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Preoperative cartilage damage and varus deformity of tibia are factors affecting cartilage status improvement in the medial compartment after open wedge high tibial osteotomy

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Faculty Disclosure Information

- Nothing to disclosure

Background

- It is known that open wedge high tibial osteotomy (OWHTO) reduces load distribution of the medial compartment by moving the load axis outward, and cartilage status improvement in the medial compartment can be expected in some cases.

Matsunaga D, et al. Knee. 2007

- However, its factors had not been thoroughly investigated.

The purposes

- To evaluate factors affecting cartilage status improvement in the medial compartment after OWHTO by comparing cartilage status arthroscopically at the time of OWHTO and second-look

- To investigate factors affecting cartilage status improvement.

Materials and Methods

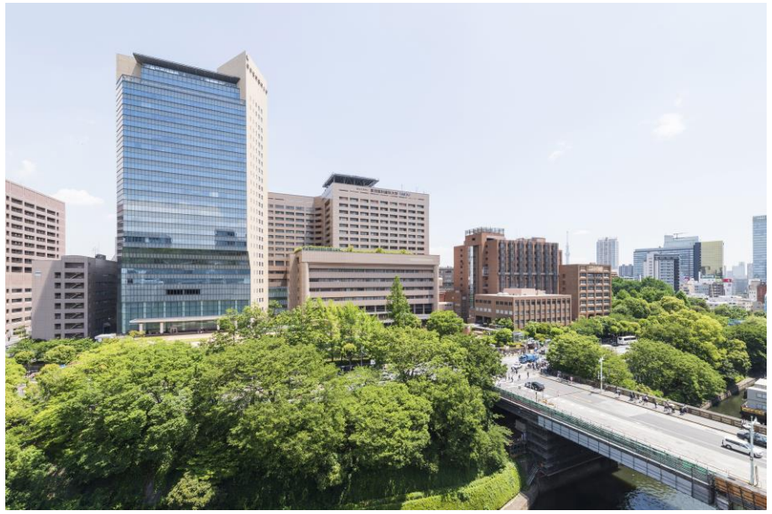
- Single center study

Between：January 2017 and May 2021

N=181 (190 knee) HTO
Registered patients

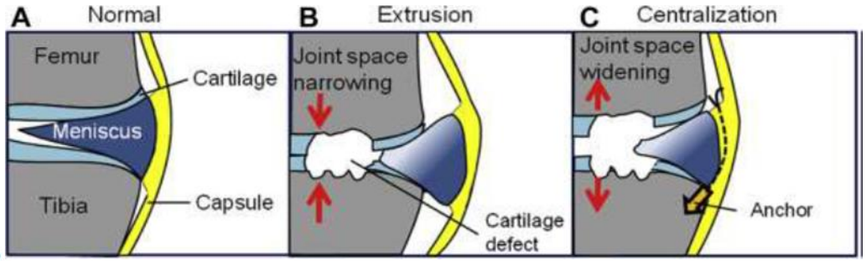
15 Excluded
- CWHTO
- Data lost

N=129 (132 knee) OWHTO
after implant removal surgery



Surgical procedure

- All patients received an arthroscopic examination.
- Arthroscopic procedures included medial meniscus procedure such as repair, partial resection or centralization.
- The weight – bearing line was designed to pass through at 57% after correction.
- Fixe with a locking plate (Tris Medial HTO Plate System; OLYMPUS)
- The gap created by the OWHTO was filled β-tricalcium phosphate (OLYMPUS)

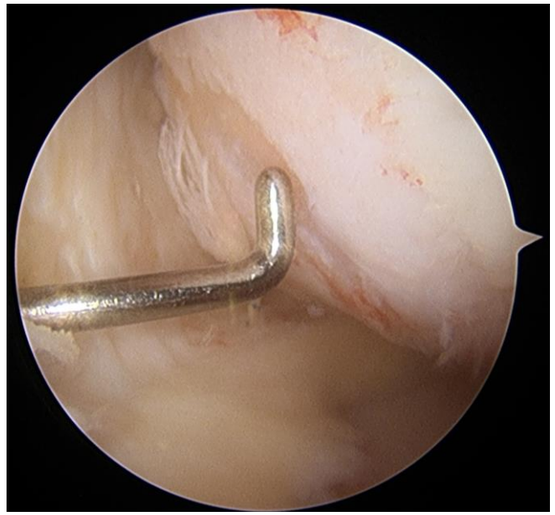


Koga H, Arthrosc Tech, 2017

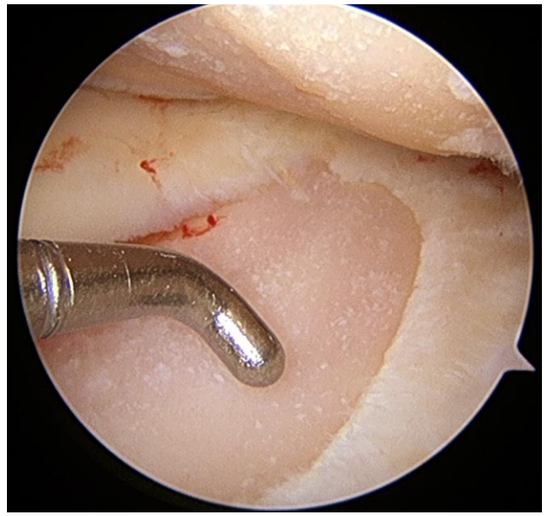
Koga H, Arthrosc Tech.2021

Evaluations

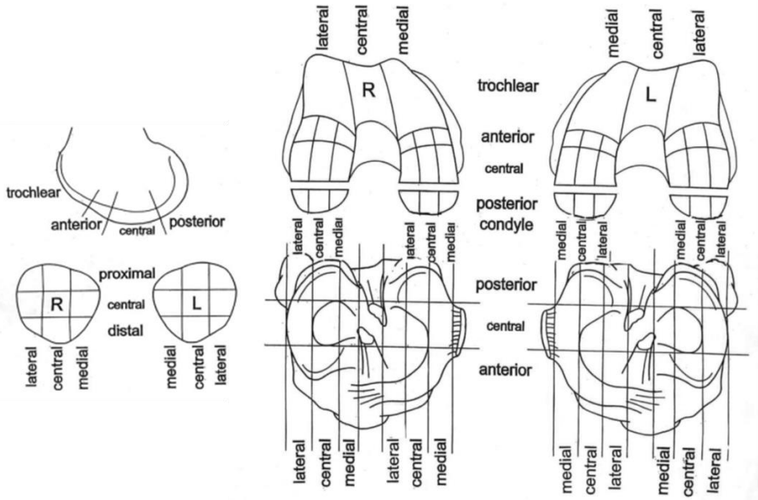
① Cartilage



MFC



MTP



Operation record

- Cartilage in both medial femoral condyle (MFC) and medial tibial plateau (MTP) were divided into 9 subregions (anterior-middle-posterior and internal-central-external) and evaluated arthroscopically according to ICRS classification during initial surgery and second-look at the time of plate removal.

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Evaluations

② The factors affecting cartilage status improvement

The dependent variable

the amount of change in ICRS classification

The independent variables

age, gender, BMI, collection angle, medial meniscus procedures, pre- and post-operative radiographic parameters (%MA, MPTA, LDFA, JLCA), and preoperative ICRS grade

Results

	OWHTO n=129 (132 knees)
Age, years, mean (range)	62 (35-78)
Sex, female/male	79/50
Height, cm, mean (range)	160.8 (143.1-179.0)
Weight, kg, mean (range)	64.3 (39.2-95.4)
BMI, mean (range)	24.9 (18.1-33.9)
Collection angle, degree, mean (range)	8.9 (3-16)
MM Centralization	99

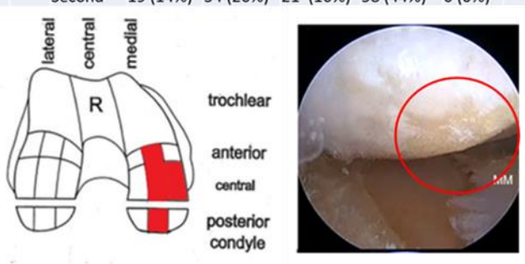
① Cartilage repair

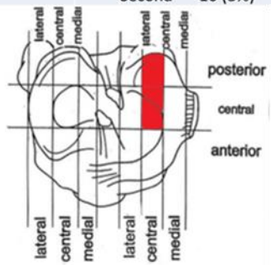
MFC

MFC			ICRS classification					
			grade 0	grade 1	grade 2	grade 3	grade 4	P value
Medial	AM	Primary	18 (4%)	23 (17%)	26 (20%)	64 (48%)	1 (1%)	
		Second	16(12%)	34 (26%)	39 (30%)	43 (32%)	0 (0%)	0.04
	CM	Primary	14 (11%)	17 (13%)	25 (19%)	76 (57%)	0 (0%)	
		Second	15(11%)	21 (16%)	38 (29%)	58 (44%)	0 (0%)	0.16
	PM	Primary	20 (15%)	23 (17%)	26 (20%)	62 (47%)	1 (1%)	
		Second	13 (10%)	32 (24%)	43 (33%)	44 (33%)	0 (0%)	<0.01
Central	AC	Primary	15 (11%)	17 (13%)	13 (10%)	85 (64%)	2 (2%)	
		Second	12 (9%)	24 (18%)	39 (30%)	57 (43%)	0 (0%)	<0.01
	CC	Primary	7 (5%)	18 (14%)	10 (8%)	96 (72%)	1 (1%)	
		Second	10 (8%)	19 (24%)	29 (22%)	74 (56%)	0 (0%)	0.18
	PC	Primary	18 (14%)	11 (8%)	23 (17%)	79 (60%)	1 (1%)	
		Second	10 (8%)	25 (19%)	30 (23%)	67 (51%)	0 (0%)	<0.01
Lateral	AL	Primary	23 (17%)	20 (15%)	16 (12%)	72 (55%)	1 (1%)	
		Second	19 (14%)	30 (23%)	30 (23%)	53 (40%)	0 (0%)	0.06
	CL	Primary	16 (12%)	19 (14%)	15 (11%)	81 (61%)	1 (1%)	
		Second	16 (12%)	27 (20%)	23 (17%)	66 (50%)	0 (0%)	0.03
	PL	Primary	20 (15%)	21 (16%)	23 (17%)	67 (51%)	1 (1%)	
		Second	19 (14%)	34 (26%)	21 (16%)	58 (44%)	0 (0%)	0.07

MTP

MTP			ICRS classification					
			grade 0	grade 1	grade 2	grade 3	grade 4	P value
Medial	AM	Primary	4 (3%)	19 (14%)	48 (36%)	61 (46%)	0 (0%)	
		Second	9 (7%)	36 (27%)	48 (36%)	39 (22%)	0 (0%)	<0.01
	CM	Primary	2 (2%)	9 (7%)	50 (38%)	71 (54%)	0 (0%)	
		Second	4(3%)	30 (23%)	48 (36%)	50 (38%)	0 (0%)	<0.01
	PM	Primary	1 (1%)	17 (13%)	41 (31%)	73 (55%)	0 (0%)	
		Second	3 (23%)	27 (20%)	56 (42%)	46 (35%)	0 (0%)	<0.01
Central	AC	Primary	3 (23%)	17 (13%)	45 (34%)	67 (51%)	2 (2%)	
		Second	7 (5%)	34 (26%)	48 (36%)	43 (33%)	0 (0%)	<0.01
	CC	Primary	0 (0%)	10 (8%)	28 (21%)	94 (71%)	0 (0%)	
		Second	1 (1%)	19 (14%)	43 (33%)	69 (51%)	0 (0%)	<0.01
	PC	Primary	1 (11%)	16 (12%)	28 (21%)	86 (65%)	1 (1%)	
		Second	2 (2%)	27 (20%)	41 (31%)	62 (47%)	0 (0%)	<0.01
Lateral	AL	Primary	13 (10%)	31 (23%)	39 (30%)	49 (37%)	0 (0%)	
		Second	11 (8%)	41 (31%)	50 (38%)	30 (23%)	0 (0%)	0.02
	CL	Primary	11 (8%)	22 (17%)	33 (25%)	66 (50%)	0 (0%)	
		Second	7 (5%)	34 (26%)	44 (33%)	47 (36%)	0 (0%)	0.03
	PL	Primary	15 (15%)	19 (14%)	32 (24%)	65 (49%)	1 (1%)	
		Second	10 (8%)	34 (26%)	47 (36%)	40 (30%)	0 (0%)	0.01





- At the time of initial surgery, ICRS classification of grade 3 or higher was more common at the central to internal subregions in the MFC and at the central subregions in the MTP.
- At the second-look surgery, following subregions of the MFC did not show significant cartilage status improvement; posterior-internal, posterior-external and anterior-external, while other subregions of the MFC and all subregions of MTP showed significant improvement.

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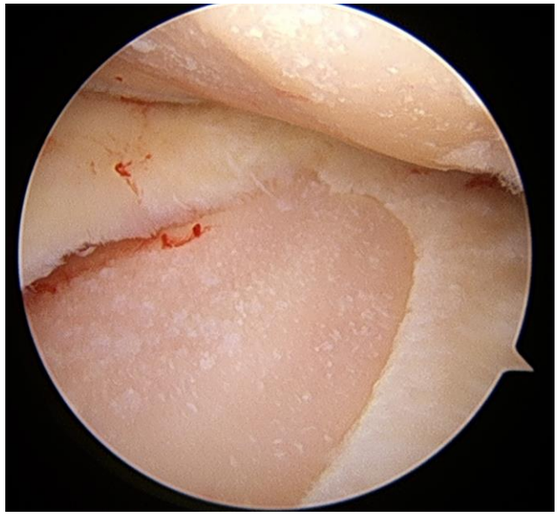
② The factors affecting cartilage status improvement

- Worse preoperative ICRS grade was detected as a factor in all MFC and MTP subregions where cartilage improvement was observed. Furthermore, smaller preoperative MPTA was also detected in middle-central regions of MFC.

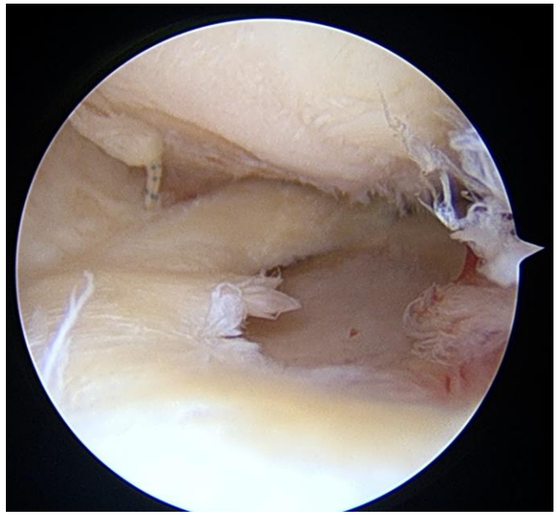
Case 69 y.o. Male

Rt.OWHTO+MM Centralization



Primary

After centralization



Second look

Discussions

- The regeneration of degenerated articular cartilage can be expected while correcting a varus deformity after OWHTO without any additional procedures.

Kim K et al. Am J Sports Med 2017

- Cartilage regeneration is affected by BMI, the difference between the MFC and MTP, preoperative cartilage degeneration grade, and postoperative limb alignment.

Kumagai K, et al. Knee Surg Sports Traumatol Arthrosc.2017

- The current study suggested that OWHTO affected the positive effect for cartilage status at loading area by reducing load distribution of the medial compartment.

Conclusions

The preoperative cartilage status affected cartilage repair in the medial compartment and the preoperative varus deformity of tibia affected cartilage repair at loading area of femur.