PRODUCTION AND CHARACTERIZATION OF THREE-DIMENSIONAL MARINE COLLAGEN SCAFFOLDS FOR REGENERATIVE MEDICINE

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Marine ecosystems are a huge source of still largely unexplored “blue” innovations for a wide range of human applications. The sustainable exploitation and the eco-friendly management of sea-derived resources are two of the main current challenges of marine biotechnology. Among marine biomaterials, collagens are a frontier field in regenerative medicine. Echinoderms, and especially sea urchins, have been recently proposed as sustainable sources of marine collagen for this purpose. Particularly, from food industry wastes of the edible sea urchin *Paracentrotus lividus* it is possible to obtain high value fibrillar collagen to produce very thin but resistant two-dimensional (2D) membranes, useful for Guided Tissue Regeneration (Ferrario et al., 2016). In this work, we developed and optimized a new protocol to produce three-dimensional (3D) scaffolds for novel tissue engineering applications, such as skin regeneration. The produced 3D scaffolds were characterized in terms of ultrastructure, stability and behaviour in wet conditions. The dry scaffolds observed at the scanning electron microscope presented a highly porous structure which could be tuned according to the different protocol conditions. Once identified the best protocol in terms of ultrastructural features and stability, it was used to prepare sponge-like scaffolds (1-2 mm in thickness) to perform *in vitro* experiments with mammalian fibroblasts and evaluate cell infiltration and viability. At both short and long term time-points cells colonized the inner layers of the scaffolds and resulted viable and proliferative. In parallel, to assess the biocompatibility of this novel marine collagen biomaterial, preliminary *in vivo* tests in rat models were performed by sub-epidermal implantation of 2D membranes. The obtained results indicated that the animals showed neither clinical signs of sufferance nor marked inflammatory reactions (*i.e.* rejection, abscess formation) but only sporadic irritation compared to commercial bovine collagen devices used as controls, suggesting its promising biocompatibility.
Overall, our data indicated that sea urchins might be considered a valuable eco-friendly alternative source of marine collagen to produce different types of tools for regenerative medicine applications, such as 3D scaffolds. Further *in vivo* tests with larger size animals (*i.e.* sheep) will be necessary to validate the biocompatibility of this innovative marine biomaterial and to investigate its actual efficacy in promoting tissue (*i.e.* skin) regeneration.