Image characteristics as predictors for the reinjury after anterior cruciate ligament reconstruction

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Disclosures:

- I have no actual or potential conflict of interest in relation to this program/presentation.

Identification of risk factors for ACL reinjury is important

Younger patients

Andernord et al. Am J Sports Med. 2015

Maletis et al. Am J Sports Med. 2015

Kaeding et al. Am J Sports Med. 2015

Allograft tissue

Maletis et al. Bone Joint J. 2013

Borchers et al. Am J Sports Med. 2009

Surgical technique

Andernord et al. Am J Sports Med. 2015

Body mass index

Maletis et al. Am J Sports Med. 2015

Posterior tibial slope

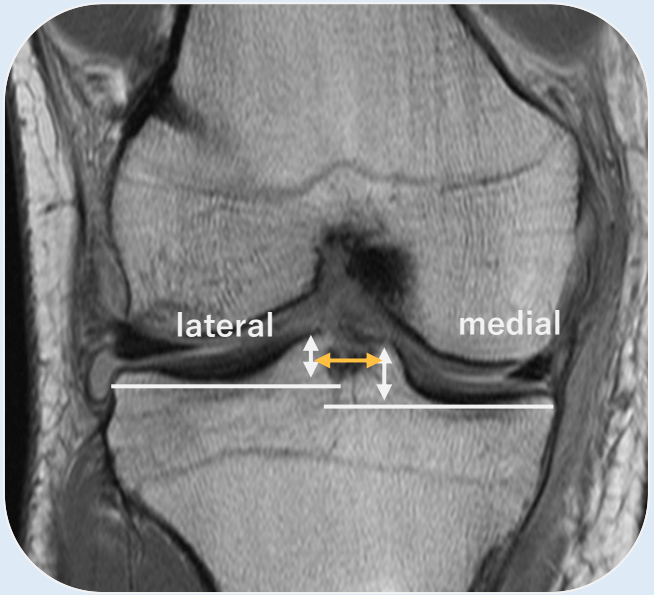
Webb et al. Am J Sports Med. 2013

There are many reports of morphological evaluation as a risk factor for ACL tear.

Harner et al. Arthroscopy . 1999
Kawaguchi et al. Arthroscopy . 2015
Iriuchishima et al. Knee Surg Sports Traumatol Arthrosc. 2016
Lansdown et al. Clin Sports Med. 2018

Few reports have been published on the morphological evaluation of cases of reinjury after ACL reconstruction.
There are few reports of morphological evaluation of patients with reinjury after ACL reconstruction.

About Tibial spine height



Previous Reports

In a comparison of first ACL tear cases and normal knees

Medial/lateral spine height tends to be lower in ACL tear cases (no significant difference)

Iriuchishima et al. Knee Surgery,Sports Traumatology, Arthroscopy. 2020

Tibial spine height is lower in ACL tear cases

Bhuiyan et al. Multimed Tools Appl. 2018

Tibial spine height is significantly lower in patients with concomitant meniscus injury than in those with ACL injury

Peixu et al. J Orthop Surg Res. 2022

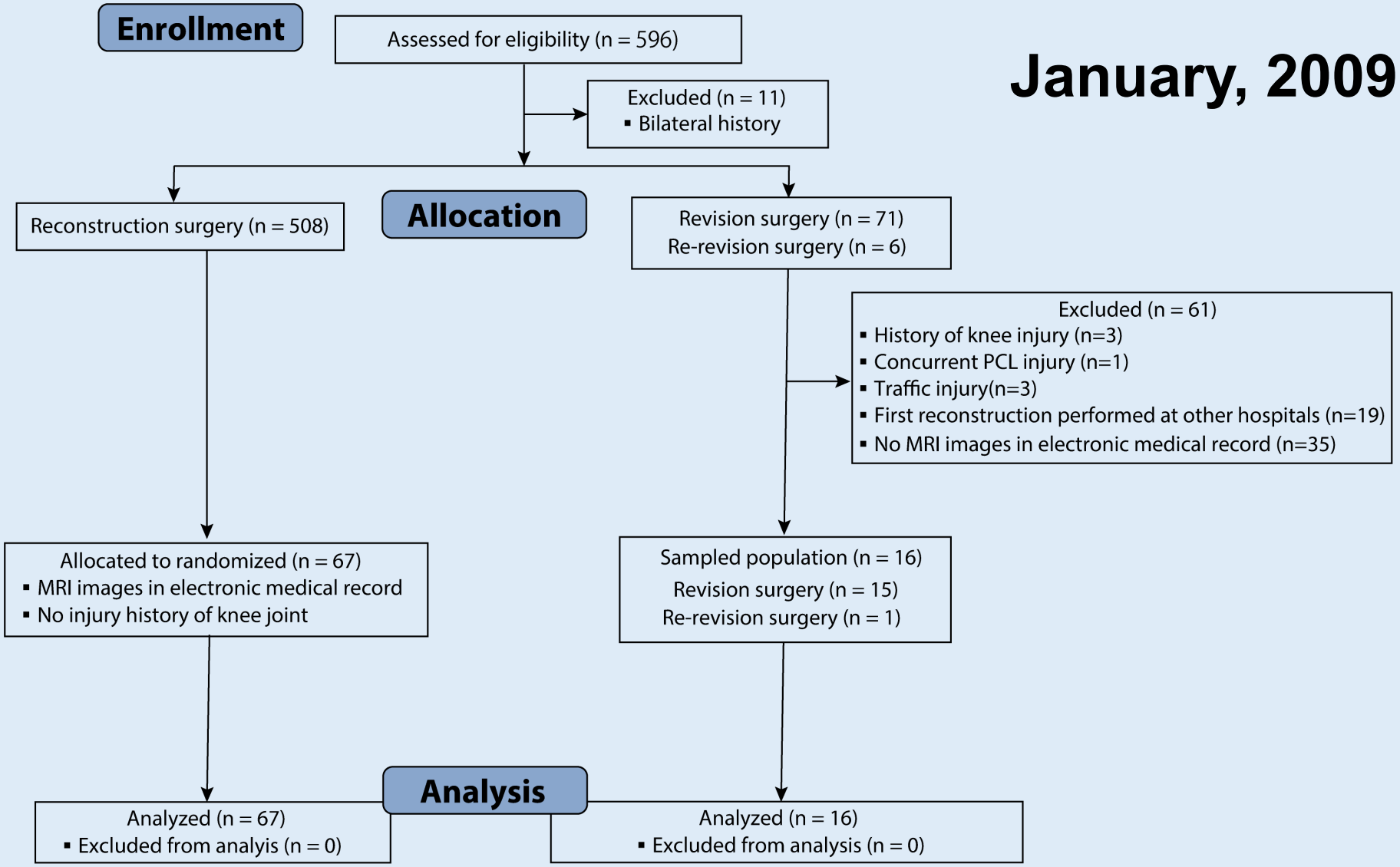
Is Tibial spine height a factor suggesting knee stability?

Purpose

Investigate whether the tibial spine height is different before and after surgery in cases of reinjury following ACL reconstruction, using MRI for imaging analysis.

Target population

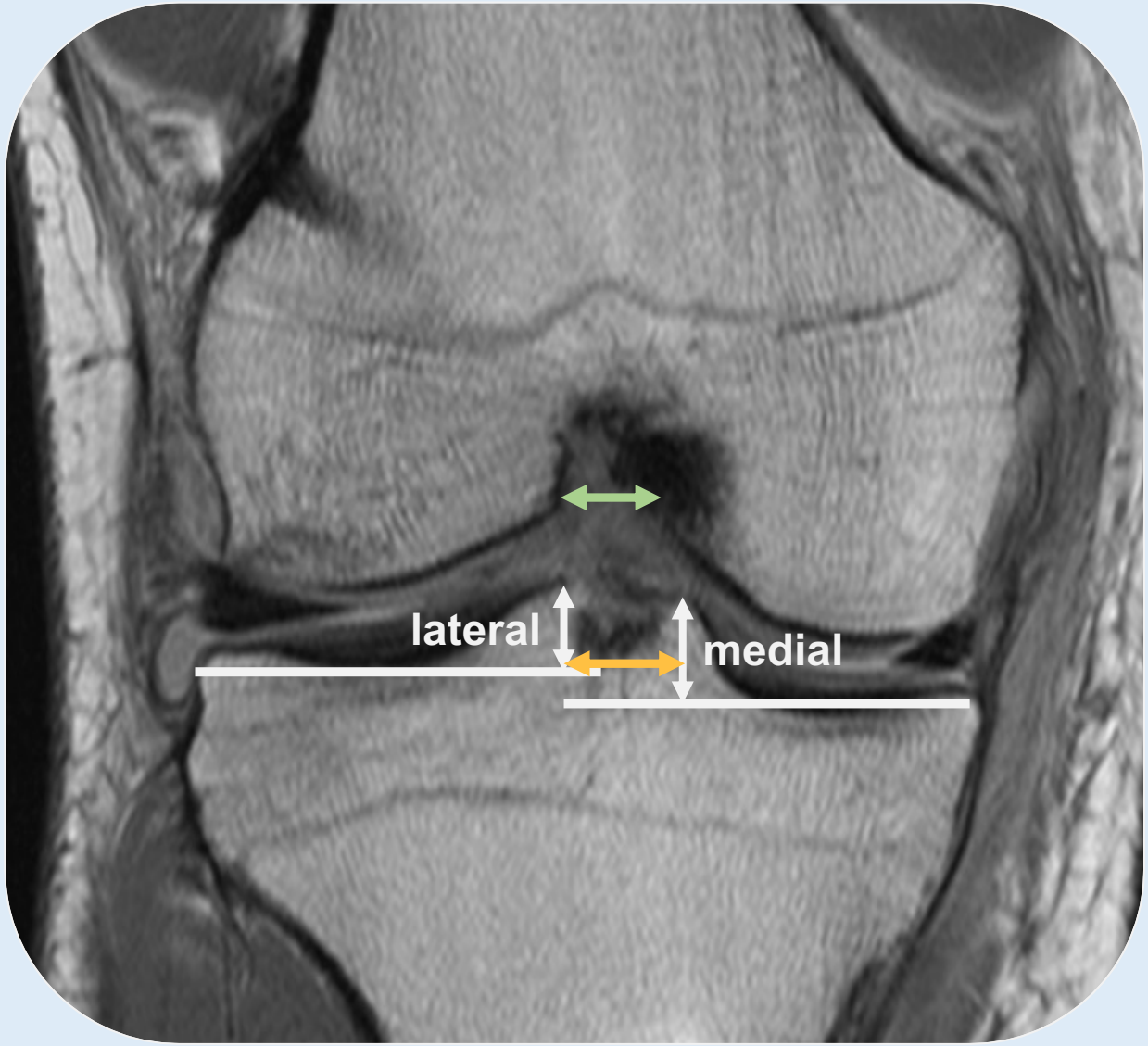
January, 2009 - April, 2020



Patients	Cases of ACL reconstruction surgery (including re-reconstruction) performed at our hospital from 2009 to 2020.
Exposure	16 cases of reinjury (including re-reinjury)
Compare	67 cases of first-time tears only (followed for more than 2 years)
Outcome	Difference in tibial spine height before and after surgery

Image examination item:

- The difference in tibial spine height between pre- and post-operation (in cases of reinjury, immediately after reinjury; in cases of initial rupture, one year after the operation)
- Tibial slope(medial/lateral)
- Notch width index



medial・lateral tibial spine height(mth/lth)

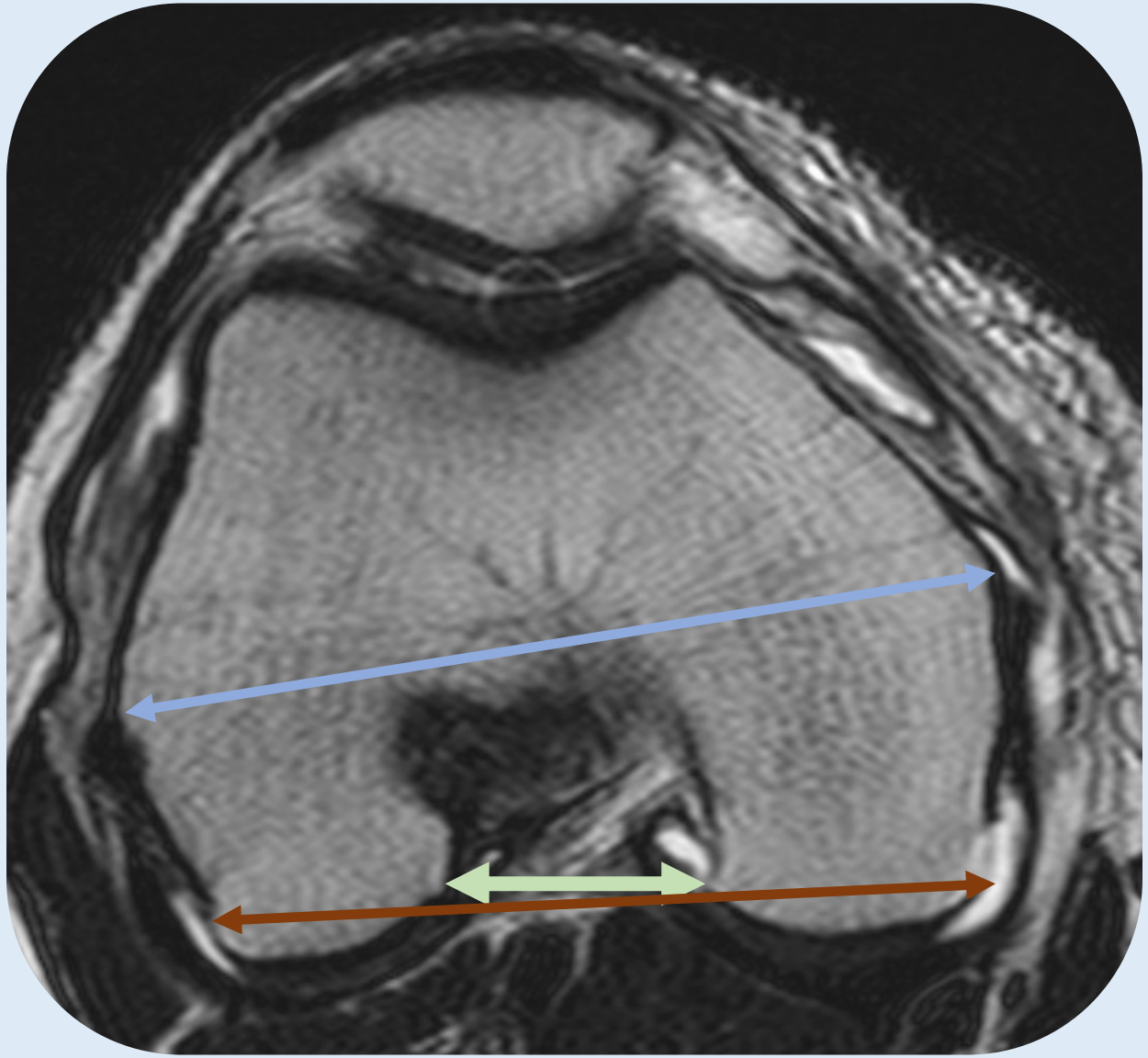
tibial spine width(TSW)

NWp:
Notch Widths at the level of popliteal sulcus

NWj:
Notch Widths at the level joint line

Difference of mth, lth and tsw
= mth at 1 year after surgery or reinjury – mth at first reconstruction

Peixu et al. J Orthop Surg Res. 2022



Longest trans-epicondylar length

Notch outlet length(A)

Length between medial and lateral posterior condyle(B)

Notch width index= A/B × 100%

Statistical Examination

Iriuchishima et al. Knee Surgery,Sports Traumatology, Arthroscopy. 2020

Results

Baseline Data of Patients *

	non reinjury (N = 67)	reinjury (N = 16)	P Value†
Age(yr)	20.6±8.1	19.1±5.8	0.48
Female sex(no.[%])	34(51%)	8(50%)	0.92
Height(m)	1.65±0.09	1.65±0.08	0.99
Weight(kg)	65.7±17.0	64.9±17.8	0.88
BMI(kg/m/m)	23.3±3.9	23.5±4.7	0.90
Duration between injury and surgery(month)	3.7±1.8	3.2±2.2	0.99
Observation period(month)	34.9±9.5	65.9±26.6	0.0001
Contact injury(no.[%])	12(18%)	5(31%)	0.23
Duration between surgery and reinjury(month)	N	22.7±23.6	N
Tegner before surgery	6.6±1.2	7.2±1.3	0.1
Tegner after surgery	6.2±1.3	7.1±1.4	0.01
Augumentation(no.[%])	39(58%)	11(69%)	0.57

* The values are given as the mean and standard deviation.

†Two-sample t test (continuous measures) or chi-square test(sex, contact injury and augumentation) for between noninjury and reinjury.

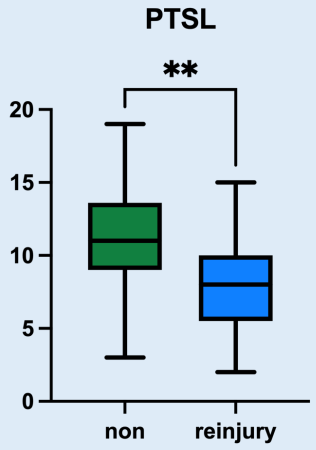
Image Results of Data *

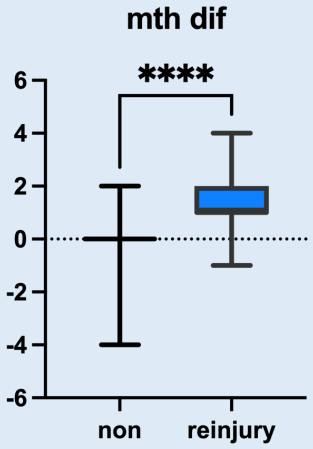
	non reinjury (N = 67)	reinjury (N = 16)	P Value†
Posterior Tibial Slope of Medial side	11.2±3.2	9.5±4.0	0.15
Posterior Tibial Slope of Lateral side	11.0±3.6	8.2±3.6	0.008
Notch Width at the level of popliteal sulcus	16.3±3.1	16.6±2.0	0.61
Notch Width at the level of joint line	17.0±3.0	17.1±3.9	0.87
Medial Tibial Height(MTH)	10.1±1.7	9.1±1.6	0.01
Lateral Tibial Height(LTH)	8.4±1.3	7.8±1.0	0.12
Tibial Spine Width(TSW)	11.5±1.8	11.2±1.3	0.71
Notch Outlet Length	21.0±5.8	19.7±3.1	0.32
Length between lateral and medial posterior condyle	64.8±9.0	65.2±5.7	0.96
Notch Width Index	32.5±3.8	30.1±4.0	0.15
Difference of MTH	-0.18±0.92	1.49±1.2	0.0001
Difference of LTH	-0.12±0.9	0.59±0.8	0.001
Difference of TSW	-0.015±1.15	0.06±1.2	0.82

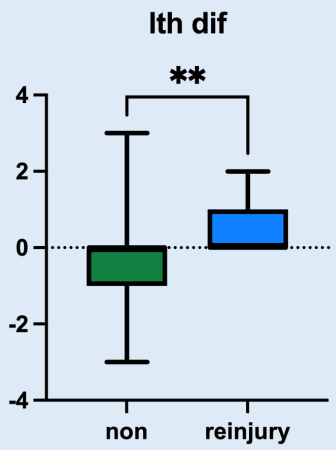
* The values are given as the mean and standard deviation.

†Two-sample t test (continuous measures) for between noninjury and reinjury.

PTSL: posterior tibial slope of lateral
mth: medial tibial height
lth: lateral tibial height



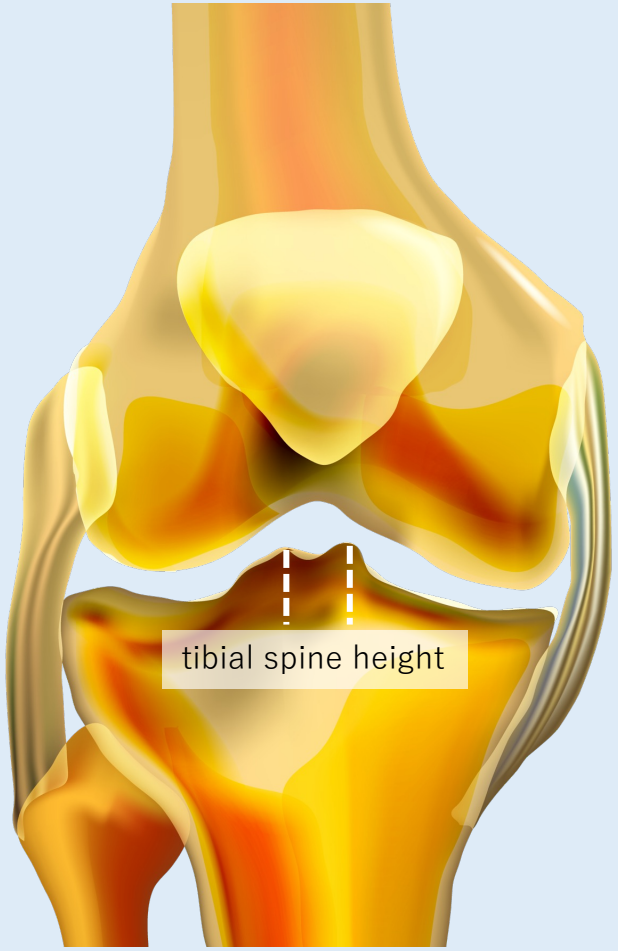




Multi linear Regression

	Estimate	Standard Error	P value	
(intercept)	0.37	0.12	0.0031	
PTSL	-0.018	0.011	0.10	
MTH Difference	0.17	0.034	0.0001	****
LTH Difference	0.11	0.044	0.01	*
N	83			

*p<.05 ****p<.0001



Discussion

The difference of Tibial spine height

Reinjury > no-injury

Osteophytes at tibial spine contribute to knee osteoarthritis

Katsuragi J et al. Osteoarthritis Cartilage. 2015

Risk factor that instability of the knee joint (especially internal deformity) contributes to the development and progression of osteophytes

Felson, D.T., et al. Arthritis & Rheumatism. 2013

Remaining of anterior instability

Osteophytes formation for contributing to stability at tibial spine height

Conclusion

- In the group of patients who experienced reinjury after ACL reconstruction, the tibial spine height difference between before and after surgery was significantly larger than the group of patients who did not experience re-rupture.
- The change in tibial spine height after surgery could be an indicator of instability.

Reference

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3) Iriuchishima T et al. The occurrence of ACL injury influenced by the variance in width between the tibial spine and the femoral intercondylar notch. Knee Surg Sports Traumatol Arthrosc. 2020 Nov;28(11):3625-3630.

4) Katsuragi J, Sasho T, Yamaguchi S, Sato Y, Watanabe A, Akagi R, Muramatsu Y, Mukoyama S, Akatsu Y, Fukawa T, Endo J, Hoshi H, Yamamoto Y, Sasaki T, Takahashi K. Hidden osteophyte formation on plain X-ray is the predictive factor for development of knee osteoarthritis after 48 months--data from the Osteoarthritis Initiative. Osteoarthritis Cartilage. 2015 Mar;23(3):383-90. doi: 10.1016/j.joca.2014.11.026. Epub 2014 Dec 24. PMID: 25542776.

5) Felson, D. T., Niu, J., Gross, K. D., Englund, M., Sharma, L., Cooke, T. D. V., ... & Guermazi, A. (2013). Valgus malalignment is a risk factor for lateral knee osteoarthritis incidence and progression: findings from the Multicenter Osteoarthritis Study and the Osteoarthritis Initiative. Arthritis & Rheumatism, 65(2), 355-362.