

## Potensi Novel Hibrida Biokeramik- Kitosan Larut Air sebagai Semen Biomimetik Saluran Akar = Potential Novel Hybrid Bioceramic- Water-Soluble Powder (WSP) Chitosan as Root Canal Biomimetic Sealer

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### Abstrak

Latar Belakang: Siler biokeramik berbasis kalsium silikat diketahui memiliki biokompabilitas tinggi, mampu beradhesi dengan dinding saluran akar serta dapat menginduksi respon osteogenik, yang dikategorikan sebagai material biomimetik. Akan tetapi, siler biokeramik memiliki kekurangan pada sifat fisiknya. Kitosan larut air merupakan bentuk modifikasi kitosan yang memiliki keunggulan sebagai antioksidan, antibakteri, berperan dalam penyembuhan lesi dan regenerasi jaringan serta sebagai dapat memperbaiki sifat fisik semen. Perpaduan kedua bahan dapat menciptakan semen saluran akar biomimetik.

Tujuan: Melakukan uji karakteristik, sifat fisik dan biologis terhadap novel siler hibrida biokeramik-kitosan larut air (BCC) sebagai semen biomimetik saluran akar.

Metode: Novel siler hibrida BCC dimanipulasi dari semen biokeramik (BC) yang telah melalui proses ball-milling dan sintering, kemudian dicampur kitosan larut air dengan W/P 0,4. Empat variabel penelitian, yaitu semen biokeramik BC, novel siler hibrida BCC, siler biokeramik dan siler epoksi resin dilakukan uji karakterisasi (XRD, SEM/EDS), uji sifat fisik (setting time, daya alir, film thickness), serta uji biologis (sitotoksisitas dan bioaktivitas terhadap hPDLSCs).

Hasil: Novel siler hibrida BCC mengandung unsur dan puncak kristalin yang serupa dengan siler biokeramik (Sure-Seal Root™), memiliki bentuk partikel yang cenderung globular dan homogen dengan jarak antarpartikel lebih rapat serta ukuran partikel deskriptif yang lebih besar dibandingkan Sure-Seal Root™ dan AH Plus® tetapi lebih kecil dibandingkan semen biokeramik BC. Hanya semen biokeramik BC dan novel siler BCC yang memiliki rasio Ca/Si/P. Novel siler BCC menunjukkan perbedaan setting time, daya alir dan film thickness yang bermakna dengan semen biokeramik BC, Sure-Seal Root™ dan AH Plus®. Keempat kelompok menunjukkan sitotoksisitas rendah terhadap hPDLSCs. Bioaktivitas novel siler BCC relatif lebih tinggi dibandingkan semua kelompok perlakuan dan kontrol.

Kesimpulan: Novel siler hibrida BCC berpotensi memberikan implikasi klinis yang baik, menunjukkan sifat fisik yang mendekati standar semen saluran akar dan memiliki bioaktivitas sebagai semen biomimetik saluran akar.

.....Background: Currently, bioceramic sealers with calcium silicate based have been developed and show high biocompatibility, are able to adhere to root canal dentin and can induce an osteogenic response, which can be categorized as biomimetic materials. On the other hand, water-soluble particle (WSP) chitosan, one of chitosan derivatives, has advantages as an antioxidant, antibacterial, plays a role in wound healing and tissue regeneration as well as a thickening agent. The combination of these two materials can create a biomimetic endodontic sealer.

**Objective:** To examine the characteristics, physical and biological properties of novel bioceramic-chitosan hybrid sealer (BCC) as biomimetic endodontic sealer.

**Methods:** Novel BCC sealer were manipulated from bioceramic cement (BC) which had been synthesized through a ball-milling and sintering process, then mixed with WSP chitosan with a W/P of 0,4. Four variables, namely novel BCC sealer, BC bioceramic cement, bioceramic and epoxy resin sealer were tested characterization (XRD, SEM/EDS), physical properties (setting time, flow, film thickness), and biological tests (cytotoxicity and bioactivity on hPDLSCs).

**Results:** Novel BCC sealer showed bioceramic elements and crystalline peaks similar to bioceramic sealer (Sure-Seal Root™), had a particle shape that tends to be globular and homogeneous with descriptive particle size larger than Sure-Seal Root™ and AH Plus® but smaller compared to BC bioceramic cement. Only BC bioceramic cements and novel BCC sealer had Ca/Si/P ratios. Novel BCC sealer showed significant differences in setting time, flow, and film thickness with BC bioceramic cements, Sure-Seal Root™ and AH Plus®. The four groups showed low cytotoxicity to hPDLSCs. The bioactivity of novel BCC sealer was relatively higher among other groups and control group.

**Conclusion:** Novel BCC hybrid sealer has good clinical implications, exhibit physical properties close to standard root canal cements and have bioactivity as root canal biomimetic sealer.