Mesenchymal stem cells derived from synovium, meniscus, anterior cruciate ligament, and articular chondrocytes share similar gene expression profiles

Yuko Segawa\textsuperscript{1}, Ichiro Sekiya\textsuperscript{2}, Takeshi Muneta\textsuperscript{1}

\textsuperscript{1}Section of Orthopedic Surgery, Tokyo Medical and Dental University, Tokyo, Japan; \textsuperscript{2}Section of Cartilage Regeneration, Tokyo Medical and Dental University, Tokyo, Japan

segawa.orj@tmd.ac.jp

Introduction: Mesenchymal stem cells (MSCs) can be obtained from various mesenchymal tissues and these cells contain common features, but an increasing number of reports describe distinguishing properties dependent on their origin.\textsuperscript{1-6} We examined (1) whether MSCs existed in several intraarticular tissues, (2) whether gene expression profiles in intraarticular tissues-MSCs closely resembled each other, and (3) whether identified genes were specific to intraarticular tissues-MSCs.

Materials and Methods: Human synovium, meniscus, anterior cruciate ligament, muscle, adipose tissue and bone marrow were harvested during total knee arthroplasty from 3 donors with knee osteoarthritis. Nucleated cells were examined for colony-forming capacity, multipotentiality, and surface epitopes, and their gene expression were compared by gene chip analysis, reverse transcriptase-PCR, and real time-PCR. Chondrocytes were also used as positive control.

Results: Cells from all tissues showed multipotentiality, and surface markers typical of MSCs. Gene profile of MSCs from intraarticular tissues and chondrocytes derived from normal cartilage were closer to each other than those of MSCs from extraarticular tissues (Fig. 1). We selected 3 genes, PRELP, OGN, and ECRG4, whose expressions were higher in all 2 chondrocytes, 3 intraarticular-MSCs than those in 3 extraarticular-MSCs. Both RT-PCRs confirmed gene chip analysis in 3 elderly and 3 young donors (Fig. 2). During in vitro chondrogenesis, synovium-MSCs stably expressed, contrarily, bone marrow-MSCs increased PRELP expression (Fig. 3).

Discussion: During development of joints, the noncartilaginous region, known as the interzone, occurs across the locations of the prospective joints in long bone elements. The interzone cells produce hyaluronan and an enlarged cavity consisting of articular cartilage and synovium. In knee joints, meniscus and cruciate ligaments are also formed by interzone cells. Our results indicate intraarticular tissues-MSCs share a common origin distinct from extraarticular tissues-MSCs.

There is no explanation as to why PRELP, OGN, and ECRG4 were only expressed in intraarticular MSCs but not in extraarticular MSCs. Nevertheless, they may become a useful marker which can distinguish intraarticular MSCs from extraarticular MSCs. This will be helpful to clarify the mechanisms of healing after intraarticular tissue injury.

Conclusion: MSCs could be isolated from various intraarticular tissues including meniscus and ligament, gene expression profiles of intraarticular tissues-MSCs closely resembled each other, and the higher expressions of PRELP, OGN and ECRG4 were characteristics of intraarticular tissues-MSCs.

References: