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Modena, 11-13 settembre 2023

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Modulation of the inflammatory response in mesenchymal stem cells induced to osteogenic differentiation by composite biomaterial for bone tissue regeneration

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Bone repair after fracture is a complex process that leads to new bone formation through sequential cellular and molecular events regulated by systemic and local factors [1]. Inflammation is an important biological process that should be considered to develop successful biomaterial-based therapeutics, since prolonged inflammation can result in delayed wound healing or, in some cases, biomaterial rejection and additional tissue damage [2,3].

This study aims to assess the potential of mesenchymal stem cells (MSCs) in modulating the inflammation during osteogenic differentiation induced by the hydroxylapatite (HA)/Collagen composite biomaterial, which is currently used in maxillofacial surgery. MSCs were cultured on the biomaterial for 21 days. Upon differentiation, cells were tested for matrix mineralization and gene expression profile, using the Real-Time PCR Arrays for osteogenesis and inflammation. MSCs grown on the biomaterial produced more mineralized matrix than those grown on tissue culture polystyrene vessels, used as control. Among Differentially Expressed Genes (DEGs) involved in osteogenic differentiation (n=31), the transcription factor SP7, secreted phosphoprotein 1 (SPP1) and bone gamma-carboxyglutamate (gla) protein (BGLAP) were over-expressed in human MSCs grown on the biomaterial compared to control. Moreover, n=24 DEGs involved in inflammation were detected in human MSCs, compared to control. Interestingly, the anti-inflammatory interleukin IL-10, was over-expressed, whereas several pro-inflammatory cytokines and chemokines, including interleukin IL-6, were down-expressed in MSCs grown on the biomaterial, compared to control. In conclusion, this investigation indicates

that MSCs combined with the composite biomaterial may enhance bone wound healing, possibly lowering the inflammation burden. Therefore, autologous MSCs implanted with the composite biomaterial could successfully be used for bone tissue regeneration in maxillofacial surgery.

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Keywords: Stem cell; osteogenic differentiation; inflammation; biomaterial; bone

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