

Cartilage Repair in Asia: Selected Reports on Research and Clinical Trials

The Asian orthopaedic community has always been in the forefront of basic science research. This, however, has not been replicated in the field of clinical research. In the last decade, awareness in the field of cartilage repair and collaborative efforts among countries has bridged this gap, and this has led to the formation of the Asian Cartilage Repair Society in 2011.

The purpose of this special collection of articles is to highlight the results of cartilage repair with and without cell-based therapy from selected Asian research and clinical teams. The section begins with a review of the research and clinical activities in the region, "Cartilage Repair: 2013 Asian Update," highlighting the difficulties confronted by local researchers and clinicians, which are both different from and in addition to those of their western counterparts. Even so, they have made their good contributions despite these issues. As noted in the article, *in vitro* research activities in Asia have concentrated on the sources of cells, growth-factor supplements, and scaffolds. A majority of the published reports are of animal studies. The following articles were taken from prominent teams as a representation of the efforts in the region. We hope that the subject matter matches the important topics as discussed in the review article.

Both cells and factors are needed for tissue regeneration. Currently, administration of cells genetically engineered to express high levels of selected cytokines is an active area of research. However, the regulatory requirements for gene delivery using retroviral vectors or other biological systems are difficult to satisfy. Hence the work of Shi et al.¹ is included. These investigators were able to demonstrate in an animal model (rabbit) that nanoparticles can be used to deliver a gene with therapeutic potential (bone morphogenetic protein 4 or BMP-4) into mesenchymal stem cells generated from adipose tissue without viral vectors. The cells had increased BMP-4 expression and retained their function after being administered into rabbits.

The next 2 papers are clinical studies, ranging from a retrospective review to a randomized controlled trial. Postprocedure monitoring is necessary to determine the repair process in terms of progress and extent. Li et al.² report that quantitative magnetic resonance imaging can be an effective tool to measure cartilage repair in younger patients with anterior cruciate ligament reconstructions.

Using relaxation time T2 measurements and follow-up of patients for 2 years, the authors noted that T2 can suggest textural changes ahead of morphologic changes. It is possible that early signs of osteoarthritis might be inferred by the use of sequential longitudinal follow-up procedures as earlier shown. Finally, as a representation of clinical trials using mesenchymal stem cells in conjunction with surgery, Wong et al.,³ in a randomized clinical trial, found that patients receiving cultured autologous bone marrow-derived mesenchymal stem cells for knee cartilage repair, when injected with hyaluronic acid after microfracture, experienced significant clinical and radiologic improvement 2 years postoperatively.

It is obviously impossible to cover all areas of research, development, and clinical application in Asia within a limited space. However, our intent is to highlight some of the important achievements in Asia, with the hope that readers can appreciate Asian research activities despite the problems specific to the area. We hope that established researchers will be encouraged to redouble their efforts and young investigators will be spurred on to a career in cartilage repair.

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References

1. Shi J, Zhang X, Zhu J, et al. Nanoparticle delivery of the bone morphogenetic protein 4 gene to adipose-derived stem cells promotes articular cartilage repair *in vitro* and *vivo*. *Arthroscopy* 2013;29:2001-2011.
2. Li H, Tao H, Hua Y, Chen J, Li Y, Chen S. Quantitative magnetic resonance imaging assessment of cartilage status: A comparison between young men with and without anterior cruciate ligament reconstruction. *Arthroscopy* 2013;29:2012-2019.
3. Wong KL, Lee KBL, Tai BC, Law P, Lee EH, Hui JHP. Injectable cultured bone marrow-derived mesenchymal stem cells in varus knees with cartilage defects undergoing high tibial osteotomy: A prospective, randomized controlled clinical trial with 2 years' follow-up. *Arthroscopy* 2013;29:2020-2028.