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Evaluation of the effects of a dynamic culture on osteogenic differentiation of oral-periosteal cells grown on PLGA sponges

Gabriele Ceccarelli[1], Laura Benedetti[1], Antonio Graziano[2], Maurizio Alloni[1], Giulia Silvani[3], Maurilio Sampaolesi[1], Piero Micheletti[1], Livia Visai[4], Maria Gabriella Cusella De Angelis[1]

[1] Department of Public Health, Experimental Medicine and Forensic, University of Pavia, Pavia, Italy - [2] HBW s.r.l., Dental School, University of Turin, Turin, Italy - [3] Multimed s.r.l., Turin, Italy - [4] Depertment of Molecular Medicine, Biochemistry Unit, University of Pavia, Pavia, Italy

Oral-periosteum derived stem cells represent an innovative cell source for bone tissue engineering applications in terms of accessibility and self-commitment towards osteogenic lineage [1]. In this scenario, biomaterials play a pivotal role in tissue engineering in supporting stem cells growth and regeneration of tissue defects [2]. Among these biomaterials, Fisiograft®, a synthetic co-polymer composed of polylactic and polyglycholic acids produced by Ghimas (Bologna, Italy), is highly biocompatible and completely absorbed within 4-6 months. In particular, Fisiograft® sponges are normally used in dental applications to fix completely periodontal defects without damage Schneider's membrane. We evaluated the osteogenic potential of Fisiograft® sponges on oral-periosteal cells derived from patients undergoing dental extractions. For this purpose, we created a dynamic culture based on a rotating apparatus in which we seeded periosteal cells with Fisiograft® sponges for 7, 14 and 21 days without adding osteogenic supplement in the medium. Osteoblast differentiation of cells was evaluated by Alizarin Red S staining and by qRT-PCR on genes involved in bone development. Results show that Fisograft® sponges promote greater osteogenic differentiation of cells in the dynamic culture with respect to standard condition already at 14 days, as demonstrated by Alizarin Red staining. BMP-2 and Osteoprotegerin genes are highly expressed by cells grown on Fisiograft® sponges in dynamic culture at 14 days with respect to plastic culture. Taken together, these results confirm the osteogenic potential of Fisiograft® sponges in accelerating the differentiation of cells to an osteoblast phenotype (already to 14 days of culture) without any osteogenic induction. The combination of this PLGA biomaterial and oral-periosteal cells could represent a promising bio-complex in maxillo-facial tissue repair.

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References

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Oral-periosteal cells; PLGA biomaterials; Fisiograft®; dynamic culture.