Potensi Novel Semen Carboxymethyl Chitosan/Amorphous Calcium Phosphate Sebagai Agen Guided Tissue Remineralization (GTR) Dentin = The Potential of Novel Cement of Carboxymethyl Chitosan/Amorphous Calcium Phosphate as an Agent of Guided Tissue Remineralization (GTR) Dentin

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Abstrak

Latar Belakang : Remineralisasi Guided Tissue Remineralization (GTR) dentin digunakan untuk meningkatkan pembentukan kristal nano ke daerah gap zone serta membangun struktur mineral apatit pada kolagen demineralized dentin dan Carboxymethyl Chitosan (CMC) berperan sebagai protein analog serta memicu remineralisasi dentin. Tujuan: Mendapatkan novel semen carboxymethyl chitosan/amporphous calcium phosphate sebagai agen GTR dentin. Metode: Modifikasi CMC menjadi bubuk CMC/ACP (CA) melalui proses Freeze Dry dan modifikasi bubuk CA melalui proses milling 30 menit menjadi bubuk CMC/ACP paska milling (CAM) dan masing-masing dievaluasi menggunakan FTIR menganalisis gugus fungsi CMC dan gugus fungsi awal CA yang terbentuk. Bubuk CA dan CAM kemudian dicampurkan dengan gipsum hemihydrate pada rasio 5% dan 10% didapatkan kelompok novel semen CAG 5%, CAG 10%, CAMG 5% dan CAMG 10%. Kelompok tersebut dievaluasi menggunakan FTIR, XRD, SEM, setting time, ketahanan kompresi dan MTT assay. Novel semen tersebut diaplikasikan pada dentin terdemineralisasi selama 14 hari dan dievaluasi menggunakan TEM. Hasil: Gugus fungsi CMC berupa -CH2COOH dan N-H terlihat pada bubuk CA dan setelah dilakukan milling menjadi bubuk CAM. Tambahan gugus fungsi fosfat (-PO4) terlihat juga pada bubuk CA dan CAM. Gugus fungsi awal bubuk CA tetap terlihat pada bubuk CAM. Gugus fungsi fosfat (-PO4) terlihat juga pada kelompok novel semen CAG dan CAMG baik 5% dan 10%. Kombinasi bubuk CA dan CAM menggunakan gipsum mempengaruhi fasa mineral material. Kesan topografi berbeda pada novel semen CAG (5% dan 10%) dan novel semen CAMG (5% dan 10%). Terdapat perbedaan bermakna antara kelompok novel semen (CAG 5%, CAG 10%, CAMG 5% dan CAMG 10%) dibandingkan dengan gipsum (kontrol) pada setting time dan ketahanan kompresi ($p<0.05$). Viabilitas sel dari uji MTT assay menunjukkan novel semen CAMG 10% tidak toksik terhadap hDPSC. Novel semen CAG (5% dan 10%) dan novel semen CAMG (5% dan 10%) menunjukkan kesan remineralisasi dentin ekstrafibrillar dan intrafibrillar pada dentin terdemineralisasi. Kesimpulan: Modifikasi carboxymethyl chitosan melalui proses freeze dry dan milling serta pencampuran rasio 5% dan 10% menggunakan gipsum memiliki kemampuan untuk menginisiasi guided tissue remineralisazation dentin baik secara ekstrafibrillar dan intrafibrillar pada dentin terdemineralisasi.

.....Background: Guided Tissue Remineralization (GTR) dentin is used to increase the formation of nanocrystals in the gap zone area and build an apatite mineral structure in demineralized dentin collagen and Carboxymethyl Chitosan (CMC) which acts as a protein analog and triggers dentin remineralization. Objective: To obtain a novel carboxymethyl chitosan/amorphous calcium phosphate cement as a dentinal GTR agent.Purpose: Obtained novel cement carboxymethyl chitosan/amporphous calcium phosphate as an agent for GTR. Methods: Modification of CMC into CMC/ACP (CA) powder through the Freeze Dry process and modification of CA powder through a 30-minute milling process into CMC/ACP powder after

milling (CAM) and evaluated using FTIR, respectively, analyzing the CMC functional group and the initial CA functional group formed. CA and CAM powder were then mixed with gypsum hemihydrate at a ratio of 5% and 10% to obtain novel cement groups of CAG 5%, CAG 10%, CAMG 5%, and CAMG 10%. The groups were evaluated using FTIR, XRD, SEM, setting time, compression resistance, and MTT assay. The novel cement was applied to demineralized dentin for 14 days and evaluated using TEM. Result: The CMC functional group (-CH2COOH and N-H) was seen in CA and CAM powder. Addition of phosphate (-PO4) functional grup were detected in CA and CAM powder. Phosphate (-PO4) functional group was seen in novel cement CAG (5% and 10%) and CAMG (5% and 10%). The combination of gipsum using CA and CAM powders produces different mineral phases. Topographical impressions differed between Novel cement groups of CAG (5% and 10%) and CAMG (5% and 10%). There was a significant difference between the novel cement groups (CAG 5%, CAG 10%, CAMG 5%, and CAMG 10%) compared to gypsum (control) in setting time and compression resistance ($p<0.05$). Viability cell confirmation using MTT assay showed that novel cemen group of CAMG 10% did not toxic to hDPSC. Novel cement groups of CAG (5% and 10%) and CAMG (5% and 10%) demonstrated the effects of extrafibrillar and intrafibrillar dentin remineralization on demineralized dentin. Conclusion: Modifying carboxymethyl chitosan through freeze dry and milling processes and modifying the mixing ratio of 5% and 10% using gypsum can initiate guided tissue remineralization of dentin both extrafibrillarly and intrafibrillarly in demineralized dentin.