

# Abnormal axial rotation of the knee due to ACL injury was successfully restored by ACL reconstruction.

Kenjiro Okimura<sup>1</sup>, Yuichi Hoshino<sup>1</sup>  
Kyohei Nishida<sup>1</sup>, Kanto Nagai<sup>1</sup>, Noriyuki Kanzaki<sup>1</sup>, Takehiko Matsushita<sup>1</sup>, Ryosuke Kuroda<sup>1</sup>

<sup>1</sup>Department of Orthopaedic Surgery, Kobe University Graduate School of Medicine, Kobe, Japan  
okkymickey75@gmail.com

**Disclosures:** Kenjiro Okimura(N), Yuichi Hoshino(N), Kyohei Nishida(N), Kanto Nagai(N), Noriyuki Kanzaki(N), Takehiko Matsushita(N), Ryosuke Kuroda(N)

**INTRODUCTION:** Anterior cruciate ligament (ACL) injury induces an anterolateral rotatory instability (pivot-shift), a combined movement of abnormal anterior-posterior translation and axial rotation. Quantitative evaluation of the pivot-shift is recommended for the ACL research [1]. While tibial anterior translation during the pivot-shift in ACL-injured knees is evaluated independently and is heavily used for diagnosis and follow-up [2-4], there is no consensus as to whether ACL injury affects pure axial rotation of knee joint. In a previous study, we reported that ACL injury increased the angle of axial rotation without anterior-posterior translation. The purpose of the current study was to quantitatively evaluate the change in axial rotation angle in response to simple axial rotation stress before and after ACL reconstruction surgery.

**METHODS:** The subjects were 35 patients with unilateral ACL injuries who underwent ACL reconstruction and removal from 2017~2022, excluding patients with concomitant meniscus injuries or other ligament injuries. The 6 degrees of freedom of the knee kinematics were measured using the electromagnetic sensor (JIMI Kobe) [5] during knee flexion while applying simple internal/external rotation stress under general anesthesia prior to ACL reconstruction. The range between maximum internal and external rotation angle was calculated as  $\Delta R$  in each flexion angle. Preoperative and postoperative  $\Delta R$  were compared using t-tests, and postoperative  $\Delta R$  was compared between ACL intact and injured knees using t-tests. Correlations between postoperative  $\Delta R$  and acceleration of posterior tibial translation during pivot shift and IKDC subjective score at 1 year postoperatively were examined using Pearson's correlation analysis.

**RESULTS:** Postoperative  $\Delta R$  was significantly smaller than preoperative  $\Delta R$  at 30° and 60° knee flexion (30°: preoperatively  $30.9 \pm 8.1^\circ$ , postoperatively  $28.4 \pm 7.6^\circ$ ; 60°: preoperatively  $28.1 \pm 7.9^\circ$ , postoperatively  $25.9 \pm 7.0^\circ$ ,  $p < 0.05$ ), but not significantly different at 90° (preoperatively  $26.6 \pm 6.8^\circ$ , postoperatively  $25.3 \pm 6.3^\circ$ ,  $p > 0.05$ ). The postoperative  $\Delta R$  at 30° and 60° did not correlate with the acceleration of posterior tibial translation during the pivot-shift test or with the postoperative IKDC subjective score.

**DISCUSSION:** This study demonstrated that knee joint axis rotation laxity increased by ACL injury was improved by ACL reconstruction. It is worthy of note that the impact of the ACL on the axial knee rotation was purely assessed by excluding meniscus injury cases. Postoperative  $\Delta R$  was not significantly different between the ACL-reconstructed knee and the contralateral normal knee. Postoperative axial rotation angle did not correlate with tibial posterior translation acceleration during pivot shift or with clinical scores.

**SIGNIFICANCE/CLINICAL RELEVANCE:** ACL reconstruction improved axial rotation angle to simple axial rotation stress. Axial rotation angle had little relationship with pivot-shift instability and clinical scores of the knee joint.

## REFERENCES

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## IMAGES AND TABLES

Image1:



Figure1: Correlation between postoperative  $\Delta R$  and pivot-shift acceleration

