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Assessment of hydration behavior and radiopacity of a novel zirconium-added calcium silicate ceramic

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Objective: Calcium silicate (Ca3SiO5) has increasingly attracted attention as a canal obturation material due to superior seal and enhanced biocompatibility. This study evaluated the hydration behavior and radiopacity of a novel zirconium-added calcium silicate with commercial OrthoMTA (BioMTA) cement.

Material & Methods: Zirconium (Zr)-added calcium silicate cements was synthesized by solid state reaction using CaO and SiO2 as starting materials and zirconium propoxide (ZrO2) as Zr precursor. CaO and SiO2 was mixed thoroughly in anhydrous ethanol with various amount of Zr precursor (0.001~0.2 mol %). After drying, as-prepared powder was annealed at 1400°C for 3h in air. Hydration behavior (distilled water/power ratio=0.3) of Zr-added Ca3SiO5 and OrthoMTA was compared according to ISO 6876 standard and the hydration character was observed by SEM, XRD, STEM, and EDS. Five block specimens (2mm thickness, 5mm in diameter) of each cement group were compared using step wedge radiography.

Results: Zr-added Ca3SiO5 had comparable radiopacity to OrthoMTA. The second phase CaZrO3 was increased by Zr in a dose-dependent manner, and stacked on the facet of Ca3SiO5. Setting time of Zr-added Ca3SiO5 was within 2 hr, whereas OrthoMTA was 5 hr.

Conclusion: Zr-added calcium silicate ceramic showed comparable radiopacity and shorter curing time than OrthoMTA.

Biography

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