purity. On two petri dishes, aliquots of the suspension containing E. faecalis were spread. This was followed by incubation of the media at thirty seven degrees centigrade for 72 hours under aerobic condition. Measurement of zone of inhibition was done at 24 hours, 48 hours and 72 hours. Measurement of the diameter of the growth inhibition zones was measured. All the results were recorded in Microsoft excel sheet and were analyzed by SPSS software. Student t test was used for evaluation of level of significance.

RESULTS

In the present study, two type of sealers were used in the present study; Calcium hydroxide based (Sealapex), and Mineral trioxide aggregate based (MTA Fillapex) against E. faecalis. Mean diameter of calcium based sealers at 24 hours, 48 hours and 72 hours was found to be 15.1 mm, 21.9 mm and 12.1 mm respectively. Mean diameter of MTA based sealers at 24 hours, 48 hours and 72 hours was found to be 7.5 mm, 5.1 mm and 0 mm respectively. Significant results were obtained while assessing the individual activity of Calcium hydroxide based sealer and Mineral trioxide aggregate based sealer against E. faecalis. However; while doing intergroup comparison maximum bacterial inhibition zone against E. faecalis is seen with calcium hydroxide-based sealer in comparison to MTA based sealer.

Table 1: Bacterial inhibition zone (mm)

Groups	24 hours	48 hours	72 hours	P value
Calcium hydroxide based sealer	15.1	12.9	11.1	0.04
MTA based sealer	7.5	5.1	0	0.01
p- value	0.00	0.01	0.00	-

DISCUSSION

For a successful endodontic treatment, complete chemicomechanical preparation, irrigation, obturation, and postendodontic restoration are essential to achieve optimal results, thus eliminating bacteria from the root

canal. Root canal disinfection is one of the main determinants which aids in the healing of the periapical tissues. Irrespective of thorough cleaning, shaping, and the use of intracanal medicaments, it is difficult to completely eradicate all microorganisms from the root canal system, which may lead to the failure of endodontic treatment. Microorganisms and their by-products are considered as primary etiological factors for pulp necrosis and apical periodontitis. Root canal sealers can be useful in reducing the remaining microorganisms in the root canal due to their antibacterial effect. The most well-known sealers are zinc-oxide eugenol-based sealers (Tg-sealer), calcium hydroxide-based sealers (Apexit), glass ionomers (Ketac-endo), resins (AH26), silicone sealers (RoekoSeal), and sealers containing pharmaceutical materials (Endomethasone).[8- 10] Hence; the present study was conducted for assessing and comparing the antimicrobial efficacy of calcium hydroxide based sealer and mineral trioxide aggregate based sealer against E. faecalis.

In the present study, two type of sealers were used in the present study; Calcium hydroxide based (Sealapex), and Mineral trioxide aggregate based (MTA Fillapex) against E. faecalis. Mean diameter of calcium based sealers at 24 hours, 48 hours and 72 hours was found to be 15.1 mm, 21.9 mm and 12.1 mm respectively. Mean diameter of MTA based sealers at 24 hours, 48 hours and 72 hours was found to be 7.5 mm, 5.1 mm and 0 mm respectively. Singh G et al evaluated the antibacterial properties of endodontic sealers against the E. faecalis. Six millimeters wells were made for each material in all the preinoculated petri plates. Then, the petri plates were incubated for 24 h. The zones of inhibition appeared were measured, and the measurements were put to statistical analysis. EndoSequence BC Sealer, MM-mineral trioxide aggregate (MTA), and ProRoot MTA showed maximum means of diameter of zones of inhibition, whereas MM-seal and Endoseal did not show any zones of inhibition. EndoSequence BC Sealer was found to be a better endodontic sealer as compared to resin-based and zinc oxide-eugenol-based sealer.[11]

In the present study, significant results were obtained while assessing the individual activity of Calcium hydroxide based sealer and Mineral trioxide aggregate based sealer against E. faecalis. However; while doing intergroup comparison maximum bacterial inhibition zone against E. faecalis is seen with calcium hydroxide-based sealer in comparison to MTA based sealer. Tanomaru JM et al evaluated the antimicrobial activity of a new root canal sealer containing calcium hydroxide (Acroseal) and the root canal sealer based on MTA (Endo CPM Sealer), in comparison with traditional sealers (Sealapex, Sealer 26 and Intrafill) and white MTA-Angelus, against five different microorganism strains. The materials and their components were evaluated after manipulation, employing the agar diffusion method. A base layer was made using Müller-Hinton agar (MH) and wells were made by removing agar. The materials were placed into the wells immediately after manipulation. The microorganisms used were: Micrococcus luteus (ATCC9341), Staphylococcus aureus (ATCC6538), Pseudomonas aeruginosa (ATCC27853), Candida albicans (ATCC 10231), and Enterococcus faecalis (ATCC 10541). The plates were kept at room temperature for 2 h for prediffusion and then incubated at 37 degrees C for 24 h. The results showed that Sealapex and its base paste, Sealer 26 and its powder, Endo CPM Sealer and its powder, white MTA and its powder all presented antimicrobial activity against all strains. Intrafill and its liquid presented antimicrobial activity against all strains except P. aeruginosa and Acroseal was effective only

against M. luteus and S. aureus.[12] Hasheminia M et al investigated the antibacterial activity of five different sealers against Enterococcus faecalis using two different methods. The mineral trioxide aggregate (MTA) Fillapex, Tg-sealer, Endomethasone, AH-26, and RoekoSeal sealers were placed into the brain heart infusion (BHI) culture medium containing E. faecalis (PTCC1393). The diameter of the bacterial zone of inhibition was measured. In the direct contact test, a suspension containing grinded set sealers and E. faecalis bacteria was cultured in BHI after 6, 15, and 60 min. The number of colonies in milliliter was calculated. In the agar diffusion test, Endomethasone had the highest antibacterial activity against E. faecalis compared to other sealers ($P < 0.001$). In the direct test, the antibacterial effect of MTA Fillapex was significantly higher than that of all other sealers ($P < 0.001$). The technique and components of the tested sealers affect the antibacterial activity results.[17]

CONCLUSION

From the above results, the authors concluded that maximum bacterial inhibition zone against E. faecalis is seen with calcium hydroxide-based sealer in comparison to MTA based sealer. However; further studies are recommended.

REFERENCES

1. Holland R, de Souza V, Nery MJ, Otoboni Filho JA, Bernabé PF, Dezan Júnior E. Reaction of dogs' teeth to root canal filling with mineral trioxide aggregate or a glass ionomer sealer. J Endod. 1999; 25:728–30.
2. Yildirim T, Gencoglu N. Use of mineral trioxide aggregate in the treatment of large periapical lesions: Reports of three cases. Eur J Dent. 2010; 4:468-74.
3. Vibha H, Rathod R. Assessment of antimicrobial efficacy of bioceramic sealer, epiphany self-etch sealer, and AH-Plus sealer against *Enterococcus faecalis*: An *in vitro* study. Endodontology. 2017; 29:151-5.
4. Jafari F, Samadi Kafil H, Jafari S, Aghazadeh M, Momeni T. Antibacterial activity of MTA fillapex and AH 26 root canal sealers at different time intervals. Iran Endod J. 2016; 11:192-7.
5. Monajemzadeh A, Ahmadi Asoor S, Aslani S, Sadeghi-Nejad B. In vitro antimicrobial effect of different root canal sealers against oral pathogens. Curr Med Mycol. 2017; 3:7-12.
6. Grossman L. Antimicrobial effect of root canal cements. J Endod. 1980; 6:594-7.
7. Gomes-Filho JE, Watanabe S, Bernabé PF, de Moraes Costa MT. A mineral trioxide aggregate sealer stimulated mineralization. J Endod. 2009; 35:256-60.
8. Duarte MA, Demarchi AC, Yamashita JC, Kuga MC, Fraga Sde C. pH and calcium ion release of 2 root-end filling materials. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2003; 95:345-7.
9. Rezende GC, Massunari L, Queiroz IO, Gomes Filho JE, Jacinto RC, Lodi CS et al. Antimicrobial action of calcium hydroxide-based endodontic sealers after setting, against *E. faecalis* biofilm. Braz Oral Res, 2016, 30.
10. Stuart CH, Schwartz SA, Beeson TJ, Owatz CB. Enterococcus faecalis: Its role in root canal treatment failure and current concepts in retreatment. J Endod. 2006; 32:93–8.
11. Singh G, Gupta I, Elshamy FMM, Boreak N, Homeida HE. In vitro comparison of antibacterial

properties of bioceramic-based sealer, resin-based sealer and zinc oxide eugenol based sealer and two mineral trioxide aggregates. Eur J Dent. 2016; 10(3):366–369.

12. Tanomaru JM1, Tanomaru-Filho M, Hotta J, Watanabe E, Ito IY. Antimicrobial activity of endodontic sealers based on calcium hydroxide and MTA. Acta Odontol Latinoam. 2008; 21(2):147-51.
13. Hasheminia M, Razavian H, Mosleh H, Shakerian B. In vitro evaluation of the antibacterial activity of five sealers used in root canal therapy. Dent Res J (Isfahan). 2017; 14(1):62–67.