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Original article

Tumor necrosis factor-α and osterix expression after the transplantation of a hydroxyapatite scaffold from crab shell (*Portunus pelagicus*) in the post-extraction socket of *Cavia cobaya*

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ABSTRACT

Background: *Socket preservation using bone graft is one way to minimize resorption and maximize the bone formation process. Tumor necrosis factor-α (TNF-α) is an inflammatory cytokine that affects bone regenerating osteoblast activity, while osterix (Osx) is an osteoblast-specific transcription factor that activates gene receptors during pre-osteoblast differentiation. The hydroxyapatite (HA) scaffold from crab shell (Portunus pelagicus) has osteoconduction properties.* ***Purpose:*** *To analyze the decrease of TNF-α expression and the increase of Osx expression and the correlation between these two in the post-extraction socket after the transplantation of a crab shell HA scaffold.* ***Methods:*** *The lower left incisors of Cavia cobaya (n = 24) were extracted and divided into four groups; the first and second groups were control groups on Day 7 and Day 14 (K7 and K14), the third and fourth groups were treatment groups (P7 and P14). The statistical analysis used was a multivariate analysis of variance (MANOVA) with a significance level of 0.05.* ***Results:*** *A MANOVA test showed that the use of crab shell HA scaffolds led to a significant difference (p < 0.05) in TNF-α expression (p = 0.01) and Osx expression (p = 0.01). A Pearson correlation test result showed a strong inverse correlation between TNF-α and Osx expressions (p = 0.00 and r = -0.78).* ***Conclusion:*** *The transplantation of HA scaffolds from crab shells can decrease TNF-α expression but increase Osx expression in the post-extraction socket of C. cobaya. Furthermore, an inverse correlation was found between TNF-α and Osx.*

Keywords: *osterix; Portunus pelagicus; scaffold; socket preservation; tumor necrosis factor-α*

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INTRODUCTION

The procedure of denture fabrication needs a healthy alveolar bone and an ideal shape for the retention of the denture. Tooth extraction without follow-up treatment can cause alveolar bone resorption; therefore, the aesthetic aspect and function of retention cannot be achieved. The alveolar bone changes shape notably in a vertical direction, but also in the lingual/palatal direction from the initial position, which causes the alveolar bone to become low, rounded or flat. This phenomenon is called residual ridge resorption.[1] This could be avoided by preserving the socket using hydroxyapatite (HA), which can be obtained from crab shells. HA has been proven to have good biocompatibility and osteoconductive properties, meaning that it is well tolerated by the tissues of the human oral cavity and is able to stimulate osteoblast differentiation.[2]

HA also has the ability to induce mesenchymal cells to differentiate towards osteoblasts, which makes it a scaffold material for bone tissue engineering.[3] HA has long-term biodegradable properties that slow down the bone repair process. A scaffold with a polymer matrix of natural materials, namely gelatine, is needed. In this study, gelatine was chosen as a scaffold material because of its excellent biocompatibility, biodegradability and porosity. HA-gelatine scaffolds are expected to increase the bioactivity,

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