

Tenogenic differentiation of mesenchymal stem cells

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Introduction/Purpose: Tendon repair has been a challenging issue for surgeons in treating. Although tissue engineering with mesenchymal stem cells (MSC) have been used for tendon repair in both in vivo and in vitro, the stem cells are obtained through invasive procedures, and there is usually a lack of adequate numbers for clinical use. The purpose of this study was to compare the potential of tri-lineage differentiation and to investigate the potential of tenogenic differentiation of human tonsil derived MSCs (T-MSCs), bone marrow derived MSCs (BM-MSCs), and adipose tissue derived MSCs (AD-MSCs).

Methods: Each tissue was obtained from 8 patients. After isolation of MSCs, flow cytometry analysis was used to characterize the phenotypes of the MSCs. Differentiation capacity to adipo-, osteo-, and chondrocytes were induced by culturing each MSCs for 3 weeks in commercially available media. Each MSCs was treated with 5ng/ml and 10ng/ml of TGF- β 3 with vehicle control.

Results: Immunophenotypic surface marker analysis of BM-MSC, AD-MSC, and TMSCs revealed that these MSCs expressed a typical MSCs. mRNA expression levels of the markers for tri-lineage differentiation were significantly lower in TMSC than other MSCs. The tenogenic transcription factor, scleraxis, showed a statistically significant increase in all MSCs differentiation groups except for the 7th day TMSC differentiation group (Figure). Gene expression of tenascin-C, an ECM glycoprotein, was specifically expressed in the T-MSC differentiation group at 14 days (Figure). Comparing the ratio of collagen 1 to collagen 3 genes, the BM-MSC showed a decrease in the ratio on days 3 and 7 unlike AD-MSCs and TMSCs. Only TMSC showed a significant increase in the ratio compared with other MSCs on the 14th day.

Conclusion: The tonsil-MSC has low fat, bone and cartilage differentiation potential and has excellent tendon-specific differentiation potential, thus being highly useful as a tendon-tailored cell therapy agent.

