

Original Research

Comparison of three bioceramic sealers in terms of dentinal sealing ability in the root canal

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ABSTRACT:

Background: The present study compared bioceramic sealers in terms of dentinal sealing ability in the root canal. **Materials & Methods:** The present study was conducted on 30 permanent mandibular premolar teeth. Specimens were accessed using round diamond burs and then prepared using the crown-down. Specimens were obturated with gutta-percha ProTaper Next cone and bioceramic sealers (iRoot® SP, MTA Fillapex, and BioRoot RCS). The root canal using a scanning electron microscope to see the dentinal sealing ability and adaptation of each sealer. **Results:** In this study group I teeth used iRoot® SP, group II used MTA Fillapex, and group III used BioRoot RCS sealer. Each group had 10 teeth. We found that mean sealing ability of sealer in group I was 4.61, in group II was 42.3 and in group III was 3.80. **Conclusion:** Authors found that sealing ability of calcium phosphate silicate-based sealer is superior to that of both pure tricalcium silicate-based and tricalcium silicate- and resin-based sealer.

Key words: Calcium phosphate, Dentine, BioRoot RCS sealer.

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INTRODUCTION

Root canal treatment performed to eliminate microorganisms and prevent reinfection. After cleaning and shaping, an effective root canal filling is necessary to maintain microorganism-free environment within the root canal and avoid recontamination. The sealing ability, biocompatibility, and antimicrobial properties of root canal filling materials are important factors in accomplishing this task. Sealers that could adapt closely to the dentinal canal walls aimed at preventing leakage in the apical region.¹

Gutmann stated that, along with the removal of debris and bacteria, good adaptation to the dentinal wall is essential to achieve an optimal root canal filling. This can be seen from the penetration of the material into the dentinal tubules.² Deep penetration of dentinal tubules is advantageous because it increases the contact area between the root canal filling material and dentin, thereby increasing the sealing quality of the entire root canal system. The sealer penetration depth depends on many factors, including smear layer

cleanliness, dentin permeability, root canal dimensions, and the physical and chemical properties of the sealer.³

There are now three types of bioceramic sealers with different base materials. These sealers are calcium phosphate silicate-based bioceramic sealers, tricalcium silicate- and resin-based bioceramic sealers, and pure tricalcium silicate-based bioceramic sealers.⁴ The components of bioceramic sealers are zirconium oxide, calcium silicates, calcium phosphate monobasic, calcium, hydroxide, fillers, and thickening agents. Contemporary studies on bioceramic-based sealer have found adequate characteristics, including its adhesive property.⁵ The present study compared bioceramic sealers in terms of dentinal sealing ability in the root canal.

MATERIALS & METHODS

The present study was conducted in the department of Endodontics. It comprised of 30 permanent mandibular premolar teeth. Approval was obtained from institutional ethical committee.

Specimens were accessed using round diamond burs and then prepared using the crown-down technique. Working length was determined using #10 K-file. The samples were prepared through the crown-down technique using the Rotary ProTaper Next instrument. Specimens were obturated with gutta-percha ProTaper Next cone and bioceramic sealers (iRoot® SP, MTA Fillapex, and BioRoot RCS). Sealers were inserted into the root canal as per the manufacturer’s protocols. Specimens then stored in an incubator for 5 days at 37°C and 100% humidity to allow the sealers to set. The specimens were then mounted in a wax block, and roots were grooved and examined them at the apical third of the root canal using a scanning electron microscope to see the dentinal sealing ability and

adaptation of each sealant. Results were statistically analyzed.

DISCUSSION

Bioceramics containing calcium phosphate silicate sealers were introduced in 2007. This sealer contains calcium silicates and calcium phosphate, which produces calcium ions to provide good bioactive biocompatibility.⁶ In 2010, the dental company Angelus issued a bioceramic sealer containing tricalcium silicate, dicalcium silicate, calcium oxide, tricalcium aluminate, resin, and bismuth oxide.⁷ The presence of tricalcium silicate is expected to provide better results in regeneration. In 2015, Septodont issued the latest bioceramic sealer made with active biosilicate technology that contains pure tricalcium silicate, zirconium oxide, and calcium chloride.

RESULTS

Table I Distribution of specimens

Groups	Group I	Group II	Group III
Sealers	iRoot® SP	MTA Fillapex	BioRoot RCS
Number	10	10	10

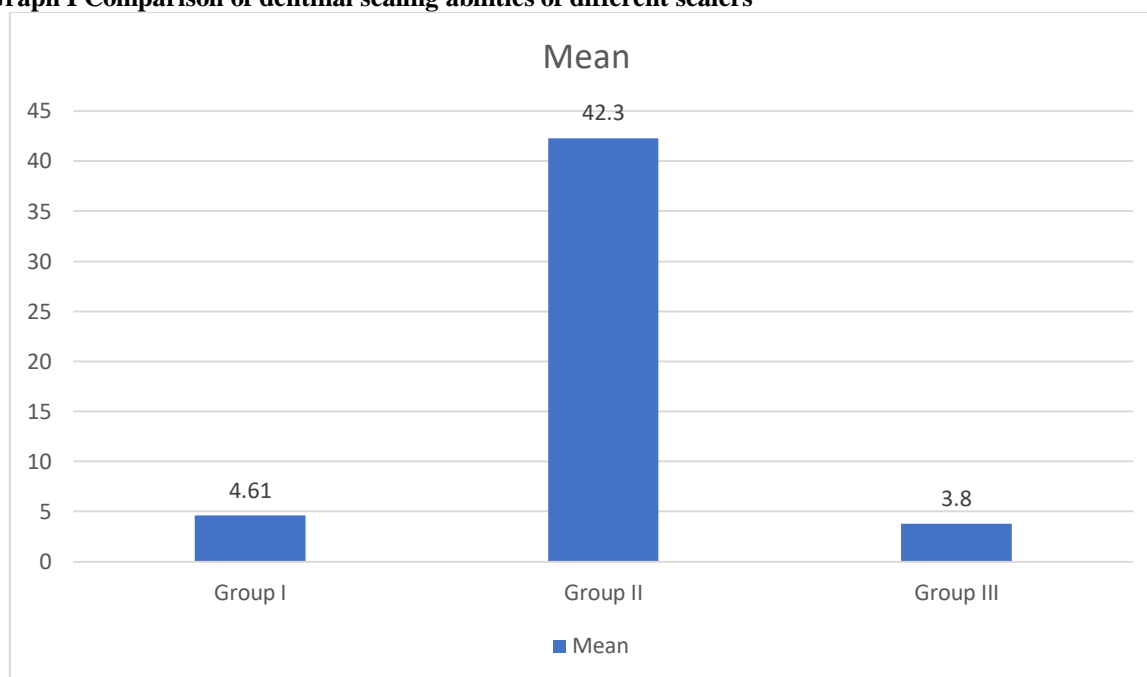
Table I shows that group I teeth used iRoot® SP, group II used MTA Fillapex, and group III used BioRoot RCS sealer. Each group had 10 teeth.

Table II Comparison of dentinal sealing abilities of different sealers

Groups	Mean	P value
Group I	4.61	0.001
Group II	42.3	
Group III	3.80	

Table II, graph I shows that mean sealing ability of sealer in group I was 4.61, in group II was 42.3 and in group III was 3.80. The difference was significant (P< 0.05).

Graph I Comparison of dentinal sealing abilities of different sealers



This sealer is recommended for single-cone filling techniques; the application procedure is fast and easy, allowing this bioceramic to become a useful alternative filling technique.⁸

In this study group I teeth used iRoot® SP, group II used MTA Fillapex, and group III used BioRoot RCS sealer. Each group had 10 teeth. Huang et al⁹ compared the adhesion of three bioceramic sealers within the root canal system. Endodontically treated teeth were obturated using three types of bioceramic sealers and then divided into three groups. Specimens were then observed using a scanning electron microscope, and the attachment distance was measured using ImageJ. The three groups exhibited were statistically significant differences ($p < 0.05$) in dentinal sealing ability. Calcium phosphate silicate-based sealer showed the highest sealing ability, followed by pure tricalcium silicate-based bioceramic sealers and then tricalcium silicate and resin-based bioceramic sealers. The sealing ability of calcium phosphate silicate-based sealer is superior to that of both pure tricalcium silicate-based and tricalcium silicate- and resin-based sealer.

We found that mean sealing ability of sealer in group I was 4.61, in group II was 42.3 and in group III was 3.80. Marissa et al¹⁰ compared the abilities of three types of bioceramic-based sealers to penetrate the dentinal tubules. Obturation used three types of bioceramic sealers. Group 1 (calcium phosphate silicate), Group 2 (a mixture of tricalcium silicate and resin), and Group 3 (pure tricalcium silicate) were observed using a scanning electron microscope and measurement of the penetration distance with ImageJ. The bioceramic sealers had statistically significant differences in penetration distance into dentinal tubules ($p < 0.001$). The mean penetration value of Group 1 (calcium phosphate silicate) was 115.99 μm , Group 2 (a mixture of tricalcium silicate and resin) was 209.28 μm , and Group 3 (pure tricalcium silicate) was 84.07 μm . Although all three bioceramic sealers penetrated the dentinal tubules, they exhibited differences in their penetration capabilities. Group 2 had the deepest penetration, likely due to the resin content.

Solubility is related to the sealing ability of a sealer, as it must be bonded tightly to dentin and to root canal filling cones. Several studies have assessed the sealing abilities of different bioceramic-based sealers *in vitro*. Further, various methodologies have revealed that the sealing ability of bioceramic-based sealers is satisfactory and comparable to that of other commercially available sealers.¹¹ Zhang et al¹² observed that bioceramic sealers containing a mixture of tricalcium silicate and resin primarily exhibited salicylate resin, diluting resin, and natural resin, bismuth trioxide, silica nanoparticle, 40% MTA (tricalcium silicate), and pigment as their largest

components. However, other bioceramic sealers that contain calcium phosphate silicate primarily show zirconium oxide, calcium silicates, calcium phosphate, calcium hydroxide, sealer, and thickening agents as their largest components.

CONCLUSION

Authors found that sealing ability of calcium phosphate silicate-based sealer is superior to that of both pure tricalcium silicate-based and tricalcium silicate- and resin-based sealer.

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