Cartilage Regeneration – Current Status And Future Perspective

Nobuo Adachi

Department of Orthopaedic Surgery, Institute of Biomedical and Health Science, Hiroshima University, Japan

Treatment of full-thickness cartilage defect of the knee has been challenging, because articular cartilage itself has very limited healing capacity. In 1994, Brittberg et al introduced a new cell technology in which chondrocytes expanded in monolayer culture were implanted into the cartilage defect of the knee. As a second generation of chondrocyte implantation, since 1996, we have performed implantation of tissue-engineered cartilage made ex-vivo for the treatment of full-thickness cartilage defects of the knee.

We evaluated the outcomes of the patients clinically using rating scale, arthroscopically, biomechanically, histologically, and by magnetic resonance imaging (MRI).

As results, implantation of tissue-engineered cartilage eliminated knee locking and reduced pain and swelling in all patients. Clinical rating scale improved significantly postoperatively and maintained at the average of 8.3 years after implantation. Arthroscopic findings were graded as normal or nearly normal according to ICRS grading scale in 94 % of the patients. Biomechanical examination also revealed that the repaired tissues had acquired hardness similar to that of the surrounding normal cartilage. Histological evaluation after implantation showed hyaline cartilage-like tissue generation was observed in most cases, although layer constitution of normal cartilage was not well established. The intensity of repaired tissues on MRI had changed chronologically and was regarded as iso-intensity compared to surrounding normal cartilage.

As conclusion, clinical results of the implantation of tissue-engineered cartilage made ex-vivo for cartilage defect of the knee was successful at the average of 8.3 years after the operation. We would like to propose this procedure as one option for the treatment of full-thickness cartilage defect of the knee.

In this presentation, I present magnetically labelled mesenchymal stem cell injection under the control of external magnetic field as novel treatment for cartilage regeneration.