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Original Research

A comparative evaluation of calcium and pH release in MTA and biodentine

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ABSTRACT:
Background: The present study assessed calcium and pH release in newer calcium silicate based root canal sealants. **Materials & Methods:** The present study was conducted in the department of Endodontics. Tubes were divided into 3 groups. Group I were control tubes, group II had MTA, group III had biodentine. In all tubes pH and calcium ions release was assessed at 24 hours, 7 days and 28 days. **Results:** In group I at 24 hours, pH was 6.94, in group II was 8.24 and in group III was 8.26. At 7 days it was 6.84, 8.37 and 8.60 respectively. At 28 days, it was 6.60, 8.32 and 8.76 in group I, II and III respectively. The difference was significant (P< 0.05). The mean calcium ion release (ppm) at 24 hours, 7 days and 28 days in group I was 0.06, 0.07 and 0.07 in group I, 9.06, 8.26 and 10.42 in group II and 5.72, 10.8 and 18.27 in group III. There was significant difference in all groups (P< 0.05). **Conclusion:** Authors found that biodentine showed significantly higher pH and calcium ion release than both MTA and control.
Key words: Biodentine, MTA, Root canal filling

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INTRODUCTION

Root end filling materials should possess certain properties such as it should own good sealing ability, improve the seal of existing root canal filling material, and should be biocompatible with the periradicular tissues.[1] Low solubility frolicked an essential role on the success rate of the surgical procedure.[2]

Solubility of a root-end filling materials is an essential property as it may influence other properties such as sealing ability, biocompatibility, and mutual effects with adjacent environment. The ability of a material to seal and get solubilized may influence treatment prognosis. To avoid venomous effects on surrounding tissues by root-end filling materials, these have very low solubility.[3]

MTA is a complex blend of hydrophilic tricalcium silicate, tricalcium oxide, and tricalcium aluminate with added oxides (bismuth oxide). However, it has revealed specific drawbacks of extended setting time and challenging handling properties. So as to recover some MTA drawbacks, numerous new calcium silicate-based materials have been invented.[4] Biodentine is one of these materials. Biodentine is a calcium silicate-based material introduced in 2010. Constituents of biodentine are tricalcium silicate powder packed in capsules (7.0 g), calcium carbonate (filler material) to be mixed with a liquid phase (0.18 mL) comprising calcium chloride.[5] The present study was conducted to evaluate calcium and pH release in newer calcium silicate based root canal sealants.

MATERIALS & METHODS

The present study was conducted in the department of Endodontics. It consisted of 60 samples size for the study. MTA and biodentine were added to 80 stainless steel ring molds. Tubes were divided into 3 groups.

Group I were control tubes, group II had MTA, group III had biodentine. The mass of dried glass bottles was measured. Shifting of samples to bottles containing 5 mL of distilled water was done and was stored for 24 h. The bottles were dried at 105°C and weighed. This procedure was repeated for 3, 10, 30, and 60 days. pH was measured using pH meter and released calcium ions were measured by atomic absorption spectrophotometer. Results thus obtained were subjected to statistical analysis. P value less than 0.05 was considered significant.

RESULTS

Graph I Distribution of samples

Group	Group I (Control)	Group II (MTA)	Group III (biodentine)
Number	20	20	20

Table I shows that group I were control tubes, group II had MTA, group III had biodentine. Each group had 20 tubes.

Table II pH recorded at 24 hours, 7 days and 28 days in each group

Groups	pH at 24 hours	At 7 days	At 28 days	P value
Group I	6.94	6.84	6.60	0.05
Group II	8.24	8.37	8.32	
Group III	8.26	8.60	8.76	

Table II, graph I shows that in group I at 24 hours, pH was 6.94, in group II was 8.24 and in group III was 8.26. At 7 days it was 6.84, 8.37 and 8.60 respectively. At 28 days, it was 6.60, 8.32 and 8.76 in group I, II and III respectively. The difference was significant (P< 0.05).

Graph I pH recorded at 24 hours, 7 days and 28 days in each group son of pH

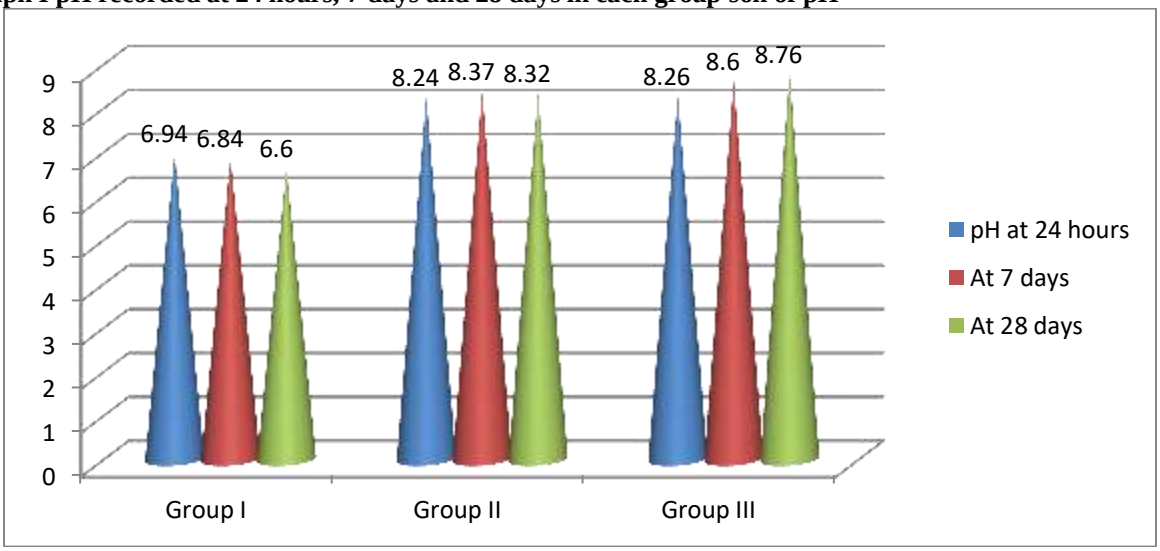
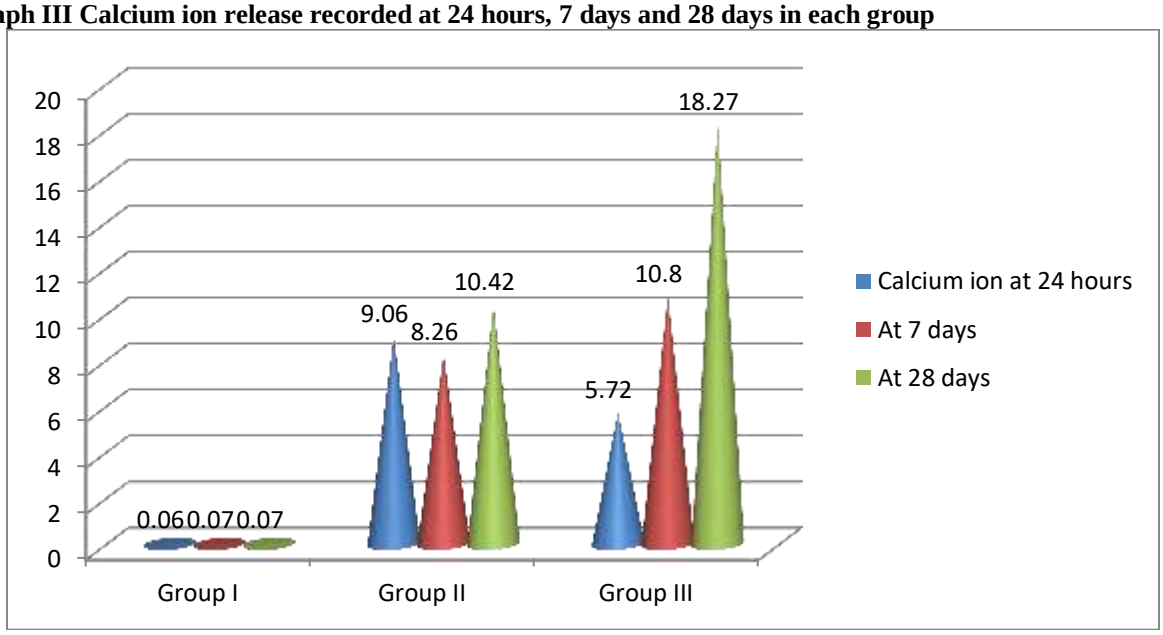


Table III Calcium ion release recorded at 24 hours, 7 days and 28 days in each group

Groups	At 24 hours	At 7 days	At 28 days	P value
Group I	0.06	0.07	0.07	0.001
Group II	9.06	8.26	10.42	
Group III	5.72	10.8	18.27	

Table III, graph II shows that mean calcium ion release (ppm) at 24 hours, 7 days and 28 days in group I was 0.06, 0.07 and 0.07 in group I, 9.06, 8.26 and 10.42 in group II and 5.72, 10.8 and 18.27 in group III. There was significant difference in all groups (P< 0.05).

Graph III Calcium ion release recorded at 24 hours, 7 days and 28 days in each group



DISCUSSION

Endodontic sealers that recently have been developed are working as sealing agents in filling root canals. A variety of endodontic sealers is available including zinc oxide eugenol, calcium hydroxide, glass ionomer, silicone, resin, and bioceramic based sealers.[6] Bioceramic based sealers are ceramic products that are designed particularly for medical and dental applications. These sealers include alumina, zirconia, bioactive glass, glass ceramics, hydroxyapatite, and calcium phosphates.[7]

There are two groups of bioactive and bioinert materials due to their interaction with the close, alive tissues. Bioactive materials, such as glass and calcium phosphate, interact with the surrounding tissue to encourage the growth of more durable tissues. The physicochemical properties of sealers have been always considered because of their biological and technical importance.[8] The present study was conducted to assess calcium and pH release in newer calcium silicate based root canal sealants.

In present study, Tubes were divided into 3 groups. group I were control tubes, group II had MTA, group III had biodentine. Each group had 20 tubes. Kumari et al[9] found that MTA released significantly higher Ca++ compared to biodentine throughout the experiment but increases and becomes higher after 28 days. Nevertheless, Ca++ release from both materials dropped with time. Between MTA and biodentine higher values were seen for MTA up to 7 days. This can be explained due to the fact that MTA has a greater quantity of calcium-containing combinations as compared to biodentine. Although the calcium ion release of biodentine was low initially till 28 days, it increases to more than that of MTA after 28 days

We found that in group I at 24 hours, pH was 6.94, in group II was 8.24 and in group III was 8.26. At 7 days it was 6.84, 8.37 and 8.60 respectively. At 28 days, it was 6.60, 8.32 and 8.76 in group I, II and III respectively. The difference was significant ($P< 0.05$). Tanomaru-Filho et al[10] conducted a study in which MTA consists of 50%–75% of calcium oxide as compared to Sealapex which consists of 24 wt% of Ca++. This high percentage of calcium oxide in the composition may explain the high initial pH and high initial release of calcium ions shown by White MTA as compared to other experimental materials. The high initial pH and Ca++ may also be explained by the high initial solubility of MTA as assessed by Bodanezi et al[11]., where MTA exhibited high initial solubility followed by a continuous decrease over 672 h.

We found that mean calcium ion release (ppm) at 24 hours, 7 days and 28 days In group I was 0.06, 0.07 and 0.07 in group I, 9.06, 8.26 and 10.42 in group II and 5.72, 10.8 and 18.27 in group III. There was significant difference in all groups ($P< 0.05$).

MTA based sealer demonstrate higher PH values than resin based sealers, MTA, calcium enriched mixture (CEM) cement, and Portland cement generated more alkalinity and the pH of 9.47-10.80.[12]

CONCLUSION

Authors found that biodentine showed significantly higher pH and calcium ion release than MTA and control.

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