

ACUTE ANTERIOR CRUCIATE LIGAMENT INJURY CAUSES CARTILAGE THICKNESS INCREASE OVER TWO AND FIVE YEARS

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INTRODUCTION: An ACL tear is a serious and common knee injury, mainly affecting young active adults. In the long term, the risk of OA development in the injured joint is increased but little is known about structural cartilage changes in the early phase.

OBJECTIVES: Using MRI, to (1) describe the rate of change in femorotibial cartilage thickness over two and over five years after an ACL injury, and (2) determine the number of knees showing a significant increase or decrease in cartilage thickness over 2 and/or 5 years.

METHODS: 121 young (mean age 26.1 years) active adults with an acute ACL tear in a previously uninjured knee were included in an RCT comparing rehabilitation plus early ACL reconstruction (n=62) and rehabilitation plus the option of having a delayed ACL reconstruction if needed (n=59). A complete set of sagittal MR images for baseline, 2, and 5 year follow-up was available for 107 of the 121 participants. Cartilage thickness (ThC) was assessed by manual segmentation of the cartilage surfaces in the medial (MFTC) and lateral (LFTC) compartment of the femorotibial joint (FTJ) with blinding to time points. The progression definition for significant increase or decrease in ThC was based on 95% confidence intervals computed from one-year changes observed in the non-exposed reference cohort of the OAI. The thresholds were 153µm/ 149µm/ 289µm for increase and -161µm/-143µm/-256µm for decrease in ThC of MFTC/LFTC/FTJ respectively. MRI results were not unblinded for treatment group in this first step and thus we present the results for the entire sample of acutely ACL injured knees.

RESULTS: In the total FTJ, average ThC slightly increased over 2 (+0.7% [95% CI: 0.0/+1.4%]; paired t-test p=0.046) and 5 years (+1.9% [+1.0/+2.8%], p<0.001). This change was predominantly driven by changes in the medial femorotibial compartment (+1.3% [+0.4/+2.1%]/ +3.1% [+2.1/+4.1%] over 2/5 years; p=0.003/p<0.001) whereas the average change in ThC in the lateral compartment was +0.2% [-0.6/+1.0%] over 2 and +0.8% [-0.2/+1.9%] over 5 years (p=0.58 and 0.12 respectively). Except for the posterior subregion of the LT, which showed a decrease in ThC of -4.2% (2 year) and -4.7% (5 years), changes in subregions were close to zero or showed an increase in ThC of up to 4.7% (external subregion of cMF, 5 years). Over 2 years, 13% of the knees showed significant decrease in the FTJ (6% in MFTC, 19% in LFTC) and 21% showed significant increase in the FTJ (26% in MFTC, 22% in LFTC). Over 5 years, the percentage of knees showing significant decrease in ThC was similar to the percentage observed over 2 years (12% in FTJ; 4% in MFTC, 18% in MFTC), whereas the percentage of knees showing significant increase in ThC was higher (30% in FTJ, 35% in MFTC, and 31% in LFTC).

CONCLUSION: A significant decrease in cartilage thickness was predominantly observed in the lateral femorotibial compartment in this post-traumatic ACL insufficiency cohort and this decrease was not more frequent after 5 than after 2 years. In contrast, a significant increase in cartilage thickness was observed with similar frequencies in both the medial and the lateral compartment and the proportion of knees showing an increase in cartilage thickness further increased between year 2 and year 5. When compared to knees with established radiographic OA, which typically show a loss in cartilage thickness, knees after a rupture of the ACL showed a slight increase of cartilage thickness on average and almost 1/3 of knees showed a significant increase in total joint cartilage thickness over the first 5 years after the injury.

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