

COMPARISON OF THREE BIOCERAMIC SEALERS IN TERMS OF DENTINAL SEALING ABILITY IN THE ROOT CANAL

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ABSTRACT

Objective: The main objective of endodontic treatment is to prevent further infection or reinfection by eliminating microorganisms within the root canal system. Proper endodontic treatment could prevent apical and coronal penetration of fluids and microorganisms. Endodontic sealer is vital components of root canal obturation to establish a fluid-tight seal. Bioceramic-based root canal sealers are considered to be an advantageous technology in endodontics and have been found to be both biocompatible and comparable to other commercial sealers. The aim of this study was to compare the adhesion of three bioceramic sealers within the root canal system.

Methods: 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.

Results: 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.

Conclusion: 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.

Keywords: Bioceramics, Dentinal sealing ability, Sealers, Sealing ability, Dentinal tubules, Scanning electron microscope.

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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 [1-3]. 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 [3-5]. As incomplete sealing of the root canals will lead to major endodontic failure, it is essential to use materials that can form a hermetic seal within the root canal system. Filling materials that evoke a biological response at the material dentin interface represent an improvement in the quality of sealing [6-9].

Bioactive endodontic sealers have been developed to improve the quality of root canal obturation. There are now three types of bioceramic sealers with different base materials. These sealers are calcium phosphate silicate-based bioceramic sealers (BioRoot RCS; Septodont, Saint-Maur-Des-Fosses, France), tricalcium silicate- and resin-based bioceramic sealers (MTA Fillapex; Angelus Industry Dental Products S/A, Londrina, PR, Brazil), and pure tricalcium silicate-based bioceramic sealers (iRoot; Innovative BioCeramix, Vancouver, BC, Canada) [10,11].

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 [5-11].

The bioactive property of the sealer for obturation material, specifically certain compositions of glasses comprising SiO_2 , CaO, Na_2O , and P_2O_5 , can bond to either the dentinal or root tissue. In general, when the bioactive sealer comes into contact with the root canal, it may induce a phosphate buffered solution, forming a tag-like structure, and it may form a fluid-tight seal with the root canal. Bioceramic materials contain calcium phosphate, which enhances the setting properties of bioceramics and creates a chemical composition and crystalline structure similar to those of tooth and bone apatite materials [12-14], thus improving sealer-to-root dentin bonding.

This *in vitro* study was performed to assess and compare the apical sealing ability of three bioceramic-based sealers: Calcium phosphate silicate-based bioceramic sealers (BioRoot), tricalcium silicate- and resin-based bioceramic sealers (MTAF), and pure tricalcium silicate-based bioceramic sealers (iRoot), which are considered to be the gold standard of sealing and adhesion to dentin [15-17].

The aim of this study was to compare three bioceramic sealers in terms of sealer adhesion in the root canal. The bioceramic sealer may have similar dentinal sealing ability within the root canal, and better sealing ability could be obtained from the tested sealers.

METHODS

In this study, we used 27 single-rooted, human mandibular premolars that were cleaned with a scaler and soaked with 0.9% NaCl solution. The experiment was performed under ethical clearance protocol number 051111018 from Universitas Indonesia Ethics and Research Department. Three team members who had been calibrated performed the experiments. Specimens were examined under an operating

