รายงานฉบับสมบูรณ์

ความเข้ากันได้ทางชีวภาพ และการสลายตัวของโครงร่างทดแทนกระดูกแบบใหม่ที่มีส่วนผสมของโพลีคาโปรแลคโตนและไบเฟสิคแคลเซียมฟอสเฟต

In vivo biocompatibility and degradation of novel Polycaprolactone-Biphasic Calcium phosphate scaffolds used as the bone substitute

..คณะผู้วิจัย..

ผศ.ดร.ทพ.ณัฐวุฒิ เทือกสุบรรณ

ทพญ.รุ่งโรจน์ ปั้นนาค

รศ.พญ.ปลื้มจิต บุญยพิพัฒน์

ดร.นฤภร มนต์มธุรพจน์

งานวิจัยนี้ได้รับทุนสนับสนุนการวิจัยจากงบประมาณแผ่นดินทุนนอกรอบ

ประจำปี 2557

In vivo biocompatibility and degradation of novel Polycaprolactone-Biphasic Calcium phosphate scaffolds used as the bone substitute

Nuttawut Thuaksuban[1], Rungrot Pannak[1], Pleumjit Boonyaphiphat[2], Naruporn Monmaturapoj[3]

[1] Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Prince of Songkla University, Kanjanavanij Road, Hatyai, Songkhla, 90112, Thailand

E-mail; nuttawut.t@psu.ac.th, Tel; +6674-429876, Fax; +6674-429876

[2] Department of Pathology, Faculty of Medicine, Prince of Songkla University, Kanjanavanij Road, Hatyai, Songkhla, 90112, Thailand

[3] National Metal and Materials Technology Center, Thailand Science Park, Pathumthani, Thailand, 12120

Abstract: Biocompatibility and degradation behaviors of the poly ε-caprolactone (PCL)-Biphasic Calcium Phosphate (BCP) scaffolds fabricated by "modified Melt Stretching and Multilayer Deposition (mMSMD)" technique were evaluated in rat models and compared with those of the PCL-20% β-tricalcium phosphate (TCP) scaffolds commercially fabricated by Fused Deposition Modeling (FDM) for benchmarking. The study groups including; Group A: PCL – 20% BCP mMSMD scaffolds and Group B: PCL-20% TCP FDM scaffolds were implanted subcutaneously in twelve male Wistar rats. On day 14, 30, 60 and 90, the specimens including the scaffolds and surrounding soft tissue were biopsied (n=9/group/time point). After fixing the specimens in formalin, their dimensional changes between pre- and post-operation were assessed using the Micro-Computed Tomography (μ-CT) analysis (n=6/group/time point). After the μ-CT analysis, the specimens were sectioned and stained with Hematoxylin and Eosin (H&E) and Masson's trichrome (MT). Degree of inflammation, collagen formation and new vessel regeneration of the surrounding tissue were descriptively evaluated. Changes of molecular weight of the scaffolds between pre- and post-operation were comparatively assessed using the Gel Permeation Chromatography (GPC) (n=3/group/time point). The histological features of both groups demonstrated that degrees of inflammation were very low and formation of collagen and new blood vessels throughout the scaffolds increased with time. The data of μ-CT analysis demonstrated that the scaffolds of both groups degraded with time. However, the GPC analysis

showed that their molecular weights were slightly changed over the observation periods. The differences of those parameters between pre- and post-operation and between the experiments groups were not significantly different ($p > 0.05$). In conclusion, the PCL – 20% BCP mMSMD scaffolds were biocompatible and they could degrade with time when implanted in animal tissue. Their properties were comparable to those of the commercial PCL-20%TCP scaffolds.

Key Words: scaffold, polycaprolactone, biphasic calcium phosphate, biocompatibility, degradation