

# T2\* value change of Hoffa's fat pad with histologic correlation in a rat model of anterior cruciate ligament transection

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## Purpose

The infrapatellar fat pad (often known as Hoffa's pad) is a soft tissue that lies underneath the patella and helps to protect the knee like a shock absorber. The anterior cruciate ligament (ACL) attaches proximally at the femoral condyle, and runs distally to the anterior tibia to provide the stability of the knee joint. When the deficiency of ACL occurs, instability of the knee joint causing stretching and impingement of the fat pad between the femur and tibia may induce Hoffa's fat pad injury<sup>1</sup>. Thus, we try to use MR T2\* measurement and histologic correlation to investigate the MR signal alternations of Hoffa's fat pad after anterior cruciate ligament transection (ACLX) in a rat model.

## Materials and Methods

Eighteen male Sprague Dawley rats were randomly separated into three groups ( $n=6$  each group). Group 1 was the normal control group. Groups 2 and 3 received ACLX and sham-ACLX, respectively<sup>2</sup>, of the right knee. T2\* values were measured in the Hoffa's fat pad of all rats at 0, 4, 13, and 18 weeks after surgery. After the image acquisition was completed, all data were calculated the mean values of the signal intensity, regions of interest (ROIs) were drawn manually on the infrapatellar fat pad by referencing to the first-echo T2\* image (Figure 1). Generalized Estimating Equation (GEE) multiple linear regression was used to assess the interaction of groups or side with time (0, 4, 13, and 18 weeks).  $P$  values  $<0.05$  were regarded as statistically significant. The rats were sacrificed following imaging at week 18 to take histologic analysis and correlation.

## Results

In the ACLX group, we observed that T2\* values increased significantly in infrapatellar fat pad of right knee from 13 weeks as compare with left knee (T2\* value is  $20.32 \pm 1.05$ ,  $15.42 \pm 2.02$  msec respectively,  $p < 0.05$ ). Hoffa's fat pad T2\* values were significantly higher at 13, and 18 weeks postoperatively in rats of the ACLX group than in rats of the control and sham groups ( $p < 0.05$ ). The T2\* value increase were not significant between normal and shame groups (Figure 2. A to C).

## Discussion

Previous study showed patients with tears of ACL may have different patterns of joint instability and generate lesions of Hoffa's fat pad. In our animal study, we found an evidence to show increased T2\* in the fat pad during progression of the ACL transection. Histologic examination confirmed the presence of corresponding changes. The increase in the T2\* of the fat pad is probably the result of the characteristic small vessel proliferation with mild myxoid change reflecting increased water content within the structures<sup>3</sup> (Figure 2. D).

## Conclusion

Quantitative MR T2\* measurements of Hoffa's fat pad are feasible. Signal intensity change in T2\* over time in Hoffa's fat pad was addresses in this study. This information could be potentially useful for *in vivo* monitoring of knee instability.

## Reference

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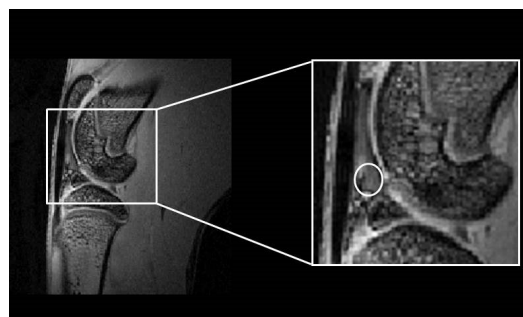


Figure 1(Upper). ROIs selected for T2\* calculation using the first-echo image

Figure 2.(Right) (A to C) Plots of the T2\* values (mean  $\pm$ SD) of three groups (ACLX, normal and shame) at weeks 0, 4, 13, and 18. In ACLX group found significantly T2\* higher at week 13, and 18 of right knee. Asterisks indicate significant differences ( $p < 0.05$ ). (D). Histologic confirmation of changes in the Hoffa's fat pad. In the ACLX group, small vessel proliferation of the right side Hoffa's fat pad with mild fibrotic and myxoid changes is seen. No significant changes are seen in the left side fat pad and both knees of the control and sham groups.

