Studi Biokompatibilitas dari Perancah Berbahan Dasar Karbon/ Hidroksiapatit/ Fibrin untuk Mempercepat Regenerasi Tulang = Biocompatibility Study of Carbon Based/ Hydroxyapatite/ Fibrin Scaffolds to Accelerate Bone Regeneration

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Abstrak

Fraktur tulang merupakan kondisi ketika kontinuitas dari tulang rusak sehingga menyebabkan perubahan pada bentuk tulang. Rekayasa jaringan tulang merupakan kombinasi dari perancah, sel, dan biofaktor dimana perancah merupakan komponen yang memainkan peranan penting. Solusi yang ditawarkan adalah memfabrikasi perancah dengan gabungan biomaterial atau komposit berupa graphite/ hydroxyapatite/ fibrin (G/HAp/F), graphene oxide/ hydroxyapatite/ fibrin (GO/HAp/F), multiwalled carbon nanotubes/ hydroxyapatite/ fibrin (MWCNT/HAp/F), dan hydroxyapatite/ fibrin (HAp/F) dengan penambahan material karbon (MWCNT, GO, dan G) sebanyak 1% wt, HAp sebanyak 2% wt, dan penambahan fibrin dengan perbandingan HAp:Fibrin senilai 20:1. Metode: Perancah disintesis dengan menggunakan metode freeze-drying. Parameter uji dilakukan melalui uji biokompatibilitas atau viabilitas sel (MTS assay), uji diferensiasi sel (pewarnaan alizarin red), dan analisa statistik. Pengujian tersebut dilakukan untuk melihat perbandingan antara keempat kombinasi perancah dalam menginduksi osteogenesis dan mempercepat proses regenerasi tulang.
Hasil: Fabrikasi perancah dengan metode freeze-drying menghasilkan perancah dengan ukuran rata-rata diameter 0,68 cm dan tinggi 0,41 cm. Uji viablitas menunjukkan perancah dengan penambahan karbon menunjukkan viabilitas sel yang buruk, tidak menginduksi adhesi dan proliferasi sel, meskipun sel cenderung bermigrasi dan mendekati perancah. Uji diferensiasi menunjukkan perancah dengan penambahan karbon gagal dalam menginduksi diferensiasi sel osteogenik, Sel yang berdiferensiasi hanya ditemukan pada perancah HAp/F.
.....A fracture is a condition when the continuity of the bone is broken, causing a change in the shape of the bone. Bone tissue engineering is a combination of scaffolds, cells, and biofactors where the scaffold is a component that plays an important role. In this study, scaffolds with a combination of biomaterials or composites in the form of graphite/ hydroxyapatite/ fibrin (G/HAp/F), graphene oxide/ hydroxyapatite/ fibrin (GO/HAp/F), multiwalled carbon nanotubes/ hydroxyapatite/ fibrin (MWCNT/ HAp/F), and hydroxyapatite/ fibrin (HAp/F) with the addition of carbon material (MWCNT, GO, and G) as much as 1% wt, HAp as much as 2% wt, and the addition of fibrin with a HAp:Fibrin ratio of 20:1 were fabricated. Scaffolds were synthesized using the freeze-drying method. The test parameters were carried out through biocompatibility or cell viability test (MTS assay) and cell differentiation test (alizarin red staining), and statistical analysis. The test was conducted to see the comparison between the three combinations of scaffolds in inducing osteogenesis and accelerating the process of bone regeneration. The scaffold fabrication using the freeze-drying method resulted in a scaffold with an average diameter of 0.68 cm and an average height of 0.41 cm. Viability test showed that the scaffolds with the addition of carbon showed poor cell viability, did not induce cell adhesion and proliferation, although cells tended to migrate and approach the scaffold. Differentiation test showed that the scaffolds with addition of carbon failed to induce

osteogenic cell differentiation. Differentiated cells were only found in the HAp/F scaffold.