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...
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.\textsuperscript{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.\textsuperscript{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)**

<table>
<thead>
<tr>
<th>Groups</th>
<th>24 hours</th>
<th>48 hours</th>
<th>72 hours</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium hydroxide based sealer</td>
<td>15.1</td>
<td>12.9</td>
<td>11.1</td>
<td>0.04</td>
</tr>
<tr>
<td>MTA based sealer</td>
<td>7.5</td>
<td>5.1</td>
<td>0</td>
<td>0.01</td>
</tr>
<tr>
<td>p- value</td>
<td>0.00</td>
<td>0.01</td>
<td>0.00</td>
<td>-</td>
</tr>
</tbody>
</table>

**DISCUSSION**

For a successful endodontic treatment, complete chemomechanical 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-end), resins (AH26),
silicone sealers (RoekoSeal), and sealers containing
pharmaceutical materials (Endomethasone). 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-
mixed 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

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against M. luteus and S. aureus.\textsuperscript{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.\textsuperscript{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**

