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The potential of 3-dimensional construct engineered from poly(lactic-co-glycolic acid)/fibrin hybrid scaffold seeded with bone marrow mesenchymal stem cells for in vitro cartilage tissue engineering (Article)

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Abstract

Articular cartilage is well known for its simple uniqueness of avascular and aneural structure that has limited capacity to heal itself when injured. The use of three dimensional **construct** in tissue engineering holds great **potential** in regenerating cartilage defects. This study evaluated the in vitro cartilaginous tissue formation using rabbit's bone marrow mesenchymal stem cells (BMSCs)-seeded onto poly(lactic-co-glycolic acid) PLGA/fibrin and PLGA scaffolds. The in vitro cartilaginous **engineered** constructs were evaluated by gross inspection, histology, cell proliferation, gene expression and sulphated glycosaminoglycan (sGAG) production at week 1, 2 and 3. After 3 weeks of culture, the PLGA/fibrin **construct** demonstrated gross features similar to the native tissue with smooth, firm and glistening appearance, superior histoarchitectural and better cartilaginous extracellular matrix compound in concert with the positive glycosaminoglycan accumulation on Alcian blue. Significantly higher cell proliferation in PLGA/fibrin **construct** was noted at day-7, day-14 and day-21 (p<. 0.05 respectively). Both constructs expressed the accumulation of collagen type II, collagen type IX, aggrecan and sox9, showed down-regulation of collagen type I as well as produced relative sGAG content with PLGA/fibrin **construct** exhibited better gene expression in all profiles and showed significantly higher relative sGAG content at each time point (p<. 0.05). This study suggested that with optimum in vitro manipulation, PLGA/fibrin when seeded with pluripotent non-committed BMSCs has the capability to differentiate into chondrogenic lineage and may serve as a prospective **construct** to be developed as functional tissue **engineered** cartilage. © 2015 Elsevier Ltd.

Author keywords

Bone marrow mesenchymal stem cells; Cartilage tissue engineering; Fibrin; Poly(lactic-co-glycolic acid); Scaffold

Indexed keywords

EMTREE drug terms: aggrecan; alcian blue; collagen type 1; collagen type 2; collagen type 9; fibrin; glycosaminoglycan polysulfate; polyglactin; collagen type 2; fibrin; lactic acid; polyglycolic acid; polylactic acid-polyglycolic acid copolymer

EMTREE medical terms: animal cell; animal tissue; Article; articular cartilage; bone marrow derived mesenchymal stem cell; cell activity; cell culture; cell proliferation; controlled study; down regulation; gene; gene expression; histology; in vitro study; nonhuman; rabbit; tissue engineering; tissue scaffold; animal; articular cartilage; bone marrow cell; chemistry; chondrogenesis; drug effects; female; mesenchymal stem cell transplantation; mesenchymal stroma cell; metabolism; tissue scaffold

Species Index: Oryctolagus cuniculus

MeSH: Animals; Bone Marrow Cells; Cartilage, Articular; Chondrogenesis; Collagen Type II; Female; Fibrin; Lactic Acid; Mesenchymal Stem Cell Transplantation; Mesenchymal Stromal Cells; Polyglycolic Acid; Rabbits; Tissue Engineering; Tissue Scaffolds

Medline is the source for the MeSH terms of this document.

Chemicals and CAS Registry Numbers: alcian blue, 12040-44-7; fibrin, 9001-31-4; glycosaminoglycan polysulfate, 63449-40-1; polyglactin, 26780-50-7, 34346-01-5; lactic acid, 113-21-3, 50-21-5; polyglycolic acid, 26009-03-0, 26124-68-5, 26202-08-