

Does Looser Knee Have Worse Clinical Outcomes after Anterior Cruciate Ligament (ACL) Reconstruction? 3 Year Follow-Up Evaluated by Quantitative Magnetic Resonance Imaging

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Summary:

Patients with relatively normal knee kinematics after ACL reconstruction may have higher activity level than loose knee by 1Y to 2Y after surgery, however, higher activity level may lead to more cartilage degeneration.

Abstract:

INTRODUCTION: Most patients have ACL reconstructions in hope to continue with athletic activities, however, ACL injuries can lead to the development of post-traumatic osteoarthritis. The goal of this study was to quantify kinematic and cartilage changes of ACL-injured knees 3-years after ACL-reconstruction using quantitative MR (qMR) T1 ρ and kinematic imaging techniques, and to explore their relationship with knee function and activity level.

METHODS: 25 patients with ACL injuries were included in this prospective cohort study (mean age, 29.3 \pm 7.6 years). Images of the bilateral knees were acquired using a 3-Tesla MRI-scanner at baseline, 6 months (6M), 1 year (1Y), 2 years (2Y) and 3 years (3Y) after ACL reconstruction. The imaging protocol included high-resolution 3D FSE and quantitative T1 ρ sequences without load, sagittal T2 FSE images with load (25% of the patient's body weight) applied axially in the extended knee position. Knee injury and Osteoarthritis Outcome Score (KOOS) and the Marx Activity Rating Scale were completed at all visits. Cartilage was segmented in 3D FSE images using an in house Matlab-based program into 6 compartments: medial femoral condyle (MF), medial tibia (MT), lateral femoral condyle (LF), lateral tibia (LT), patella (PAT), and trochlea (TRO). Side-to-side difference of TP (TP-SSD) was calculated by subtracting the contralateral side measurements from the injured side. Patients were then divided into two groups based on TP-SSD at 1 year follow-up (1Y-TP-SSD) by 1.36mm, the standard deviation of normal subjects. 18 patients were categorized as normal group, while the other 7 patients were categorized as loose group. T-tests were used for comparing differences between the two groups and Paired T-tests were used for comparing longitudinal changes. Significance was set at p<0.05.

RESULTS: TP-SSD was significantly lower at 1Y, compared to 2Y and 3Y in normal group. Significant difference was found between 1Y and 3Y in the loose group. Loose group had higher TP-SSD at all time points when comparing to normal group. At 3Y, injured knees had significantly elevated T1 ρ relaxation times compared to BL in MF, LF, PAT and TRO. At 3Y, all the KOOS were significantly higher than that at BL and 1Y. Difference between groups: There were no differences of age, gender, and body mass index (BMI) between the two groups. Normal group had significantly higher cutting scores at 1 year follow-up and higher cutting and decelerating scores at 2 year follow-up than loose group. While the increase of T1 ρ relaxation times in cMFP subcompartments from 1Y to 3Y were higher in normal group comparing to loose group. There was no significant difference of KOOS between two groups at all time points.

DISCUSSION: Our results demonstrated that ACL reconstruction was not able to completely restore the normal TP, but most patients went back to sports activities. Our results also demonstrated that higher activity score in normal TP-SSD group at 1Y and 2Y after ACL reconstruction. The lack of significant difference in KOOS scores and Marx at 3Y between the two groups suggests that subtle abnormalities in knee kinematics may not affect patient knee function

ISAKOS

**International Society of Arthroscopy, Knee Surgery and
Orthopaedic Sports Medicine**

11th Biennial ISAKOS Congress • June 4-8, 2017 • Shanghai, China

Paper #186

and symptoms for normal daily life. However, normal TP-SSD group has more cartilage degeneration from 1Y to 3Y in some of the subcompartments.