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# Molecular and cellular characterization during chondrogenic differentiation of adipose tissue-derived stromal cells *in vitro* and cartilage formation *in vivo*

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**Human adipose tissue is a viable source of mesenchymal stem cells (MSCs) with wide differentiation potential for musculoskeletal tissue engineering research. The stem cell population, termed processed lipoaspirate (PLA) cells, can be isolated from human lipoaspirates and expanded *in vitro* easily. This study was to determine molecular and cellular characterization of PLA cells during chondrogenic differentiation *in vitro* and cartilage formation *in vivo*. When cultured *in vitro* with chondrogenic medium as monolayers in high density, they could be induced toward the chondrogenic lineages. To determine their ability of cartilage formation *in vivo*, the induced cells in alginate gel were implanted in nude mice subcutaneously for up to 20 weeks. Histological and immunohistochemical analysis of the induced cells and retrieved specimens from nude mice at various intervals showed obviously cartilaginous phenotype with positive staining of specific extracellular matrix (ECM). Correlatively, results of RT-PCR and western blot confirmed the expression of characteristic molecules during chondrogenic differentiation namely collagen type II, SOX9, cartilage oligomeric protein (COMP) and the cartilage-specific proteoglycan aggrecan. Meanwhile, there was low level synthesis of collagen type X and decreasing production of collagen type I during induction *in vitro* and formation of cartilaginous tissue *in vivo*. These cells induced to form engineered cartilage can maintain the stable phenotype and indicate no sign of hypertrophy in 20 weeks *in vivo*, however, when they cultured as monolayers, they showed prehypertrophic alteration in late stage about 10 weeks after induction. Therefore, it is suggested that human adipose tissue may represent a novel plentiful source of multipotential stem cells capable of undergoing chondrogenesis and forming engineered cartilage.**

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