

Cartilage regeneration by chondrogenic induced adult stem cells in osteoarthritic sheep model

Abstract

Objectives: In this study, Adipose stem cells (ADSC) and bone marrow stem cells (BMSC), multipotent adult cells with the potentials for cartilage regenerations were induced to chondrogenic lineage and used for cartilage regenerations in surgically induced osteoarthritis in sheep model. **Methods:** Osteoarthritis was induced at the right knee of sheep by complete resection of the anterior cruciate ligament and medial meniscus following a 3-weeks exercise regimen. Stem cells from experimental sheep were culture expanded and induced to chondrogenic lineage. Test sheep received a single dose of 2×10^7 autologous PKH26-labelled, chondrogenically induced ADSCs or BMSCs as 5 mls injection, while controls received 5 mls culture medium. **Results:** The proliferation rate of ADSCs 34.4 ± 1.6 hr was significantly higher than that of the BMSCs 48.8 ± 5.3 hr ($P = 0.008$). Chondrogenic induced BMSCs had significantly higher expressions of chondrogenic specific genes (Collagen II, SOX9 and Aggrecan) compared to chondrogenic ADSCs ($P = 0.031, 0.010$ and 0.013). Grossly, the treated knee joints showed regenerated de novo cartilages within 6 weeks post-treatment. On the International Cartilage Repair Society grade scores, chondrogenically induced ADSCs and BMSCs groups had significantly lower scores than controls ($P = 0.0001$ and 0.0001). Fluorescence of the tracking dye (PKH26) in the injected cells showed that they had populated the damaged area of cartilage. Histological staining revealed loosely packed matrixes of de novo cartilages and immunostaining demonstrated the presence of cartilage specific proteins, Collagen II and SOX9. **Conclusion:** Autologous chondrogenically induced ADSCs and BMSCs could be promising cell sources for cartilage regeneration in osteoarthritis.

Keyword: Cartilage regenerations; Chondrogenically; Adipose stem cells (ADSC); Bone marrow stem cells (BMSC); Osteoarthritis