Improved functional assessment of osteoarthritic knee joint after chondrogenically induced cell treatment

ABSTRACT

Objectives: Our previous studies on osteoarthritis (OA) revealed positive outcome after chondrogenically induced cells treatment. Presently, the functional improvements of these treated OA knee joints were quantified followed by evaluation of the mechanical properties of the engineered cartilages. Methods: Baseline electromyogram (EMGs) were conducted at week 0 (pre-OA), on the locomotory muscles of nine un-castrated male sheep (Siamese long tail cross) divided into controls, adipose-derived stem cells (ADSCs) and bone marrow stem cells (BMSCs), before OA inductions. Subsequent recordings were performed at week 7 and week 31 which were post-OA and post-treatments. Afterwards, the compression tests of the regenerated cartilage were performed. Results: Post-treatment EMG analysis revealed that the control sheep retained significant reductions in amplitudes at the right medial gluteus, vastus lateralis and bicep femoris, whereas BMSCs and ADSCs samples had no further significant reductions ($P < 0.05$). Grossly and histologically, the treated knee joints demonstrated the presence of regenerated neo cartilages evidenced by the fluorescence of PKH26 tracker. Based on the International Cartilage Repair Society scores (ICRS), they had significantly lower grades than the controls ($P < 0.05$). The compression moduli of the native cartilages and the engineered cartilages differed significantly at the tibia plateau, patella femoral groove and the patella; whereas at the medial femoral condyle, they had similar moduli of 0.69 MPa and 0.40-0.64 MPa respectively. Their compression strengths at all four regions were within ±10 MPa. Conclusion: The tissue engineered cartilages provided evidence of functional recoveries associated to the structural regenerations, and their mechanical properties were comparable with the native cartilage.

Keyword: Cartilage; Cell therapy; Function; Osteoarthritis; Regeneration