Calcium Release and pH of Three Endodontic Root Canal Sealers.

Corresponding Author:
Dr. Constantino Ledesma-Montes,
Chief of the Posgraduate Studies and Research, Faculty of Dentistry, 29000. - Mexico

Submitting Author:
Dr. Constantino Ledesma-Montes,
Chief of the Postgraduate Studies and Research, Faculty of Dentistry, 29000. - Mexico

Article ID: WMC003017
Article Type: Research articles
Submitted on: 15-Feb-2012, 04:24:10 AM GMT   Published on: 15-Feb-2012, 10:13:09 AM GMT
Article URL: http://www.webmedcentral.com/article_view/3017
Subject Categories: DENTISTRY
Keywords: Endodontics, Sealers, Calcium, pH, Root canal.


Copyright: This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Additional Files:
pH AND Ca
ILUSTRATION 1
ILUSTRATION 2
The aim of this study was to assess the calcium release and pH of three root canal sealers, Apexit, Sealapex and Vitapex, were assessed at 30 and 60 min, and 7 days after spatulation. After manipulation, the sealers were placed in tubes and immersed in sealed glass flasks containing 10 ml of deionized water and stored at 37°C. Tubes were removed at the scheduled times and the water was tested for pH with a potentiometer and for released calcium by atomic absorption spectrophotometry was used. Vitapex produced an alkaline pH and released significantly higher calcium amounts more pronounced results at 7 days compared with the other sealers. Sealapex presented the highest calcium ion release, especially after the longest interval. High calcium release and pH are valuable features for a root canal sealer under clinical conditions.

Key words: Endodontics, sealers, calcium, pH, root canal.

Introduction

Since many years ago, microorganisms have been implicated in the genesis of the pulpal and periapical diseases (1). As it is well known, Pulpal disease is treated with cleaning, conformation and obturation of the radicular channel system with a careful sealing at coronal and apical levels (2). Obturation of the root canal system may be temporal with the use of intra-canal pastes or definitive using gutapercha points and adding root canal sealers. In this moment, materials with chemical composition based on high content of calcium hydroxide are highly recommended.

Calcium hydroxide has good biological activities as antibacterial and mineralization induction (3). In addition, calcium hydroxide exerts its antibacterial properties destroying the microbial cellular membrane (protein denaturalization) and inhibition of some metabolic bacterial processes (4). pH is important on the delicate microbial metabolism; any alteration on it will produce serious inhibition of the main metabolic processes resulting in microbial death (3). Bacterial surveillance, growth and behavior depend on adequate environmental conditions associated to physical-chemical factors as: pH, temperature, osmotic pressure, oxygen and nitrogen concentrations and available substrata (5).

It is important to note that response of the periapical tissues to endotoxins produced by Gram-negative bacteria from the infected root canal system or within the periapical tissues is by means of an inflammatory response including a reparative response from the periodontal ligament and the surrounding bone. These processes should be supported by a careful preparation, cleaning, disinfection and obturation of the root canals as well as an adequate sealing of the canal walls (6).

The success of the calcium hydroxide as an intracanal cleanser is related to its dissociation to calcium and hydroxyl ions. Also, its stimulatory capacity to the tisular reparation is inducing tisular mineralization (7,8). Estrela et al (3) demonstrated that calcium hydroxide inhibits the enzymatic metabolism because the hydroxyl ions act on the bacterial plasmatic membrane and cvitating tisular enzymes as alkaline phosphatase which activates bone mineralization and repair.

The aim of this study was to evaluate the pH and calcium release of three root canal sealers, Apexit, Sealapex and Vitapex at 30 and 60 min, and 7 days after spatulation.

Materials and methods

We tested three root canal sealers Apexit (Ivoclar/Vivadent), Sealapex (Kerr) and Vitapex (Neo Dental Chemical Products, Japan). Root canal sealers were mixed according manufactures instructions. Then, five samples of 0.5 mg each product were immersed during 30 min, one hour and seven days in glass flasks containing 10 mL distilled water. Positive controls were 0.1 to 0.5 mg pure calcium hydroxide in 10 mL distilled water. Values higher to 0.5 mg/10 mL were tested with appropriate dilutions and converted to mg/10 mL. Negative control was distilled water.

Calcium release was determined by the da Silva et al method (9) using an atomic absorption spectrophotometer. pH release was made with a
potentiometer Orion, model 290A (Orion Research. Cambridge, Mass. USA) and a Orion 9720BNWP Calcium Ion Selective Electrode (Orion Research. Cambridge, Mass. USA). Five determinations each sample were made and mean was considered correct. Student’s T test was applied and p < 0.05 was considered statistically significant.

Results

At all experimental times, all materials showed an alkaline pH (Table 1). Apexit pH slightly varied with the time, but this variation was not statistically significant (p>0.05). Sealapex showed irregular pH variation but changes were not statistically significant (p > 0.05). Vitapex showed the greatest pH variations but also, they were not statistically significant (p > 0.05). Mean pH for the tested materials were: Apexit= 10.79; Sealapex= 11.5 and the most alkaline material was for Vitapex (11.5).

Calcium release values for all three tested materials are shown in table 2. As can be seen in table 2, the more soluble material was Sealapex, followed by Vitapex and the less soluble endodontic material tested was Apexit.

Discussions and Conclusion

Physical properties of the endodontic materials used in the clinical practice have been extensively studied during the last 30 years, research on setting time, tissue toxicity, interaction with other materials, cell culture, fracture resistance, antibacterial activity, bond strength, viscosity, dissolving properties, degree of conversion, sealing ability, microleakage and so on. It is well documented that different root canal sealers contain different substances it is also clear that experimental behavior of different materials varied widely and that experimental protocols are not standardized.

The importance of the experimental work on the physical properties of the endodontic materials available in the market is to inform to Specialists and DDS on the features determined during our experimental procedures. This reaches higher importance when these results are included in the class room discussions of the Endodontics courses at DDS and Specialty levels.

Hardening time can explain the different rates of calcium release demonstrated in this study. Fidel et al (10) reported that Sealapex setting time is almost 30 times longer compared with that of Apexit. These data will explain why ion release is greater in Apexit. Also, Sealapex consistency is softer than that of Apexit. Results from Fidel et al (11) demonstrated that Sealapex prevented high solubility and disintegration and Tronstad (12) reported that Apexit was one of the less soluble sealers.

Our results on pH agree with those from Fidel et al (13) we obtained high alkaline values for all the tested endodontic sealers. As did da Silva y col reported (9), we found that Sealapex had the highest pH values compared with those from Apexit and Vitapex.

It is important to point out that the advantage of an alkaline pH is that these materials have a potent antimicrobial activity (14) and seems that Sealapex despite its high pH has better effect on periapical repair in chronic apical periodontitis (15).

Our results and those from other studies (12,14-19) strongly suggest that sealers with high calcium release and high pH values have excellent biological properties and that antimicrobial properties of these endodontic materials make them as the favorite sealers for clinical work.

References

9. da Silva LA, Leonardo MR, da Silva RS, Assed S, Guimarães LF. Calcium hydroxide root canal sealers: evaluation of pH, calcium ion concentration and
Illustrations

Illustration 1

Table 1

<table>
<thead>
<tr>
<th>Experimental time</th>
<th>Apexit</th>
<th>Sealapex</th>
<th>Vitapex</th>
<th>Distilled water</th>
<th>Distilled water+CaOH$_2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 min</td>
<td>10.14</td>
<td>10.03</td>
<td>11.36</td>
<td>6.5</td>
<td>11.76</td>
</tr>
<tr>
<td>60 min</td>
<td>10.06</td>
<td>9.88</td>
<td>10.85</td>
<td>6.5</td>
<td>12.05</td>
</tr>
<tr>
<td>7 days</td>
<td>10.09</td>
<td>12.47</td>
<td>12.29</td>
<td>6.5</td>
<td>12.48</td>
</tr>
</tbody>
</table>
Illustration 2

Table 2

<table>
<thead>
<tr>
<th>Calcium release* from three different root canal sealers at different times.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Materials tested.</td>
</tr>
<tr>
<td>Experimental time</td>
</tr>
<tr>
<td>30 min</td>
</tr>
<tr>
<td>60 min</td>
</tr>
<tr>
<td>7 days</td>
</tr>
</tbody>
</table>

*Values expressed in mg/10 ml.
Disclaimer

This article has been downloaded from WebmedCentral. With our unique author driven post publication peer review, contents posted on this web portal do not undergo any prepublication peer or editorial review. It is completely the responsibility of the authors to ensure not only scientific and ethical standards of the manuscript but also its grammatical accuracy. Authors must ensure that they obtain all the necessary permissions before submitting any information that requires obtaining a consent or approval from a third party. Authors should also ensure not to submit any information which they do not have the copyright of or of which they have transferred the copyrights to a third party.

Contents on WebmedCentral are purely for biomedical researchers and scientists. They are not meant to cater to the needs of an individual patient. The web portal or any content(s) therein is neither designed to support, nor replace, the relationship that exists between a patient/site visitor and his/her physician. Your use of the WebmedCentral site and its contents is entirely at your own risk. We do not take any responsibility for any harm that you may suffer or inflict on a third person by following the contents of this website.