

The relationship between preoperative static anterior tibial subluxation and graft maturation on MRI after double-bundle anterior cruciate ligament reconstruction

Shigehiro Asai, H. Fukuda, T. Ogura, K. Ueno, C. Saito,
H. Sakai, I. Yamaura, A. Tsuchiya, K. Takahashi

Funabashi Orthopaedic Hospital, Sports Medicine and Joint Center, Funabashi, Japan

Disclosure

Shigehiro Asai, MD

I have no financial conflicts to disclose.

Introduction

- Static anterior tibial subluxation (ATS) after an anterior cruciate ligament (ACL) injury highlights the abnormal relationship between the tibia and femur in patients with ACL insufficiency. Several studies indicated that an abnormal tibiofemoral relationship remained after ACL reconstruction.
- Chronicity of ACL deficiency had an effect on the preoperative tibiofemoral relationship in the sagittal plane. Early graft failure at 6 months increased in patients with ACL deficiency longer than 2 years. The preoperative ATS might be one of the risk factor for early graft failure on MRI.
- Several studies have investigated maturation of the ACL graft using MRI in clinical studies, MRI graft signal intensity (SI) after ACL reconstruction is considered a marker of graft healing and maturation.

Purpose

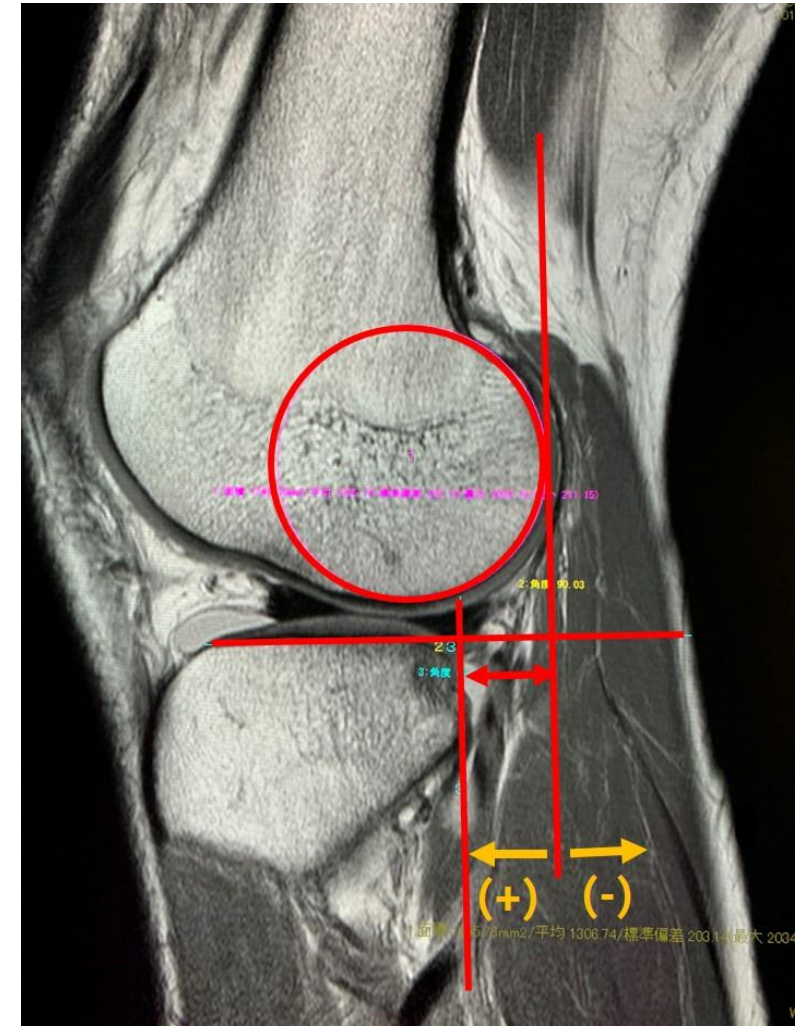
- To determine the relationship between preoperative static tibial subluxation and graft maturity on MRI after double-bundle anterior cruciate ligament reconstruction

Materials and Methods (1)

- Sixty patients who underwent double-bundle ACL reconstruction between January 1 and December 31, 2017 were included in this retrospective study.
- All participants underwent magnetic resonance imaging (MRI) preoperative and postoperative at 12 months.
- All patients provided their informed consent to participate in this study, which was approved by our institutional review board.

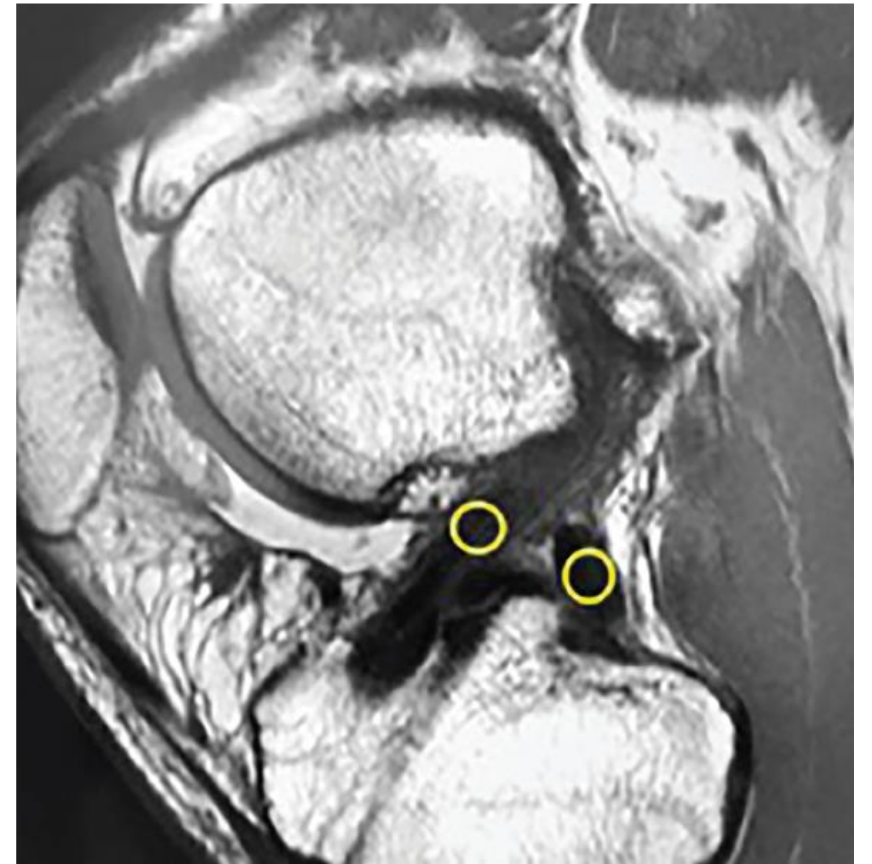
Materials and Methods (2)

- Examinations were performed in the supine position with a pillow under the knee, supporting it in neutral rotation. Anterior tibial subluxation (ATS) of the lateral and medial compartments relative to the femoral condyles were measured on MRI. On sagittal proton density images, we drew a best fit-circle over the posterior femoral condyle at the subchondral bone. Along the posterior margin of the circle, a line perpendicular to the tibial plateau was drawn at the posterior aspect of the tibia. The distance between these lines determined the amount of anterior tibial subluxation.



Materials and Methods (3)

- Proton density-weighted images in an oblique sagittal plane were used for measurement for signal intensity. Regions of interest (10-mm²) were set at the anteromedial (AM) bundle and the posterolateral (PL) bundle of the ACL grafts and at the posterior cruciate ligament. Signal intensity ratio was calculated as the ratio of signal intensity of the graft to signal intensity of the posterior cruciate ligament. The SI ratio (SIR) of the 2 grafts was calculated as follows: $SIR = SI \text{ of ACL graft} \div SI \text{ of PCL}$.



Results (1)

Demographic factors

Number	60
Sex	Male 24 : Female 36
Age(years old)	30.7 ± 13.5
BMI(kg/m ²)	23.2 ± 3.7
Meniscus injury	Medial meniscus tear: 9 Lateral meniscus tear: 17 Bilateral meniscus tear: 14 intact: 20

Results (2)

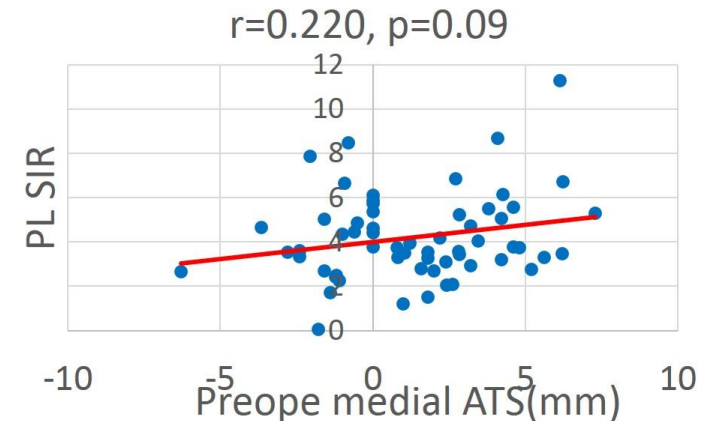
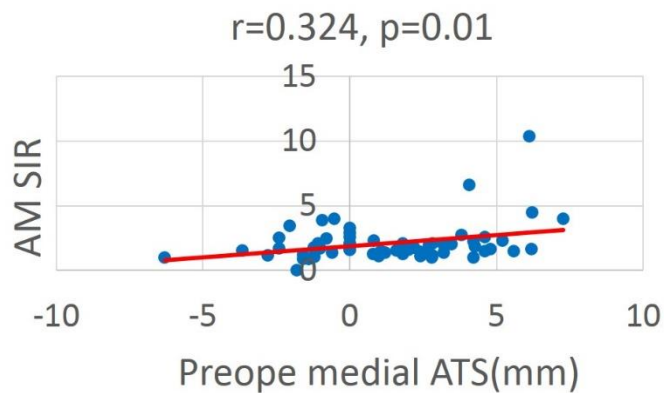
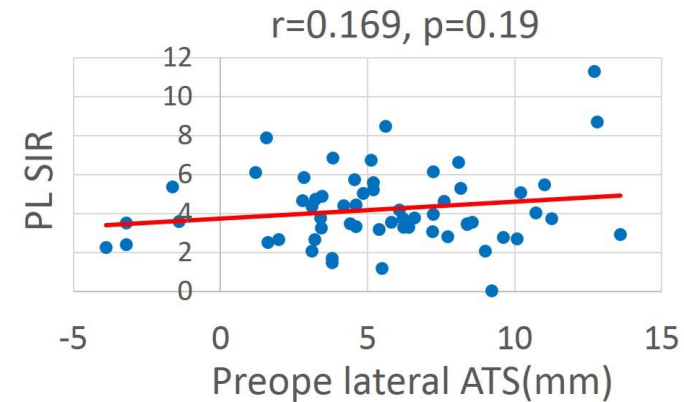
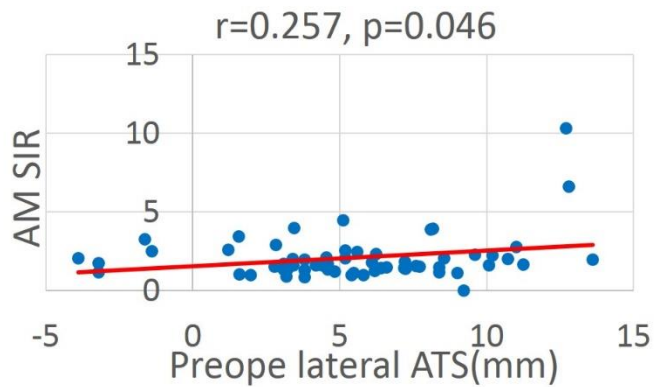
- In lateral compartment, the mean ATS was 5.5 mm before surgery, while it was 4.7 mm at 12months after surgery which was statistically significant. In medial compartment, the mean ATS was 1.4 mm before surgery, while it was 1.7 mm at 12months after surgery which was not statistically significant.

Results of preoperative and postoperative measurement

Preoperative	Lateral ATS (mm)	5.5 ± 3.8
	Medial ATS (mm)	1.4 ± 2.8
Postoperative	Lateral ATS (mm)	4.7 ± 3.1
	Medial ATS (mm)	1.7 ± 2.7
	AM SIR	2.2 ± 2.0
	PL SIR	4.1 ± 2.2
	KT side to side difference (mm)	1.0 ± 2.4

Results (3)

- The preoperative lateral ATSwas weak positive correlated with the AM SIR. ($r=0.257$, $p =0.046$). The preoperative medial ATS was moderate positive correlated with the AM SIR and weak positive correlated with PL SIR. ($r= 0.324$, $p=0.01$, $r=0.220$ $p=0.09$ respectively).



Discussion (1)

- The finding of this study was that the ATS in lateral compartment was significant different between before and after surgery. On the other hand, the ATS in medial compartment was not significant different between before and after surgery. The preoperative lateral ATS demonstrated a significant positive correlation with the AM SIR. The preoperative medial ATS demonstrated a significant positive correlation with the AM SIR and PL SIR.

Discussion (2)

- Almekinders et al. found that irreducible ATS remains after conventional reconstruction of the ACL. Preoperative ATS might be one of the risk factor for early graft failure, therefore MRI graft signal intensity after ACL reconstruction which is considered a marker of graft healing and maturation might be higher for large ATS patient.
- Anatomic reconstruction of the anterolateral ligament (ALL) is a lateral extra-articular tenodesis (LET) technique performed during ACL reconstruction that yields better results in terms of rerupture rate, medial meniscal repair, and reconstruction after a chronic ACL tear, without increasing the number of complications.
- Cavaignac et al. reported the MRI appearance of ACL grafts showed generally better incorporation and maturation when combined with LET.

Conclusion

- The ATS in lateral compartment was significant different between before and after surgery.
- The preoperative lateral ATS demonstrated a significant positive correlation with the AM SIR.
- The preoperative medial ATS demonstrated a significant positive correlation with the AM SIR and PL SIR.

References

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