Medial Open Wedge High Tibial Osteotomy with Bone Marrow Derived Stem Cell for Medial Knee Osteoarthritis

WY Chung, MD, HH Lee, MD

CatholicKwandong University

Disclosures :

The authors do not have a financial interest or other relationship with a commercial company or institutions.

Purpose

To analyze the results of isolated autologous bone marrow derived mesenchymal stem cell (MSC) transplantation in conjunction with multiple drilling and medial opening-wedge high tibial osteotomy (HTO)

Methods & Materials

Thirty knees in 29 patients with unicompartmental osteoarthritic knee and genu varum were allocated to the cell-recipient group (n=15) or control group (n=15). Patients who had more than 2 compartment osteoarthritic knee joint, malalignment of the knee from femoral causes or more than 15 degree varus deformity were excluded. All patients underwent HTO and multiple drilling. The cell-recipient group received transplantation of isolated MSCs with hyaluronic biomaterial and fibrin glue whereas the control group only received microfracture alone. The primary outcome measure was WOMAC score at intervals of 6 months and 1 year postoperatively. Secondary outcome measures were 1-year postoperative Magnetic Resonance Observation of Cartilage Repair Tissue (MOCART) scores and secondary arthroscopic findings at implant removal surgery.

Demographic data		Study group	Control group	P value
Number of patients		15	15	
Age(years)		56.3 ± 3.2	57.2 ± 4.1	0.562
ICRS grade	III	1	8	
	IV	14	7	
K-L grade	II	2	2	
	III	13	13	
BMI		28.1 ± 3.4	27.0 ± 4.1	0.459
Preoperative mechanical axis (varus)		9.1 ± 2.6	10.6 ± 1.3	0.120
Correction angle		10.7 ± 2.2	11.9 ± 1.2	0.143
Follow up (months)		23.1 ± 4.7	26.2 ± 6.1	0.173

Methods & Materials

Arthrotomy, preparation and stem cell transplantation

Abrasion chondroplasty and Subchondral drilling.

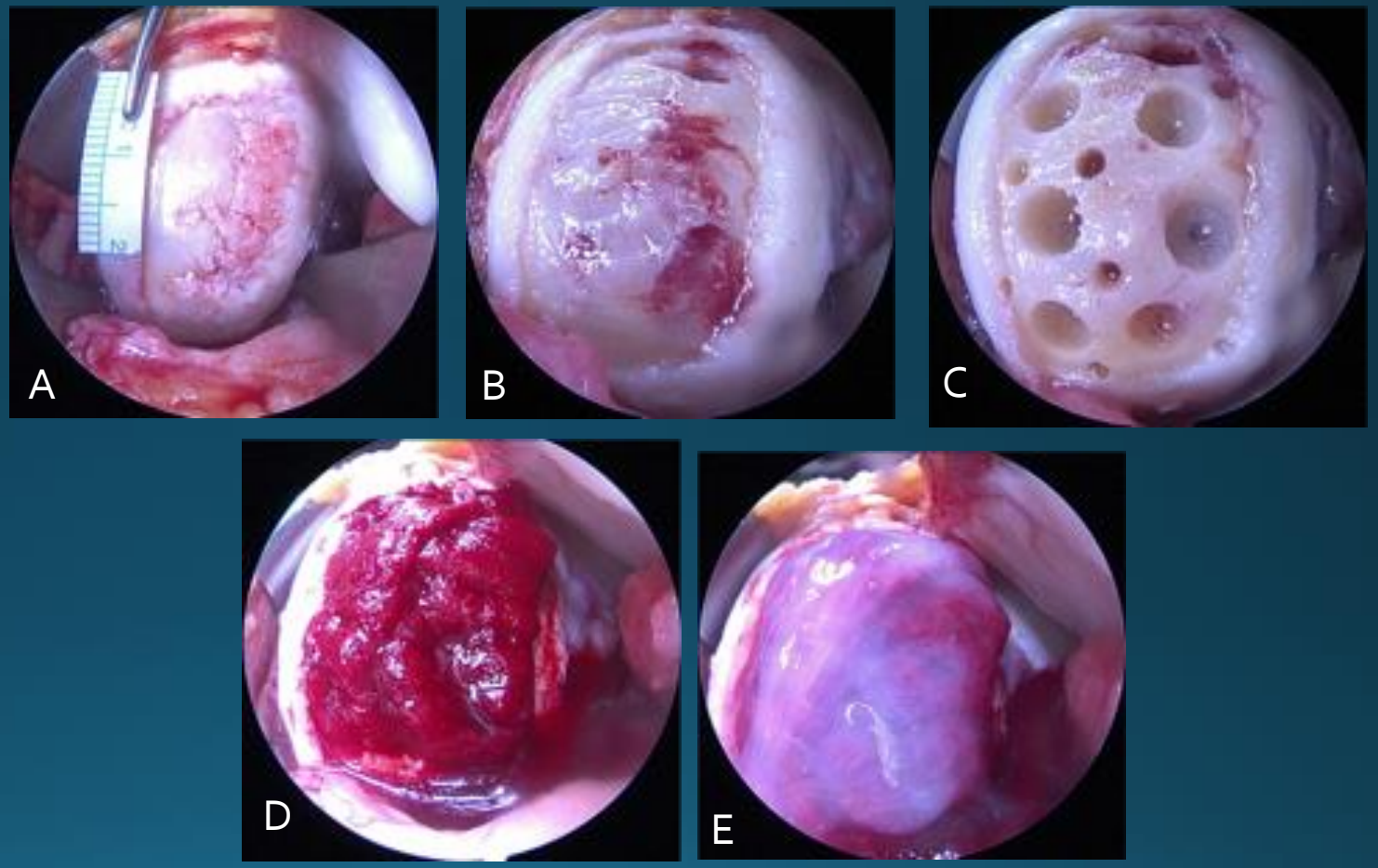
(A) A delaminated cartilage on the medial and central trochlear area of the left knee

(B) Abrasion chondroplasty of cartilage lesion using a 2-mm burr

(C) Marginal trimming and macro (5mm) and micro (1mm) drilling

(D) Hyaluronic biomaterial soaking with bone marrow stem cell transplantation

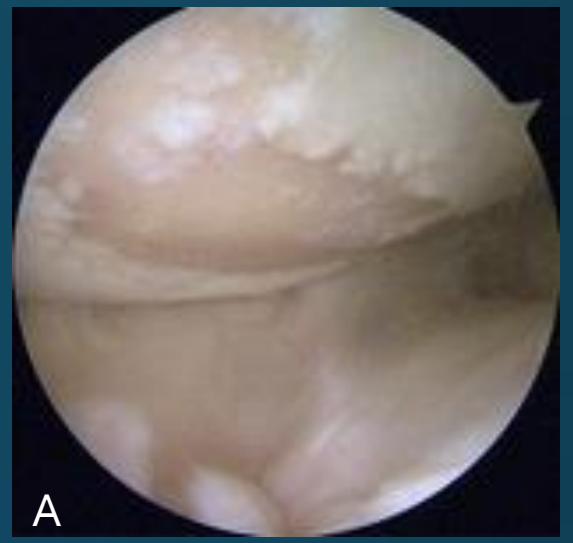
(E) Sealed up using fibrin glue

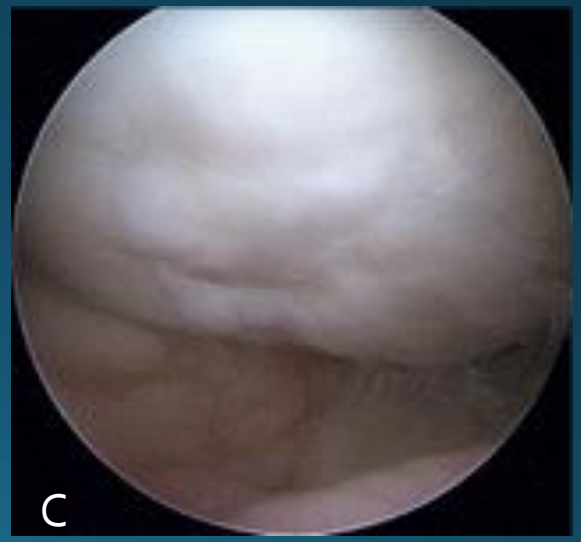


Results
- Arthroscopy

(A) Severe chondral defect lesion of medial chondyle of the left knee

(B,C) Second-look arthroscopy of the regenerated cartilage showed a stable, smooth surface with no delamination. On probing, the regenerated cartilage had the same consistency as the surrounding normal cartilage. Regeneration of previous chondral lesion and hyline cartilage like appearance





Results - Size & Grade

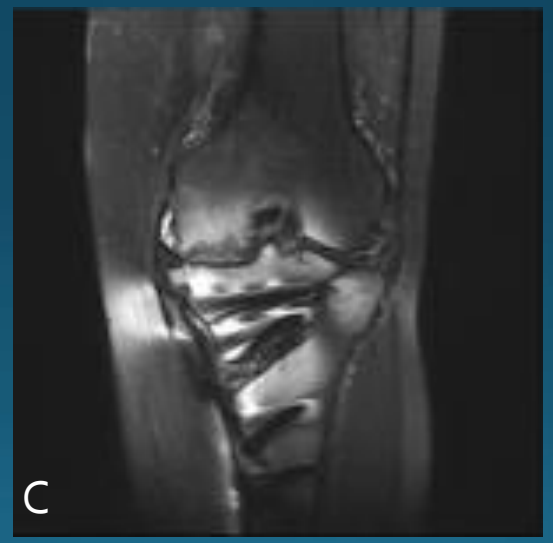
Cartilage repair		Study group	Control group	p value
Preoperative	Defect size (Cm^2)	5.5 ± 0.9	3.5 ± 1.7	0.001
	ICRS grade	3.9 ± 0.3	3.5 ± 0.5	0.011
Postoperative	Coverage size (Cm^2)	4.4 ± 1.0	0.9 ± 0.4	0.000
	Recovery rate (%)	79.6 ± 15.4	32.0 ± 20.9	0.000
	MOCART	73.7 ± 10.4	51.5 ± 10.6	0.000
	Koshino score	2.8 ± 0.4	1.6 ±0.5	0.000

Preoperatively defect size and ICRS grade were larger and more severe in the study group. Postoperatively filling up size and recovery rate of chondral lesion were superior in the study group. MOCART and Koshino score were also better in the stem cell therapy group.

Results
- MRI

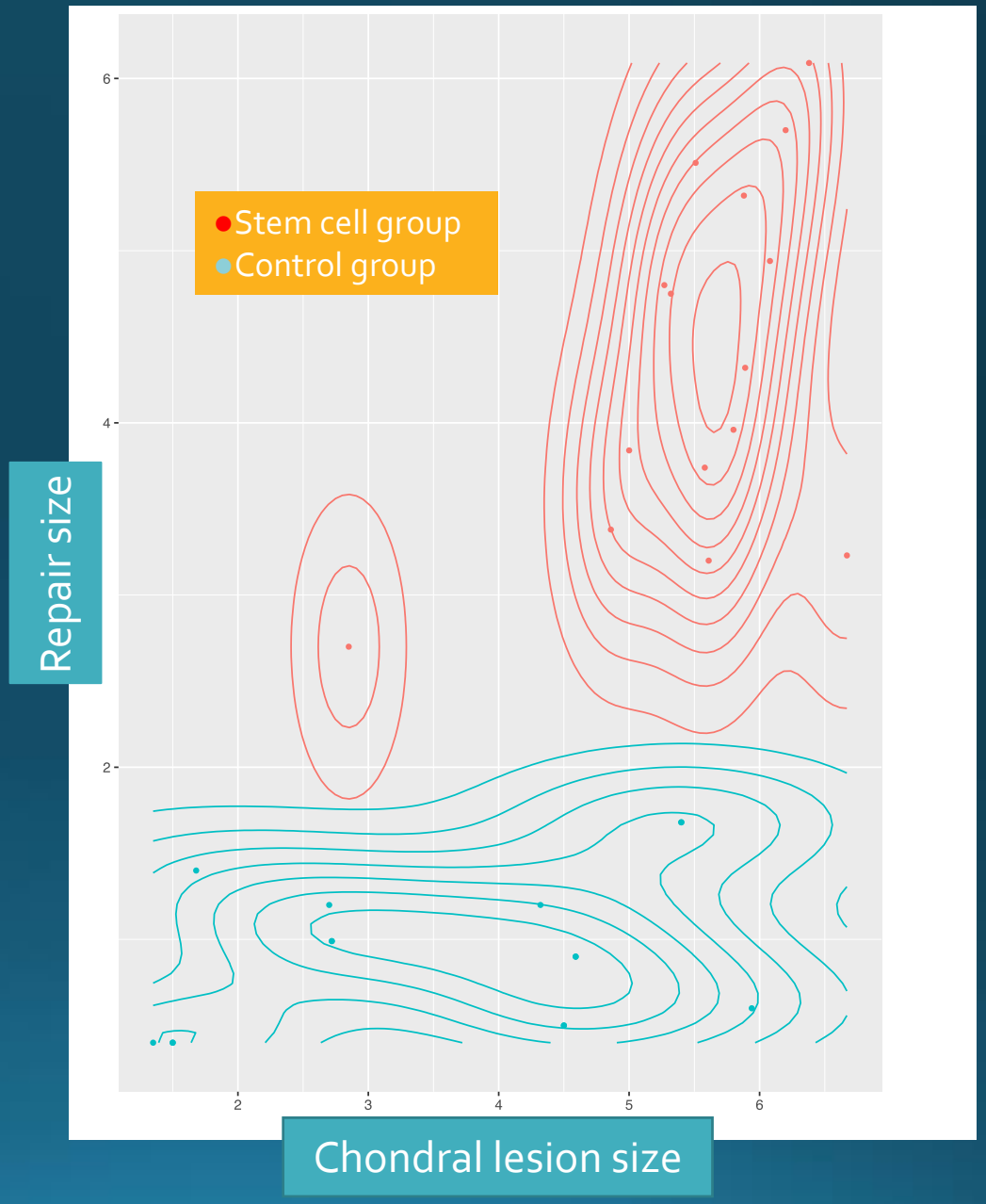
(A,B) Preoperative MRI. Underlying medial femorotibial and patellofemoral compartments with subchondral cysts and focal marrow edema, and multifocal cartilage defects (ICRS grade 3 and 4).

(C,D) Postoperative MRI. Chondral defect lesion was filled up with regenerative tissue and bone marrow edema was found.



Results
- Repair size

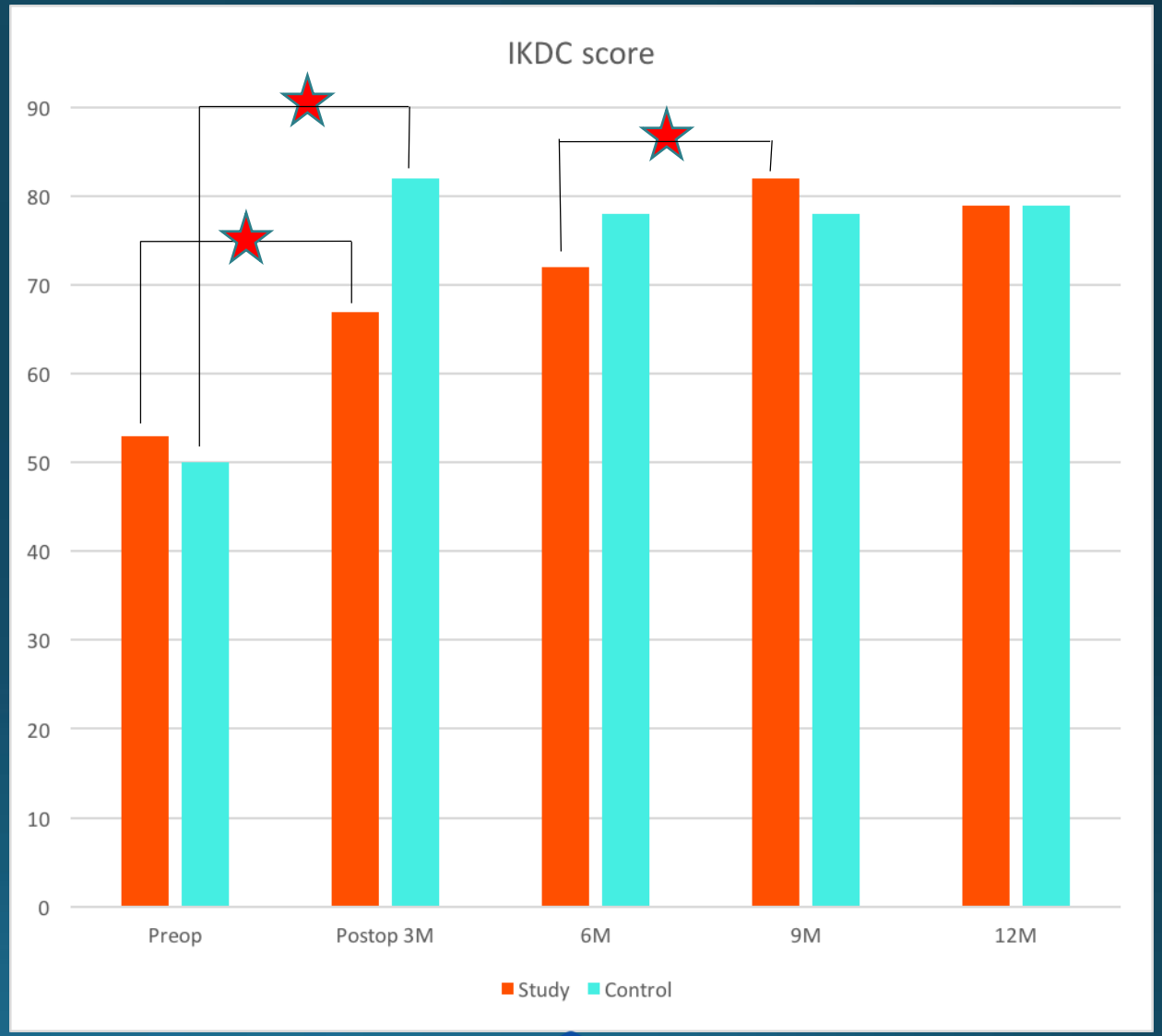
Chondral lesions >4 Cm^2 were significantly filled with regenerative cartilage in the study group over 50 years old patients .



Results
- Knee Score

IKDC subjective scores improved from 51.9 ± 12.3 to 81.1 ± 5.5 in the study group and 50.5 ± 12.8 to 80.2 ± 4.6 in the control group, respectively. ($p<0.001$)

Postoperative 3months, the control group was superior to the study group but after 6months, there were no difference between two groups.



Conclusions

HTO and microfracture procedure improved knee symptom in uni-compartment osteoarthritic patients. And regenerative ability of chondral lesion in superior in isolated autologous bone marrow derived mesenchymal stem cell (MSC) transplantation for patients over 50 years old.

References

Gobbi A, Scotti C, Karnatzikos G, Mudhigere A, Castro M, Peretti GM. One-step surgery with multipotent stem cells and Hyaluronan-based scaffold for the treatment of full-thickness chondral defects of the knee in patients older than 45 years. Knee Surg Sports Traumatol Arthrosc 2016.

Kim KI, Seo MC, Song SJ, Bae DK, Kim DH, Lee SH. Change of Chondral Lesions and Predictive Factors After Medial Open-Wedge High Tibial Osteotomy With a Locked Plate System. Am J Sports Med 2017;45:1615-21.

Saw KY, Anz A, Jee CS, Ng RC, Mohtarrudin N, Ragavanaidu K. High Tibial Osteotomy in Combination With Chondrogenesis After Stem Cell Therapy: A Histologic Report of 8 Cases. Arthroscopy 2015;31:1909-20.

Koshino T, Wada S, Ara Y, Saito T. Regeneration of degenerated articular cartilage after high tibial valgus osteotomy for medial compartmental osteoarthritis of the knee. Knee 2003;10:229-36.

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: The Journal of Arthroscopic & Related Surgery 2013;29:2020-8.

Thank you.

Department of Orthopaedic Surgery,
CatholicKwandong University
International St Marys Hospital,
25, ShimGok Ro 100, Seo-ku,
Incheon 22711, Korea

Whan-Yong Chung, M.D.
E-mail : jhy0707@gmail.com

CATHOLIC KWANDONG UNIVERSITY
INTERNATIONAL ST. MARY'S HOSPITAL