



Biomechanical Changes at the Knee Joint between Pre- and Post-operative Gait in Patients with ACL Injury

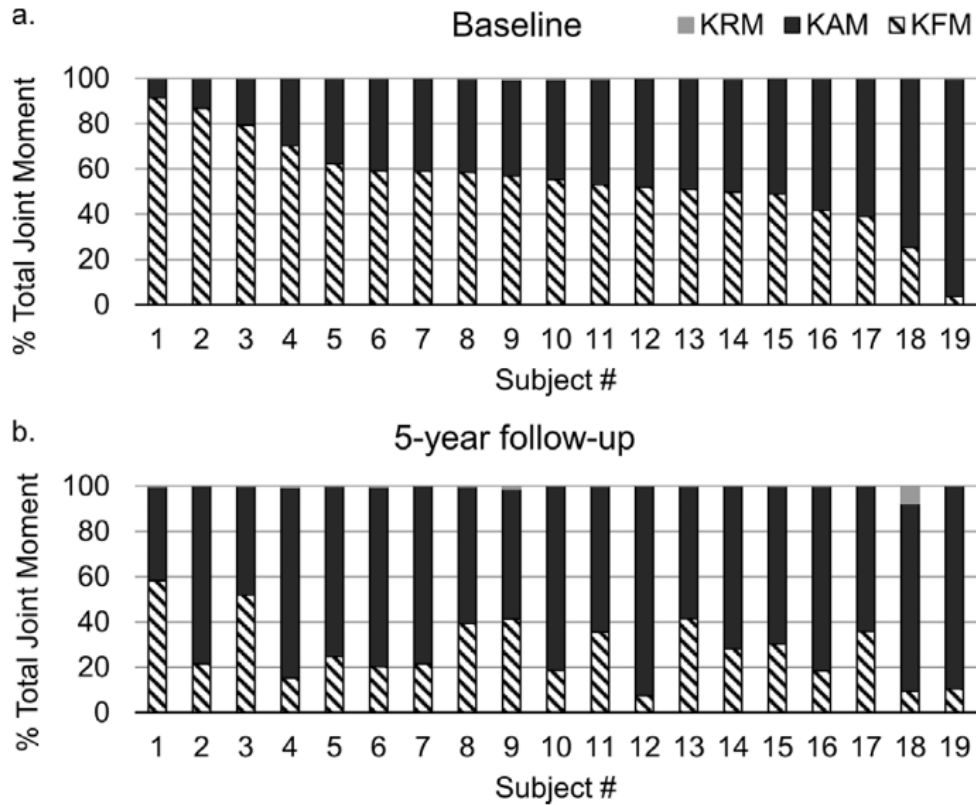
Kohei Nishizawa¹, Kengo Harato¹, Shu Kobayashi¹,
Yasuo Niki¹, Takeo Nagura²

1 Department of Orthopedic Surgery, Keio University School of Medicine, Tokyo, Japan,
2 Clinical Biomechanics, Keio University School of Medicine, Tokyo, Japan

The authors have no conflict of interest to disclosure with respect to this presentation.

Total joint moment

Asay et al. Changes in the Total Knee Joint Moment in Patients With Medial Compartment Knee Osteoarthritis Over 5 Years. J Orthop Res. 36:2373–2379, 2018.



Total joint moment (TJM):

$$\sqrt{KFM^2 + KAM^2 + KRM^2}$$

Proportion of each joint moment to the TJM

$$\%KFM = \frac{KFM^2}{TJM^2} \times 100$$

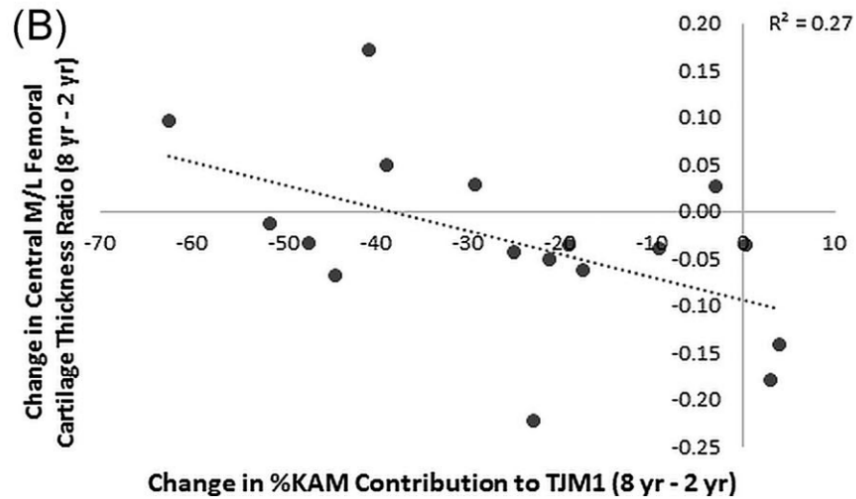
$$\%KAM = \frac{KAM^2}{TJM^2} \times 100$$

$$\%KRM = \frac{KRM^2}{TJM^2} \times 100$$

OA had a high proportion of KAM to the TJM.



Purpose



Changes in KAM ratio from 2 to 8 years after ACL reconstruction were associated with changes in cartilage thickness.

Erhart-Hledik et al J Orthop Res 2019.

However, the total joint moment before and after surgery in ACL injured patients has not been sufficiently evaluated.



The purpose of the present study was to investigate the total joint moment during gait in pre and post ACL reconstruction.



Subjects

- ▶ A total of 24 unilateral ACL injured subjects
 - Gender: 9 males, 15 females
 - Age: 31.5 (10.7) years
 - Height: 165.4 (9.5) cm
 - Weight: 61.9 (12.0) kg
- ▶ All subjects underwent ACL reconstruction by a single surgeon.
- ▶ Used graft: semitendinosus tendon
- ▶ Rehabilitation protocol
 - 1 week: Partial weight-bearing
 - 3 month: Jogging
 - 8 month: Return to sport



Gait analysis

Obtained data time

Gait analysis was performed at pre and post operation (> 9 months).

Three-dimensional motion analysis system

Eight infrared cameras (120 frames/s; Oqus, Qualisys)

Two ground reaction force plates (600 Hz; AM6110, Bertec)

Forty-six retro-reflective markers

Processing

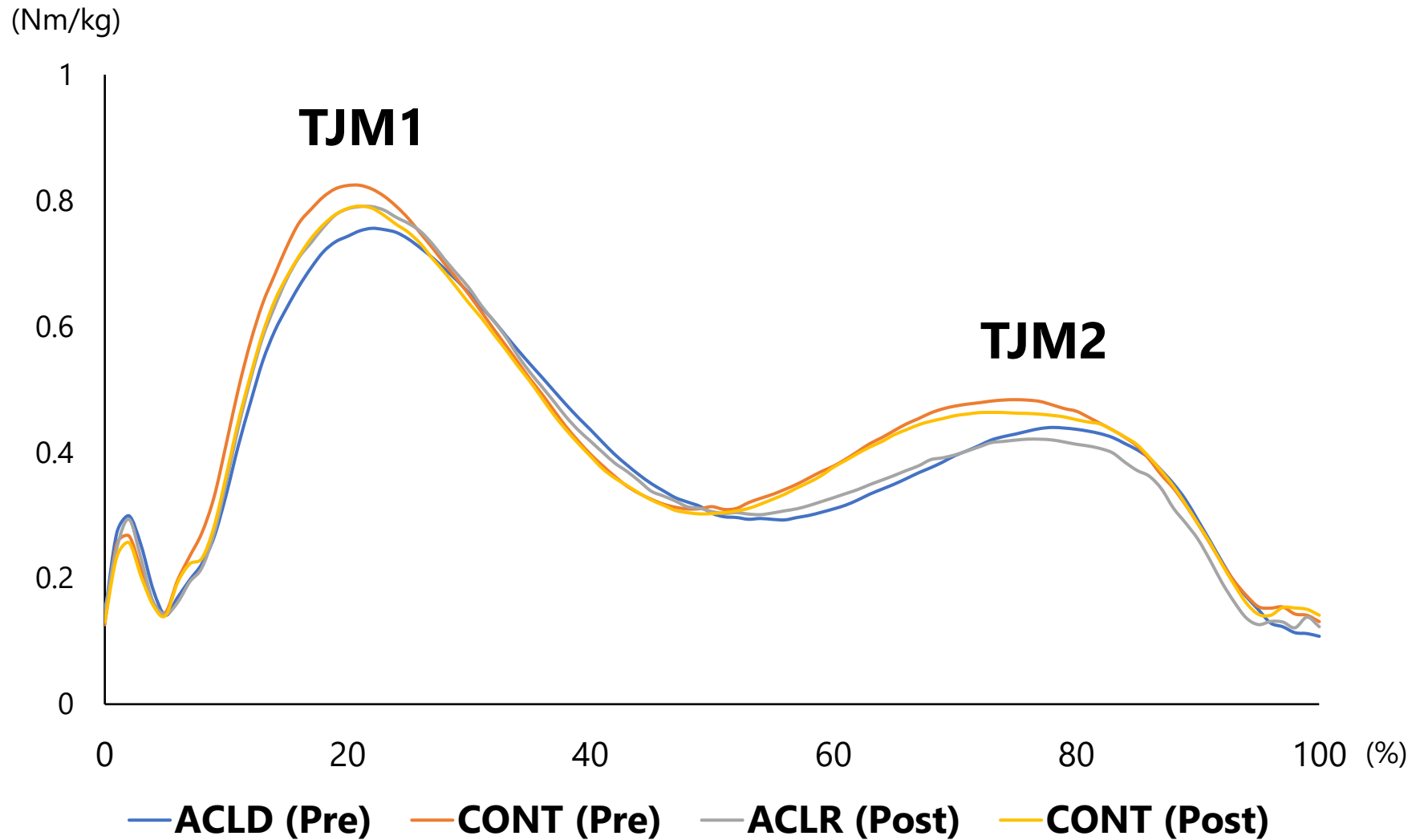
Kinematic and kinetic parameters were obtained using Visual 3D (C-motion Company).

Statistical analysis

Two-way analysis of variance was done to clarify the difference between ACLD and contralateral side in pre and post reconstruction, and two-tailed paired t-test was utilized as post hoc test.



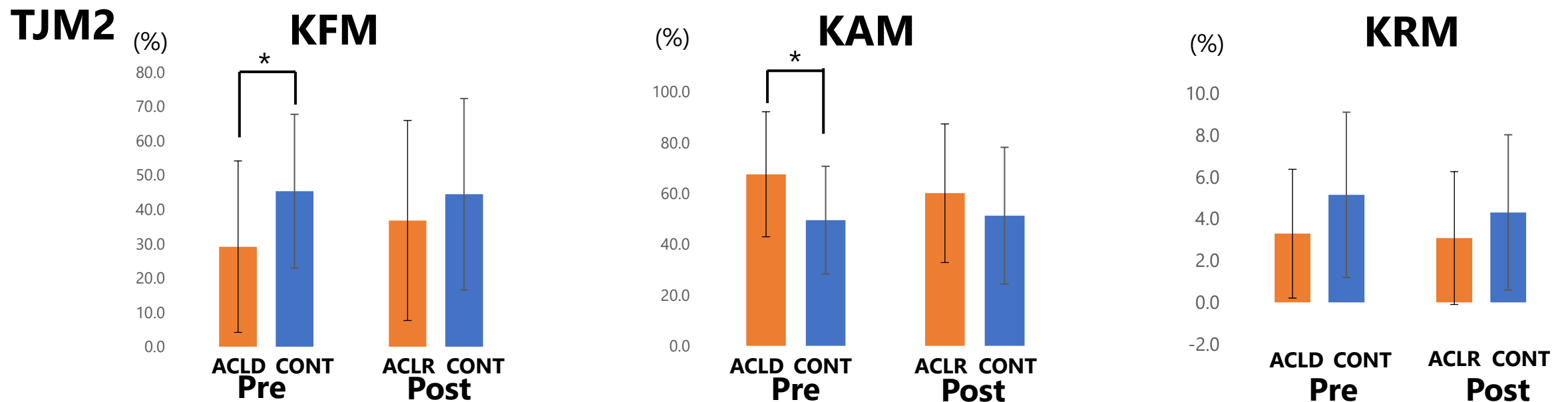
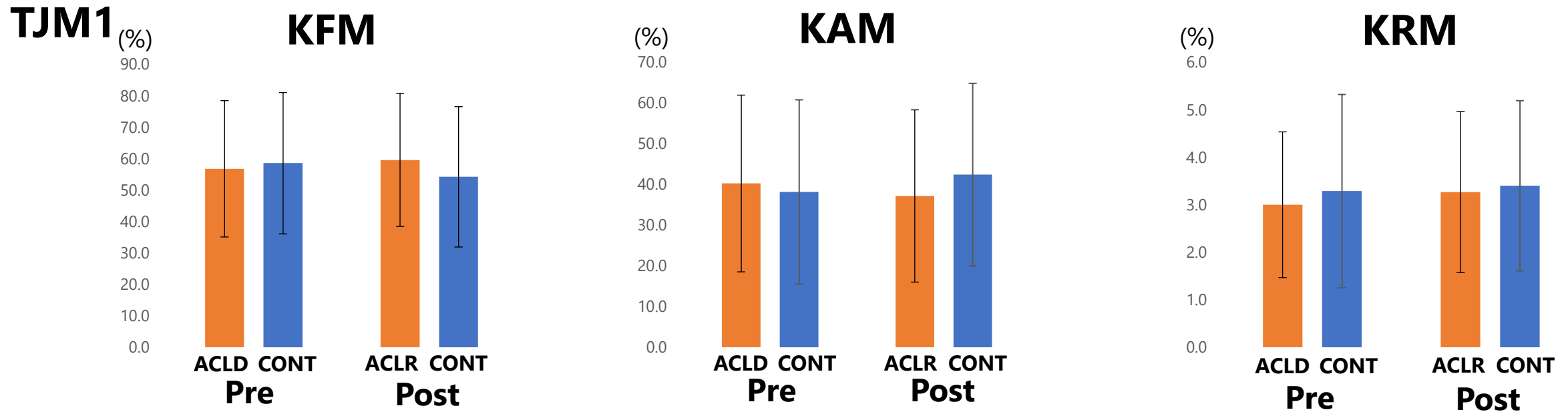
Results: total joint moment



No significant difference

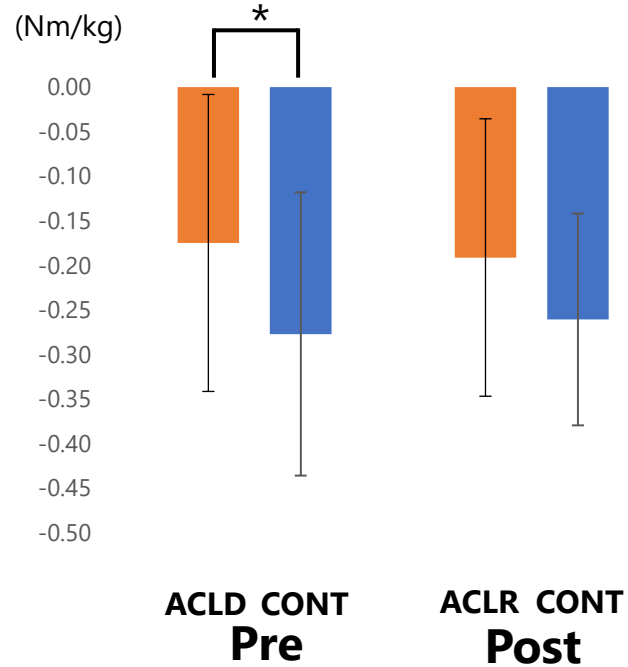


Proportion of each joint moment to the TJM

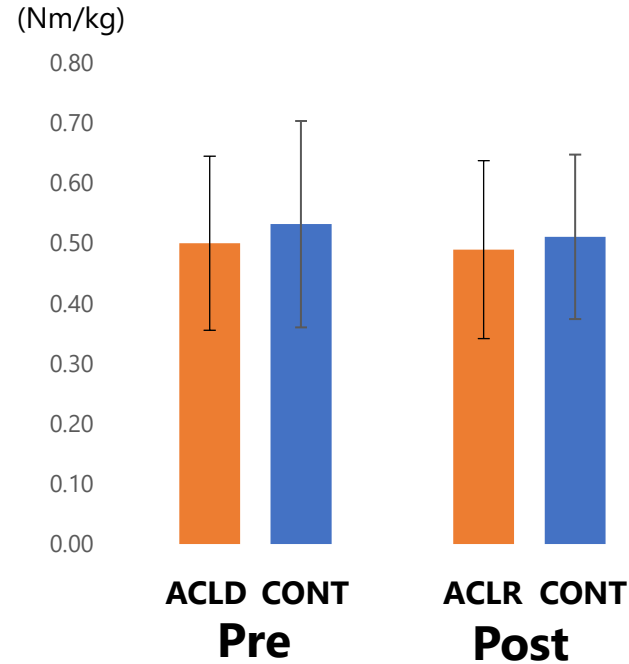


Peak moment (terminal stance)

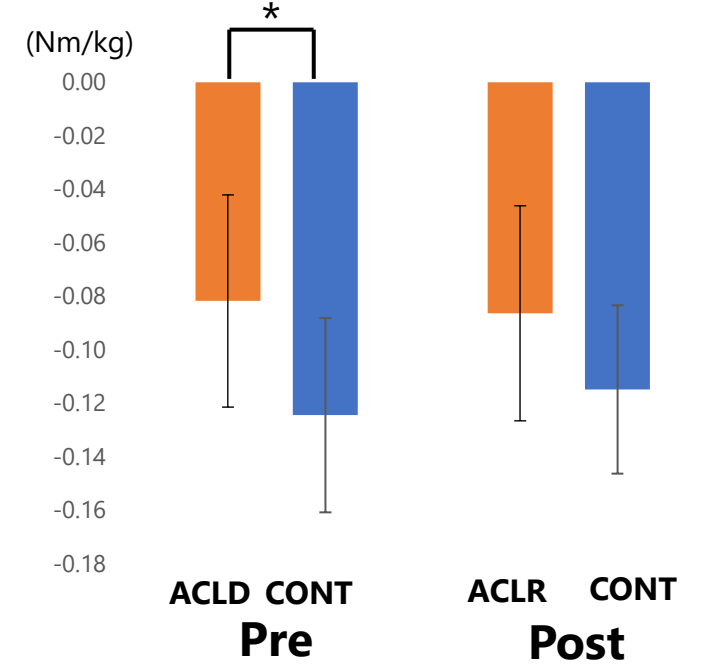
Extension moment



Adduction moment



Internal rotation moment



Preoperative condition (ACLD side)

KFM % at TJM2 ↓

KAM % at TJM2 ↑

Peak extension moment ↓

Peak internal rotation moment ↓



Knee moment

Previous study

Approximately 35% of patients with ACL injuries had tibiofemoral OA.

Lie et al. Br J Sports Med. 2019

KAM impulse is a risk factor for tibial medial cartilage reduction.

Bennell et al. Ann Rheum Dis. 2011

Present study

ACLD injured pattern

KFM % at TJM2 ↓

KAM % at TJM2 ↑



The kinetic pattern may be a risk factor for secondarily OA.



Summary

- ▶ Total joint moment in ACL injured patients at pre and post reconstruction was investigated.
- ▶ The proportion of KFM to total joint moments decreased and KAM increased in second half of stance phase.
- ▶ The change of the joint moment pattern due to ACL injury may be related to secondarily OA.

