

# Pengaruh penambahan carboxymethyl chitosan pada mineral trioxide aggregate terhadap perubahan karakteristik kristal hidroksiapatit dan kekerasan mikro dentin terdemineralisasi = The effect of carboxymethyl chitosan modified mineral trioxide aggregate on hydroxyapatite crystal characteristic and microhardness of demineralized dentin

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## Abstrak

Latar Belakang: Aplikasi Mineral Trioxide Aggregate (MTA) sebagai material bioaktif yang umum digunakan dalam upaya remineralisasi affected dentin memiliki peranan penting dalam preservasi jaringan gigi pada perawatan terapi pulpa vital, namun diketahui tidak dapat menghasilkan dentin dengan sifat mekanis menyerupai dentin sehat karena hanya menghasilkan remineralisasi ekstrasfibrillar. Carboxymethyl Chitosan (CMC) merupakan biomaterial alami yang dikembangkan sebagai analog protein non-kolagen pada dentin untuk menghambat laju presipitasi kalsium fosfat yang dihasilkan oleh interaksi antara material bioaktif dengan jaringan sehingga dapat memasuki ruang intrafibrillar kolagen.

Tujuan: Mengetahui pengaruh penambahan CMC pada semen MTA terhadap perubahan karakteristik kristal hidroksiapatit dan kekerasan mikro dentin terdemineralisasi, yang diobservasi selama 14 hari periode remineralisasi.

Metode: Remineralisasi dilakukan melalui aplikasi material MTA, MTA-CMC 5%, dan MTA-CMC 10% pada dasar kavitas sampel dentin terdemineralisasi. Akar gigi direndam selama 14 hari dalam cairan phosphate-buffered saline. Observasi karakteristik kristal hidroksiapatit dilakukan dengan alat uji X-ray Diffractomete dan perubahan kekerasan mikro dianalisis secara kuantitatif melalui uji Vickers Hardness.

Hasil: Pembentukan kristal hidroksiapatit ditemukan pada sampel MTA dan MTA-CMC dengan derajat kristalinitas hidroksiapatit paling tinggi pada sampel MTA-CMC 10%. Kekerasan mikro dentin meningkat pada kelompok MTA-CMC 5% dan MTA-CMC 10% dibandingkan pada kelompok MTA.

Kesimpulan: Aplikasi modifikasi material Mineral Trioxide Aggregate dengan Carboxymethyl Chitosan selama 14 hari menginisiasi terbentuknya fase mineral hidroksiapatit dan meningkatkan derajat kristalinitas hidroksiapatit pada dentin terdemineralisasi serta meningkatkan kekerasan mikro dentin terdemineralisasi.

.....Background: Application of Mineral Trioxide Aggregate (MTA) as remineralization agent of affected dentin which holds a vital role in the preservation of tooth structure has been widely used in clinical practice, however it's only capable of generating extrafibrillar remineralization resulting in the inability to produce dentin with mechanical properties resembling sound dentin. Carboxymethyl Chitosan (CMC) is a natural biomaterial developed as analogue of dentin non-collagenous proteins to inhibit the spontaneous precipitation of calcium-phosphate produced by the interaction of dentin with remineralization agent so that intrafibrillar remineralization can be accomplished.

Objective: To evaluate hydroxyapatite crystals characteristic and assess the microhardness of demineralized dentin after 14 days application of CMC-modified MTA.

Method: Remineralization was performed by the application of MTA, MTA-CMC 5%, and MTA-CMC 10% on demineralized dentin samples. During the remineralization process, root canals of tooth models were immersed in phosphate-buffered saline solution. Hydroxyapatite crystals' characteristic was observed

by X-ray Diffractometer, while dentin microhardness score was assessed by Vickers Hardness test.

Result: Formation of hydroxyapatite crystals was identified in MTA and MTA-CMC samples. Highest degree of crystallinity was found in MTA-CMC10% sample. Microhardness score of demineralized dentins in MTA-CMC 5% group and MTA-CMC 10% group was significantly higher than those in MTA group.

Conclusion: CMC-modified MTA application on demineralized dentin in 14 days was found effective in initiating hydroxyapatite formation with higher degree of crystallinity and increasing the microhardness of demineralized dentin.