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Original Article

The Development of Bioceramic Root Canal Sealer

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Abstract

Objectives: This study evaluated the physical properties of cockle shell derived bioceramic sealer (Biosealer) and compared it with commercial bioceramic sealer (iRoot SP).

Methods: Cockle shell derived tricalcium silicate powder was manufactured. Various additives were mixed with tricalcium silicate powder to modify the physical properties of Biosealer. According to a modified ISO 6876:2012 standard, the flowability, setting time, film thickness, solubility, and radiopacity of the Biosealer and iRoot SP were investigated.

Results: Biosealer exhibited acceptable flowability, setting time, film thickness, and radiopacity according to ISO 6876:2012 requirements. There was no significant difference between the physical properties of Biosealer and iRoot SP, except for the setting time ($p<0.05$).

Conclusions: Biosealer possessed good physical properties and was comparable to iRoot SP.

Keywords: bioceramic, cockle shell, physical properties, root canal sealer, tricalcium silicate

Introduction

Bioceramic sealer has been used widely in endodontics for their good physicochemical and biological properties.[1] *In vitro* and *in vivo* studies illustrated its good sealing ability, antibacterial activity and biological advantages.[2-4] Clinically, root canal treatments using a single-cone technique with bioceramic sealer exhibited a high clinical success rate.[5,6]

To date, bioceramic root canal sealer was marketed in both premixed (iRoot SP, Ceraseal, Endoseal MTA) and powder-liquid (Bioroot RCS, Proroot ES) formulations. Similarly, both contain calcium silicate as the main component, requiring water to enhance setting via a hydration reaction. Zirconium oxide, calcium phosphate, calcium hydroxide, and other additives are added to improve the physical properties of the sealer.[1]

Cockle shells are made of more than 95% calcium carbonate.[7] When processed, cockle shells provide calcium which can be the basis of various biomaterials for clinical use. In medical applications, cockle shell derived nanoparticles were used to create drug delivery scaffolds and bone grafts.[8] *In vitro* studies show cockle shell derived calcium carbonate nanoparticles possess minimal toxicity and high biocompatibility.[9] For dental applications, cockle shell derived calcite nanoparticles have been proposed for use as dentin desensitizing agent.[10] Also, a study on cockle shell derived hydroxyapatite paste as a remineralization agent has been conducted.[11] Moreover, cockle shell derived hydroxyapatite-tricalcium phosphate was formulated for use as a bone scaffold.[12]

Theoretically, calcium carbonate reacts with the silica at a temperature of 1450°C to yield calcium silicate[13], to be used as the main component of a bioceramic sealer. To acquire acceptable physical properties, additives such