Effects of Estrogen Deprivation and Titanium Surfaces on Osteogenic Differentiation of Human Bone Marrow Stromal Cells, an *in Vitro* Study

Chonticha Chookiartsiri* Prisana Pripatnanont Boonsin Tangtrakulwanich*** Premjit Arpornmaeklong****

Abstract

Objectives: The study aimed to investigate effects of estrogen deficiency and titanium surfaces on growth and osteogenic differentiation of hBMSCs.

Methods: Under a written informed consent, human bone marrow stromal cells (hBMSCs) were harvested, cultured and seeded on cell culture plates and titanium disks (Straumann, Switzerland), smooth and sandblasted acid-etched (SLA) titanium surfaces. Then cells were cultured in estrogen-deprived (ED) growth medium for 24 h. and subsequently in conventional (FBS-OS) and ED-osteogenic (ED-OS) media for 21 day. Examination under scanning electron microscope (SEM) was performed to assess cell viability, attachment, morphologies and growth. Cell viability assay was conducted to determine cell growth. Alkaline phosphatase activity and calcium contents levels were measured to evaluate osteogenic differentiation potential (n=4, Mean±SD).

Results: Titanium surface microtopographies and ED cell culture influenced cell morphology, attachment and growth. Human BMSCs were spindle-shaped cells on cell culture plate and smooth titanium surfaces, while on SLA titanium surface cells were stellate-like cells. Estrogen-deprived cell culture decreased cell attachment, growth and osteogenic differentiation potential of hBMSCs. Alkaline phosphatase activity and calcium content levels on all surfaces in ED-OS were markedly and significantly lower than FBS-OS media ($p<0.05$). Promoting effects of SLA surface on osteogenic differentiation, ALP activity and calcium contents, were found only in FBS-OS not ED-OS media.

Conclusions: Estrogen-deprived cell culture decreased cell growth and osteogenic differentiation of hBMSCs. A SLA surface could not promote osteogenic differentiation of hBMSCs in ED-condition. Thus, modification of titanium surface microtopographyalone might be insufficient to enhance osteointegration of dental implant in osteoporotic bone.

Key words: Osteoporosis, Sandblasted and acid etched titanium surface, Osteoblastic differentiation

**Graduate Student, Department of Oral & Maxillofacial Surgery, Faculty of Dentistry, Prince of Songkla University, Hat Yai, Songkhla, Thailand*

***Associate Professor, Department of Oral & Maxillofacial Surgery, Faculty of Dentistry, Prince of Songkla University, Hat Yai, Songkhla, Thailand*

****Associate Professor, Department of Orthopaedic Surgery & Physical Medicine, School of Medicine, Faculty of Medicine, Prince of Songkla University, Hat Yai, Songkhla, Thailand*