Journal of Advanced Medical and Dental Sciences Research

@Society of Scientific Research and Studies

Journal home page: www.jamdsr.com doi: 10.21276/jamdsr ICV 2018= 82.06

(e) ISSN Online: 2321-9599; (p) ISSN Print: 2348-6805

Original Research

Evaluation of calcium and pH release in newer calcium silicate based root canal sealants

Pinky Singh[1], Kanwardeep Singh Sohi[2]

[1]Senior Resident, Patna Medical College and Hospital Patna, Bihar, India;
[2]Reader, Shaheed Kartar Singh Sarabha Dental College and Hospital, Sarabha, Ludhiana, Punjab, India

***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. N" polyethylene tubes were cut into 30 tubes of equal sizes. Tubes were divided into 3 groups. Group I were control tubes, group II had sealapex, group III had MTA fillapex. All tubes were filled with respective materials. IN all pH and calcium ions release was assessed at 24 hours, 7 days and 28 days. **Results:** In group I at 24 hours, pH was 6.92, in group II was 8.23 and in group III was 8.28. Similarly, at 7 days and 28 days, the difference was significant (P< 0.05). The mean calcium ion release (ppm) at 24 hours, 7 days and 28 days shows significant difference in all groups (P< 0.05). **Conclusion:** Authors found that MTA fillapex showed significantly higher pH and Calcium ion release than both sealapex and control.
Key words: MTA fillapex, Root canal filling, sealapex

Received: 30 June, 2018 Revised: 2 September, 2019 Accepted: 15 September, 2019

Corresponding author: Dr. Pinky Singh, Senior Resident, Patna Medical College and Hospital Patna, Bihar, India

This article may be cited as: Singh P, Sohi KS. Evaluation of calcium and pH release in newer calcium silicate based root canal sealants. J Adv Med Dent Scie Res 2019;7(10): 77-80.

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. As per ISO 6876 standard, the suitable limit of weight loss for solubility test is 3%. The root end filling material should also have the ability to increase the pH and release of calcium ions (Ca++) as it leads to mineralized tissue formation.[2]

The focus of research in sealers shifted toward calcium (Ca++) based sealers due to their antimicrobial activity owing to their Ca++ releasing potential. These sealers have been popularly used because of their potential for providing a high alkaline environment. The use of these materials create high alkalinity which aids in mineralization of hard tissue and provides good antimicrobial activity. The use of calcium hydroxide clinically in the root canal was first reported by Rohner in 1940. Calcium hydroxide-based sealers have since been in use and have remained popular. Among the variety of calcium hydroxide-based sealers available, sealapex is the most popularly used.[3]

The latest among which is MTA Fillapex. According to the manufactures, the composition of this sealer is basically MTA incorporated with salicylate resin, natural resin, bismuth, and silica. The present study was conducted to assess calcium and pH release in newer calcium silicate based root canal sealants.

MATERIALS & METHODS

The present study was conducted in the department of Endodontics. Ethical clearance was taken prior to the study. "N" polyethylene tubes were cut into 30 tubes of equal sizes. The tubes were pre-weighed by a digital weighing balance machine to select similar weight tubes. The tubes were than prewashed with 5% nitric acid to prevent interference with phosphate ions and alkaline metals. The polyethylene mounted tubes were divided into three

experimental and one control group according to the materials with which they were filled.
Tubes were divided into 3 groups. Group I were control tubes, group II had sealapex, group III had MTA fillapex. All tubes were filled with respective materials. The filled polyethylene tubes were weighed to have similar amount of material (±0.002 g) in each sample. The deionized water was verified for the total absence of calcium ions and the presence of neutral pH (6.8). At 24 h, 7 days and 1 month, the deionized water was measured for pH by a 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

Table I Distribution of patients

Group	Group I (Control)	Group II (sealapex)	Group III (MTA fillapex)
Number	10	10	10

Table I shows that group I were control tubes, group II had sealapex, group III had MTA fillapex. Each group had 10 tubes.

Table II Comparison of pH in each group

Groups	pH at 24 hours	At 7 days	At 28 days	P value
Group I	6.92	6.87	6.65	0.02
Group II	8.23	8.35	8.36	
Group III	8.28	8.62	8.70	

Table II, graph I shows that in group I at 24 hours, pH was 6.92, in group II was 8.23 and in group III was 8.28. Similarly, at 7 days and 28 days, the difference was significant (P< 0.05).

Graph I Comparison of pH

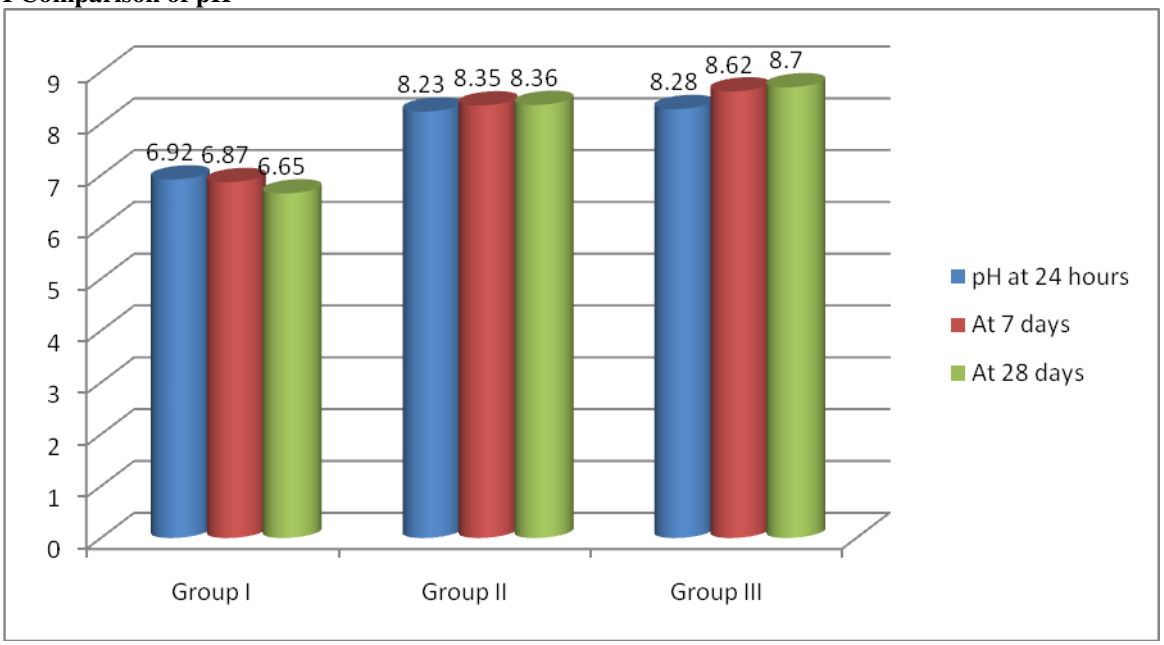
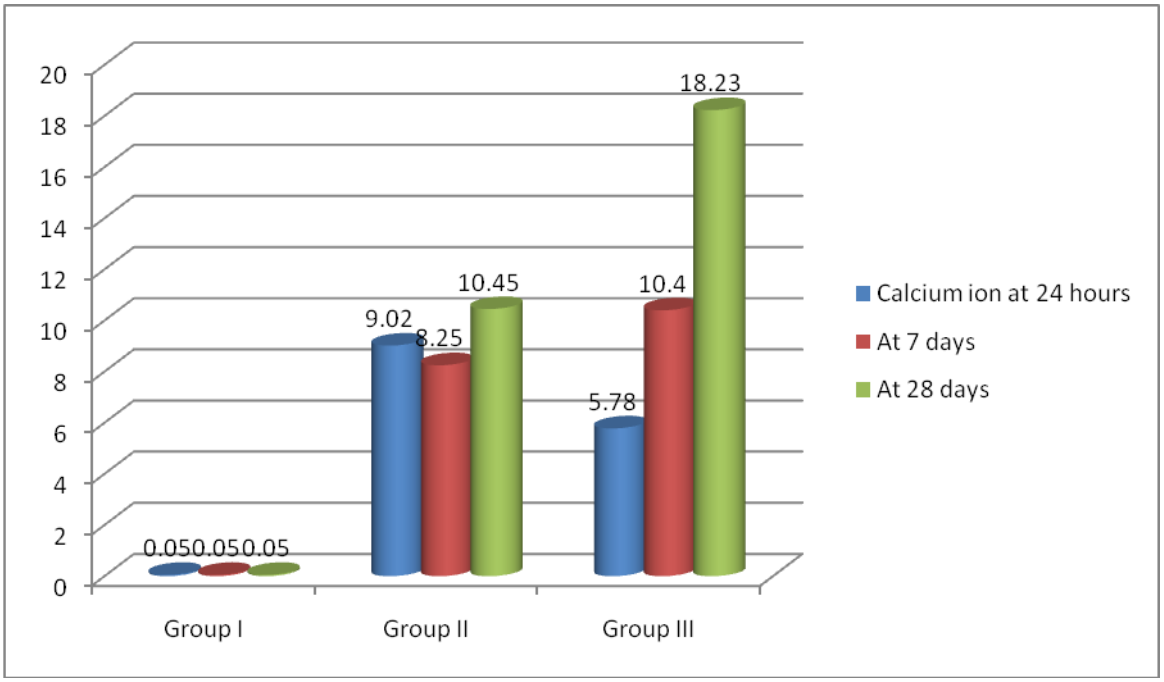


Table III Calcium ion release

Groups	Calcium ion at 24 hours	At 7 days	At 28 days	P value
Group I	0.05	0.05	0.05	0.001
Group II	9.02	8.25	10.45	
Group III	5.78	10.4	18.23	

Table III, graph II shows that mean calcium ion release (ppm) at 24 hours, 7 days and 28 days shows significant difference in all groups (P< 0.05).

Graph III Calcium ion release



DISCUSSION

A variety of endodontic sealers is available including zinc oxide eugenol, calcium hydroxide, glass ionomer, silicone, resin, and bioceramic based sealers. These sealers include alumina, zirconia, bioactive glass, glass ceramics, hydroxyapatite, and calcium phosphates. Bioceramic based sealers are ceramic products that are designed particularly for medical and dental applications.[4]

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.[5] 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 sealapex, group III had MTA fillapex. All tubes were filled with respective materials. Kumari et al[6] evaluated and compared solubility, pH, and calcium ion release of calcium-silicate based root-end filling materials mineral trioxide aggregate (MTA) and biodentine. Significantly higher solubility was exhibited for biodentine for 30 and 60 days than MTA. Statistical difference was observed between the solubility, pH, and calcium ion release values of MTA and biodentine.

We found that in group I at 24 hours, pH was 6.92, in group II was 8.23 and in group III was 8.28. Similarly, at 7 days and 28 days, the difference was significant (P< 0.05).

Duarte et al[7] compared and evaluated pH and calcium ion release in newer calcium silicate-based root canal sealers. At 24 h, White MTA showed the highest pH (8.52) and highest calcium (Ca++) release (14.7). At 7 days and 28 days, MTA fillapex showed significantly higher pH (8.64; 8.7) and Ca++ release (10.30; 18.60) than the other two groups.

We found that mean calcium ion release (ppm) at 24 hours, 7 days and 28 days shows significant difference in all groups (P< 0.05). MTA fillapex contains natural resin, salicylate resin, diluting resin, bismuth trioxide, nanoparticulated silica, pigments and MTA. MTA is a paste-catalyst MTA containing resin based bioceramic sealer which is developed as a paste or paste sealer in a formulation that allows its appropriate insertion into the root canal as a conventional endodontic sealer.[8]

Tanomaru-Filho et al[9] 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[10]., where MTA exhibited high initial solubility followed by a continuous decrease over 672 h.

CONCLUSION

Authors found that MTA fillapex showed significantly higher pH and Calcium ion release than both sealapex and control.

REFERENCES

1. Lee SJ, Monsef M, Torabinejad M. Sealing ability of a mineral trioxide aggregate for repair of lateral root perforations. J Endod 1993;19:541-4.
2. Chng HK, Islam I, Yap AU, Tong YW, Koh ET. Properties of a new root-end filling material. J Endod 2005;31:665-8.
3. Kogan P, He J, Glickman GN, Watanabe I. The effects of various additives on setting properties of MTA. J Endod 2006;32:569-72.
4. Kuga MC, Campos EA, Viscardi PH, Carrilho PZ, Xavier FC, Silvestre NP. Hydrogenion and calcium releasing of MTA Fillapex and MTA-based formulations. RSBO 2011;8:271-6.
5. 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.
6. Kumari S, Mittal A, Dadu S, Dhaundiyal A, Abraham A, Yendrembam B. Comparative evaluation of physical and chemical properties of calcium silicate‐based root‐end filling materials (mineral trioxide aggregate and biodentine): An in vitro study. Indian J Dent Sci 2018;10:197-202.
7. Duarte MA, Demarchi AC, Giaxa MH, Kuga MC, Fraga SC, de Souza LC, *et al.* Evaluation of pH and calcium ion release of three root canal sealers. J Endod 2000;26:389-90.
8. Jain SV, Kothamachu S, Chandak MG, Nikhade P. An in vitro comparison four root‐end filling material's solubility. Int J Dent Clin 2013;5:1‐3.
9. Tanomaru- Filho M, Saçaki JN, Faleiros FB, Guerreiro-Tanomaru JM. pH and calcium ion release evaluation of pure and calcium hydroxide-containing epiphany for use in retrograde filling. J Appl Oral Sci 2011;19:1-5.
10. Bodanezi A, Carvalho N, Silva D, Bernardineli N, Bramante CM, Garcia RB, et al. Immediate and delayed solubility of mineral trioxide aggregate and port land cement. J Appl Oral Sci 2008;16:127‐31