Immunohistochemical and molecular analysis of bone remodelling pattern in alveolar socket

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Following tooth extraction, the alveolar bone remodelling process starts. Bundle bone and buccal wall resorption occur early with horizontal and vertical bone crest reduction [1]. The use of bone substitutes has been proposed to limit bone resorption, thus allowing further dental rehabilitation [2]. Aim of this project was to characterize by a molecular and morphological approach the physiological remodelling of post-extractive alveolar socket and to compare it with the bone remodelling occurring after alveolar bone reconstruction with an alloplastic material.

Thirty-six patients needing tooth extraction were enrolled and equally divided into three groups: A) baseline, B) spontaneous healing, C) biomaterial. In each group, 2 biopsies per site were harvested during tooth extraction (group A) or 4-6 months after tooth extraction (groups B and C). In group B, patients recovered spontaneously, while in group C the alveolar socket was filled with a magnesium-enriched hydroxyapatite. One biopsy was processed for immunohistochemistry to localise TNF-α, IL-6, RANK, RANKL and OPG. The second biopsy underwent a Real-Time PCR analysis for the same biomarkers in order to evaluate gene expression. In groups B and C, a third biopsy was retrieved and processed for ground section aiming to assess tissue composition. Differences between the three groups were investigated using Kruskal Wallis test (p<0,05) followed by post-hoc tests.

All samples showed a normal structure without inflammatory infiltrate. At immunohistochemical analysis, all biomarkers except for OPG had increased. Significant differences were found between the three groups for TNF-α (p< 0,05), IL-6 (p<0,001), RANK (p< 0,01) and RANKL (p<0,001), between groups A and C for IL-6 (p≤ 0,001), RANK (p≤ 0,01), RANKL (p≤ 0,001) and between B and C for IL-6 (p≤ 0,01). Gene expression did not show statistical differences. Crumbles of biomaterial surrounded by regenerated bone were evident. A higher percentage of mineral component was obtained in group B than in C.

The biomarkers selected in the current study were involved in the alveolar remodelling and the biomaterial used for socket preservation did not influence the process.

References

Keywords
Bone turnover, post-extraction site, immunohistochemistry, bone substitute, gene expression.