ISAKOS 2025
Munich, Germany
June 7-11th, 2025

Preoperative Knee Cartilage Condition in the Patellofemoral Joint Results in Worse Clinical Outcome Scores 2 Years After Inverted V-shaped High Tibial Osteotomy

Dai Sato[1], Yeonseok Jo[1], Taku Ebata[1], Yoshiaki Hosokawa[1], Koji Iwasaki[1], Masatake Matsuoka[1], Tomohiro Onodera[1], Eiji Kondo[2], Norimasa Iwasaki[1]

[1]Department of Orthopedic Surgery, Hokkaido University Graduate School of Medicine, Sapporo, Japan,
[2] Centre for Sports Medicine, Hokkaido University Hospital, Sapporo, Japan.

Disclosure

Presentation Title: Preoperative Knee Cartilage Condition in the Patellofemoral Joint Results in Worse Clinical Outcome Scores 2 Years After Inverted V-shaped High Tibial Osteotomy

Presenter's Name: Dai Sato

We have no conflicts.

Clinical outcomes after iV-HTO

- iV-HTO is a useful surgical option for medial OA of the knee [1]
- iV-HTO has also demonstrated favorable outcomes in patients with medial OA of the knee combined with patella femoral (PF) OA [2]
- Influence of preoperative detailed condition of the knee on postoperative outcomes remains unclear

Hypothesis

- Patients with worse preoperative knee cartilage quality on MRI will have worse postoperative outcome survey scores at 2 years follow-up

Purpose

- To investigate how the preoperative anatomic condition of the knee, as assessed by MRI, correlates with postoperative outcomes

Study design

- Patients who underwent iV-HTO for knee osteoarthritis (2015-2022)
  - ✓ Inclusion criteria：Minimum of 2 years follow-up
  - ✓ Exclusion criteria：Knee ligamentous injury, history of revision surgery
- 48 knees (39 patients) were included in the study
  - ✓ Average age: 55.1 years (± 9.1 SD)
  - ✓ 15 men, 24 women
  - ✓ The average BMI was 28.0 (± 3.7 SD)
- Indication for iVHTO [3]
  - ✓ Valgus correction of more than 10 degrees
  - ✓ Valgus correction of less than 10 degree in patients with mild PF OA

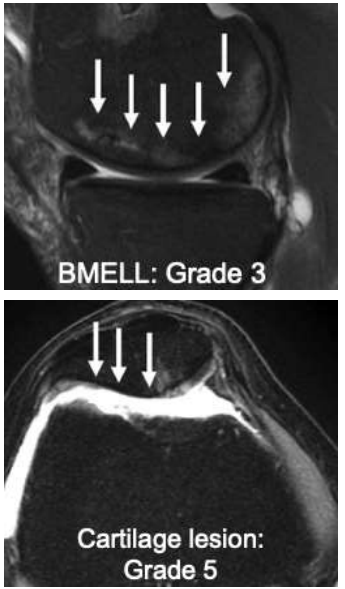
Clinical and radiological examination

- Clinical outcomes at preoperatively and 2 years postoperatively
  - ✓ Lysholm score, Knee Osteoarthritis and Injury Outcome Score (KOOS)

- Radiological parameters at preoperatively and 2 years postoperatively
  - ✓ Hip knee angle (HKA), Percent of mechanical axis (%MA), Femoral-tibial angle (FTA), Medial proximal tibial angle (MPTA)

- Assessment of intra-articular condition of the knee at preoperatively
  - ✓ Whole Organ Magnetic Resonance Imaging Score (WORMS) [4,5]

Calculating WORMS and Statistical analysis



- WORMS summation scores were calculated for each lesion type in each compartment for each exam [4, 5]
  - ✓Lesion type (6 sub scale)

    Meniscus, Ligament, Cartilage,

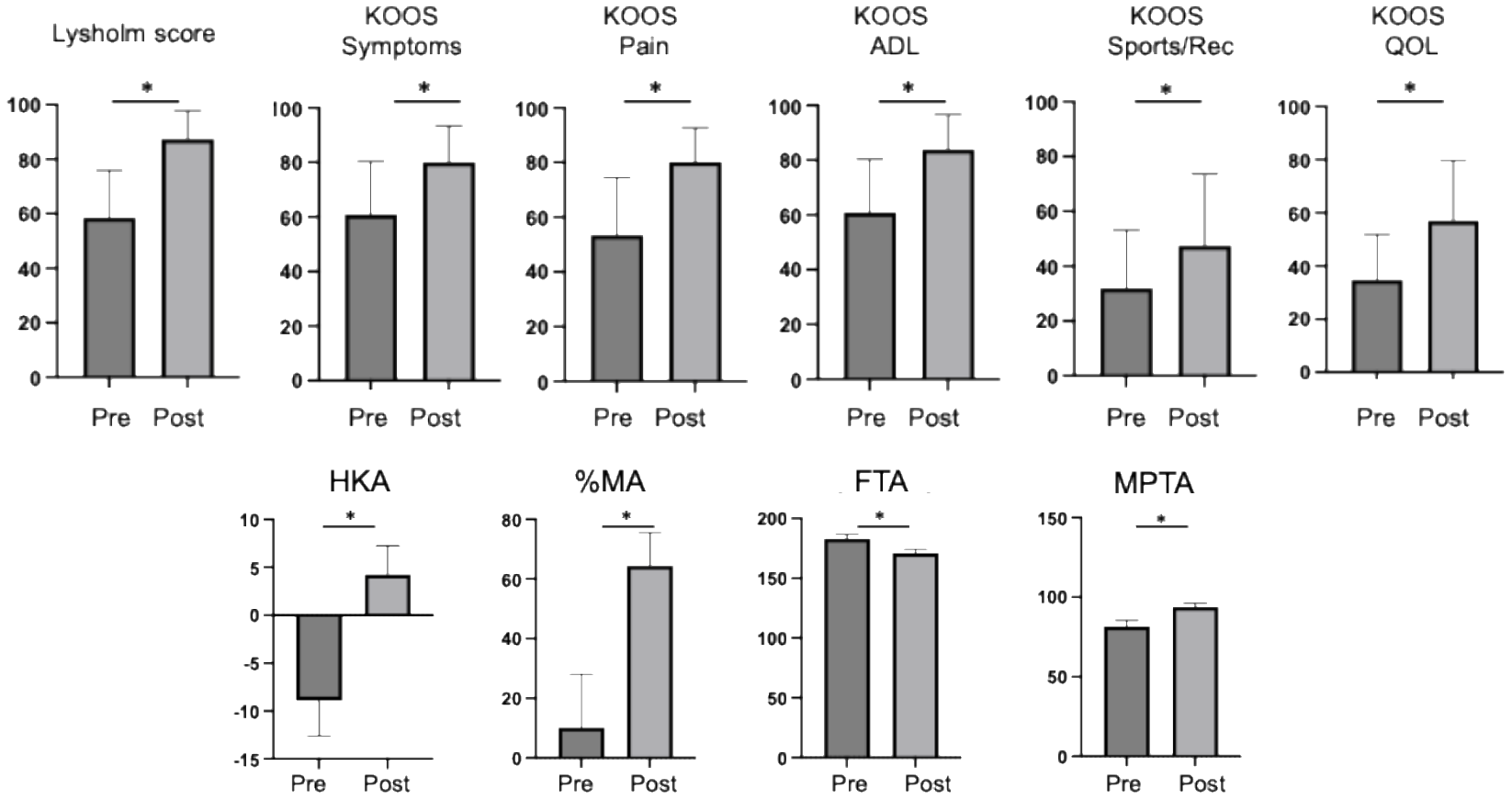
    Bone marrow edema like lesions (BMELL),

    Subchondral cyst-like lesions, Joint effusion

- An orthopedic surgeon (over 10 years of experience) to calculate the scores

- Statistical analysis
  - ✓Pearson correlation tests, paired t-tests（p = 0.05.）

Clinical and radiological outcomes



Correlations between Pre-op WORMS for each lesion type and Post-op KOOS

	KOOS Symptoms and stiffness		KOOS Pain		KOOS ADL		KOOS sport/rec		KOOS QOL	
	r	p	r	p	r	p	r	p	r	p
WORMS										
Meniscus lesions	-0.042	0.78	0.011	0.94	0.074	0.62	0.049	0.74	0.100	0.51
Ligament	-0.21	0.16	-0.001	0.99	-0.194	0.20	-0.008	0.96	-0.140	0.36
Cartilage defects	**-0.35**	**0.017**	-0.113	0.45	-0.183	0.23	-0.191	0.20	-0.093	0.54
BMELL	-0.073	0.63	0.027	0.40	0.027	0.85	-0.215	0.15	-0.066	0.66
Subchondral cyst	-0.050	0.74	0.192	0.20	0.188	0.21	-0.110	0.47	-0.080	0.60
Effusion	0.009	0.95	0.035	0.81	-0.109	0.47	-0.132	0.38	0.025	0.86
Total	-0.291	0.052	-0.033	0.83	-0.10	0.48	-0.199	0.19	-0.086	0.57

There was a significant correlation between cartilage defects and the postoperative KOOS Symptoms and Stiffness

Correlations between Pre-op WORMS for cartilage in each region and Post-op KOOS

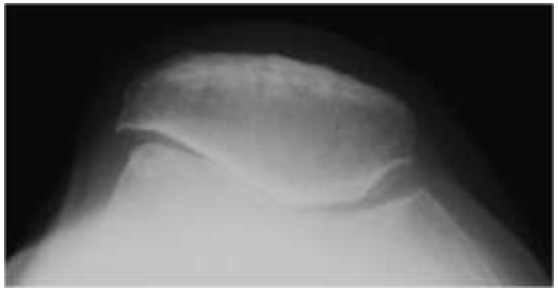
	KOOS Symptoms and Stiffness		KOOS Pain		KOOS Function, daily living		KOOS, sport/rec		KOOS QOL		KOOS Total	
	r	p	r	p	r	p	r	p	r	p	r	p
Cartilage in each region												
Patella	**-0.47**	**0.0010**	**-0.39**	**0.0065**	-0.28	0.054	**-0.33**	**0.023**	**-0.29**	**0.049**	**-0.40**	**0.0056**
Trochlea	**-0.33**	**0.024**	-0.19	0.19	-0.22	0.13	-0.15	0.32	-0.12	0.39	-0.24	0.10
Medial femoral condyle	-0.27	0.070	0.058	0.70	-0.013	0.93	-0.001	0.99	0.030	0.84	-0.047	0.76
Lateral femoral condyle	-0.064	0.67	-0.074	0.62	-0.13	0.39	0.039	0.80	0.025	0.87	-0.068	0.65
Medial tibial condyle	-0.12	0.40	0.039	0.80	-0.079	0.60	-0.21	0.15	-0.026	0.86	-0.11	0.45
Lateral tibial condyle	-0.065	0.67	-0.005	0.97	-0.072	0.64	0.056	0.71	0.024	0.87	-0.020	0.89

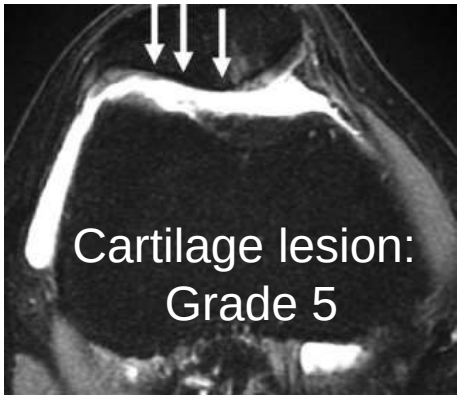
There was a significant correlation between PF joint and the postoperative KOOS sub scale

The present study

- MRI assessments, particularly the WORMS cartilage condition, negatively influenced clinical outcomes after iV-HTO

- Specifically, a higher WORMS cartilage score in PF joint negatively influenced clinical outcomes at the 2-year follow-up





Influence of PFOA on clinical outcomes after HTO

- Lateral closed wedge high tibial osteotomy (including iV-HTO) shows mid-term success in varus knee combined with PF joint OA [2,6]
  - ✓ It may improve PF joint congruity
- This study suggested that poorer cartilage condition in the PF joint could influence postoperative outcomes following iV-HTO
- Further study needs to determine the influence of PFOA on clinical outcomes after iv-HTO

Conclusion

- This study suggested that poorer cartilage condition in the PF joint could influence postoperative outcomes following iV-HTO

1) Aoki Y, Yasuda K, Mikami S, Ohmoto H, Majima T, Minami A. Inverted V-shaped high tibial osteotomy compared with closing-wedge high tibial osteotomy for osteoarthritis of the knee. Ten-year follow-up result. J Bone Joint Surg Br. 2006 Oct;88(10):1336-40.

2) Kondo E, Yabuuchi K, Joutoku Z, Matsubara S, Iwasaki K, Matsuoka M, Onodera T, Momma D, Inoue M, Yagi T, Iwasaki N, Yasuda K. Effect of the Inverted V-Shaped Osteotomy on Patellofemoral Joint and Tibial Morphometry as Compared With the Medial Opening Wedge High Tibial Osteotomy. Am J Sports Med. 2022 Jul;50(9):2439-2452.

3) Kondo E, Yasuda K, Yabuuchi K, Aoki Y, Inoue M, Iwasaki N, Yagi T. Inverted V-Shaped High Tibial Osteotomy for Medial Osteoarthritic Knees With Severe Varus Deformity. Arthrosc Tech. 2018 Sep 10;7(10):e999-e1012. doi: 10.1016/j.eats.2018.06.005. PMID: 30377579; PMCID: PMC6203232.

4) Peterfy CG, Guermazi A, Zaim S, Tirman PF, Miaux Y, White D, Kothari M, Lu Y, Fye K, Zhao S, Genant HK. Whole-Organ Magnetic Resonance Imaging Score (WORMS) of the knee in osteoarthritis. Osteoarthritis Cartilage. 2004 Mar;12(3):177-90.

5) Joseph GB, Baum T, Alizai H, Carballido-Gamio J, Nardo L, Virayavanich W, Lynch JA, Nevitt MC, McCulloch CE, Majumdar S, Link TM. Baseline mean and heterogeneity of MR cartilage T2 are associated with morphologic degeneration of cartilage, meniscus, and bone marrow over 3 years--data from the Osteoarthritis Initiative. Osteoarthritis Cartilage. 2012 Jul;20(7):727-35.

6) Ishimatsu T, Takeuchi R, Ishikawa H, Yamaguchi Y, Maeyama A, Osawa K, Jung WH. Hybrid closed wedge high tibial osteotomy improves patellofemoral joint congruity compared with open wedge high tibial osteotomy. Knee Surg Sports Traumatol Arthrosc. 2019 Apr;27(4):1299-1309.