

Comparative evaluation of RNA sequencing analysis of neotissue following combined autologous chondrocyte implantation with high tibial osteotomy for femoral cartilage injury with varus deformity versus isolated high tibial osteotomy

Tomoya Iseki, Kanto Ryo, Takuya Iseki, Syota Morimoto, Yoshitaka Nakao, Shunsuke Akai, Shontaro Onishi, Futoshi Morio, Hiroshi Nakayama, Toshiya Tachibana

Department of Orthopaedic Surgery, Hyogo Medical University,

Disclosures: Tomoya Iseki (N), Kanto Ryo (N), Takuya Iseki (N), Shintaro Onishi (N), Yoshitaka Nakao (N), Shunsuke Akai (N), Futoshi Morio(N), Hiroshi Nakayama (N), ,Toshiya Tachibana (N)

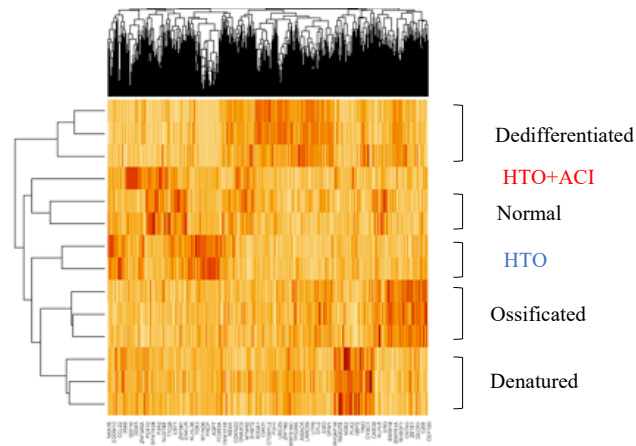
INTRODUCTION: Autologous chondrocyte implantation (ACI) is a commonly performed procedure to repair local articular defects. The effectiveness of this procedure may be limited in case. However, it is unclear whether neo-tissue following combined ACI with high tibial osteotomy for femoral cartilage injury of a middle-aged patient with varus deformity indicating a mild osteoarthritis has the potential to be hyaline-like cartilage.

METHODS: Four patients with a traumatic cartilage injury with a varus of lower limb leg alignment undergoing combined ACI with open wedge HTO aiming at neutral alignment comprised the study population. The mean age at surgery was 61.5 years. The preoperative and postoperative %MA was 18.2% and 56.7%, respectively. As control group, 4 cases matched for age and lower leg deformity to group who underwent high tibial osteotomy. Biopsy was performed for neo-cartilage tissue by a second arthroscopy a year after surgery. Then the histological analysis following Safranin O staining, the cluster analysis of gene expression and the principal component analysis of 3D plots were conducted to evaluate the generation of a more hyaline cartilage phenotype. Knee Injury and Osteoarthritis Outcome Score (KOOS), and the score of the International Knee Documentation Committee (IKDC) Subjective Knee Evaluation Form were used as patient-reported outcome measures.

RESULTS: Neo-tissue stained more strongly for the proteoglycan content (red stain) and the integration at the border of hyaline-like cartilage tissue and subchondral bone without obvious gap was seen. RNA-seq data analysis revealed the cluster of expressed phenotypes in the neo-tissue has a closer enhancement to chondrogenic makers of the chondrocyte cultured from normal humans than the degenerated chondrocyte cultured in an in vitro expansion with IL-1 beta or with BMP, β GP.

DISCUSSION: ACI combined with knee osteotomy may be beneficial in promoting the formation of more hyaline-like cartilage repair tissue by the generation of a more hyaline cartilage phenotype even for middle-age OA patients. Postoperative neutral alignment has an advantage of generating of more hyaline-like cartilage for implanted chondrocyte.

SIGNIFICANCE: This finding suggests that ACI combined with knee osteotomy may be beneficial in promoting the formation of more hyaline-like cartilage repair tissue by the generation of a more hyaline cartilage phenotype even for middle-age OA patients.



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