

Bioactive Glasses in Soft Tissue Repair: Advances and Challenges

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Most research activities in the field of bioactive glasses (BGs) have been devoted to applications in orthopedics and dentistry considering that BGs were developed originally (by the late Prof. Larry L. Hench, more than 40 years ago) with the goal of creating bone bonding materials which could be used for treating bone defects. However, even in the early days of development of BGs, also their positive interaction with soft tissues was reported. More recently, based on the high surface reactivity of BGs, their applications are being extended to consider soft tissue repair and wound healing [1, 2]. Indeed the typical cellular processes involved in the early stages of soft tissue regeneration are influenced by the local ionic concentration in the wound, which depends strongly on the dissolution products released by BGs. In this context, evidence of the positive effect of BGs on angiogenesis, which is a key process in the wound healing mechanism, has been highlighted as being the key feature of BGs enabling their applications in soft tissue engineering [1]. In this presentation, the development of biologically active ion doped BGs for soft tissue repair will be reviewed summarizing relevant results achieved for silicate, phosphate and borate compositions. Technologies being developed to fabricate malleable or flexible scaffolds incorporating BGs, e.g. organic-inorganic composites and hybrids, which are of relevance for soft tissue repair, will be discussed. The lecture will also present relevant cell biology results which confirm the effects of BG ionic dissolution products on angiogenesis, in particular showing the effect of selected ions such as Sr, Co, Cu, Li and B on the release of vascular endothelial growth factor, induction of hypoxia conditions and endothelial cell response. The talk will also discuss future avenues for research in the field, focusing on emerging applications of both sol-gel based and melt-derived BGs in skin regeneration, nerve tissue repair and regeneration of complex tissue interfaces.

[1] Miguez-Pacheco, V., Hench, L. L., Boccaccini, A. R., Bioactive glasses beyond bone and teeth: emerging applications in contact with soft tissue, *Acta Biomaterialia* 13 (2015) 1-15.

[2] Bairo, F., Novajra, G., Miguez-Pacheco, V., Boccaccini, A. R., Vitale-Brovarone, C., Bioactive glasses: Special applications outside the skeletal system, *J. Non-Cryst. Solids* 432 Part A (2016) 15-30.