Placenta as a source of ECM for tissue engineering applications

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Abstract

Extracellular matrices (ECM) from decellularized tissues and organs have been widely applied as scaffolds for tissue regeneration due to its bioactivity, integration to the host site, degradability, reduction of scar and capacity to facilitate exchanges of nutrients. Placentas may represent a rich and important source of ECM as they have abundant stroma with a rich network of blood supply and are commonly discarded after birth. The matrix of a placenta is known to contain antioxidants, anti-clotting and other bioactive molecules such as collagen, elastin, laminin, proteoglycans and growth factors, and have immunoregulatory and anti-inflammatory properties. This study aimed to compare different detergents in order to establish an effective protocol for decellularization of canine placentas. Canine placentas were harvested and their maternal and fetal components were processed either separately or in conjunction. Samples having 5mm thickness were washed in ultra-pure water for 3 days and immersed in 1% SDS or 1% SDS/10mM Tris for 48 hours (group 1) and 72 hours (group 2) at 4°C. The protocols continued with incubation of the samples in 1% Triton X-100 at 4°C for 2 days and wash in ultra-pure water. The processed tissues were then fixed in 4% paraformaldehyde and analyzed through histology and scanning electron microscopy (SEM). Preliminary results demonstrated that the solution containing 1% SDS+10mM Tris is more effective than 1% SDS only. Although both experimental conditions allowed decellularization of the maternal and fetal components of the placenta while maintaining their tridimensional structure, as shown by SEM, the ECM tended to be more disorganized in group 2 (incubation for 72 hours) than in group 1 (48 hours). Placentas can be successfully decellularized and represent an interesting source of ECM for tissue engineering strategies. Analyses of protein content of both placental components – maternal and fetal – as well as potential differences on their bioactivity have been investigated.