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Does return to preinjury levels of performance affect graft remodeling after anterior cruciate ligament reconstruction using bone-patellar tendon-bone autograft? : A serial 3T-MRI study

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COI Disclosure

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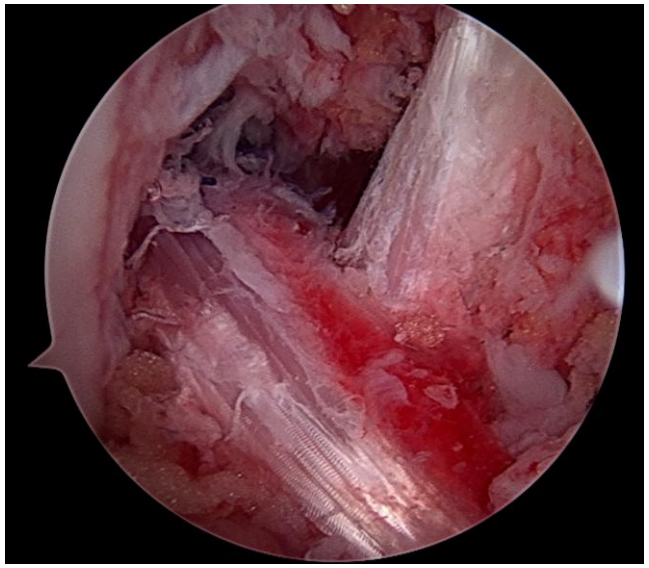
We **DO NOT** have a financial interest or other relationship with a commercial company or institution in this presentation.

Introduction



Bone-patellar tendon bone autograft (BPTB) during anterior cruciate ligament reconstruction (ACLR)

6 to 48 months [1)]

?

Return to preinjury levels of performance (RTP)

around 1 year

Graft remodeling

Quantitative assessment using MRI [2,3)]

Purpose

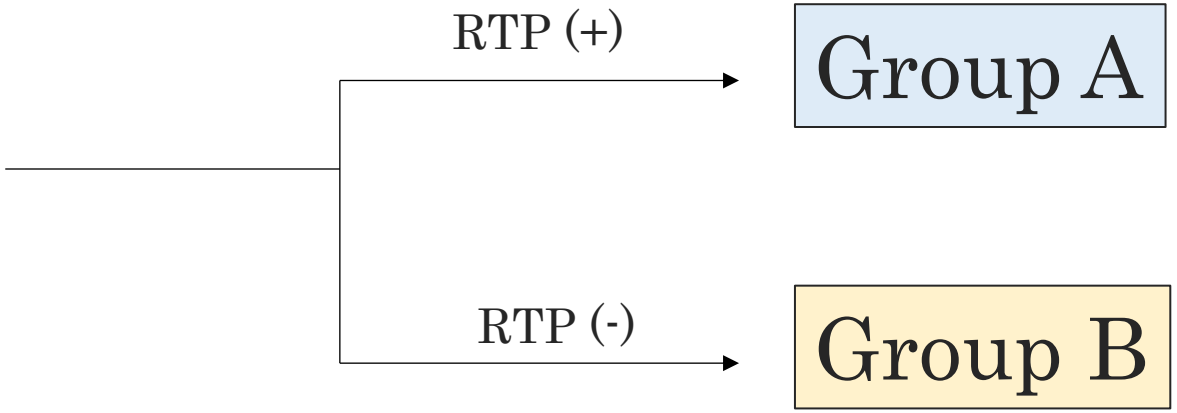
- to assess whether RTP affects ACL graft remodeling after ACLR using BPTB autograft with a serial 3-T MRI

Hypothesis

✓ RTP would delay the reduction of ACL intensity on post-operative MRI.

Patients

111 cases



- ✓ primary ACLR using BPTB*
- ✓ MRI at 6, 12, 24 months
- ✓ CT at 1 week

*Femoral tunnel: Modified trans-tibial creation [4)]

Methods

Variables

Age
Gender
Body mass index (BMI)
Time from injury to surgery
Med. / Lat. Posterior tibial slope (PTS)*
Meniscus injury
Cartilage injury (Outerbridge grade 2 or more)
Graft bending angle (GBA)**

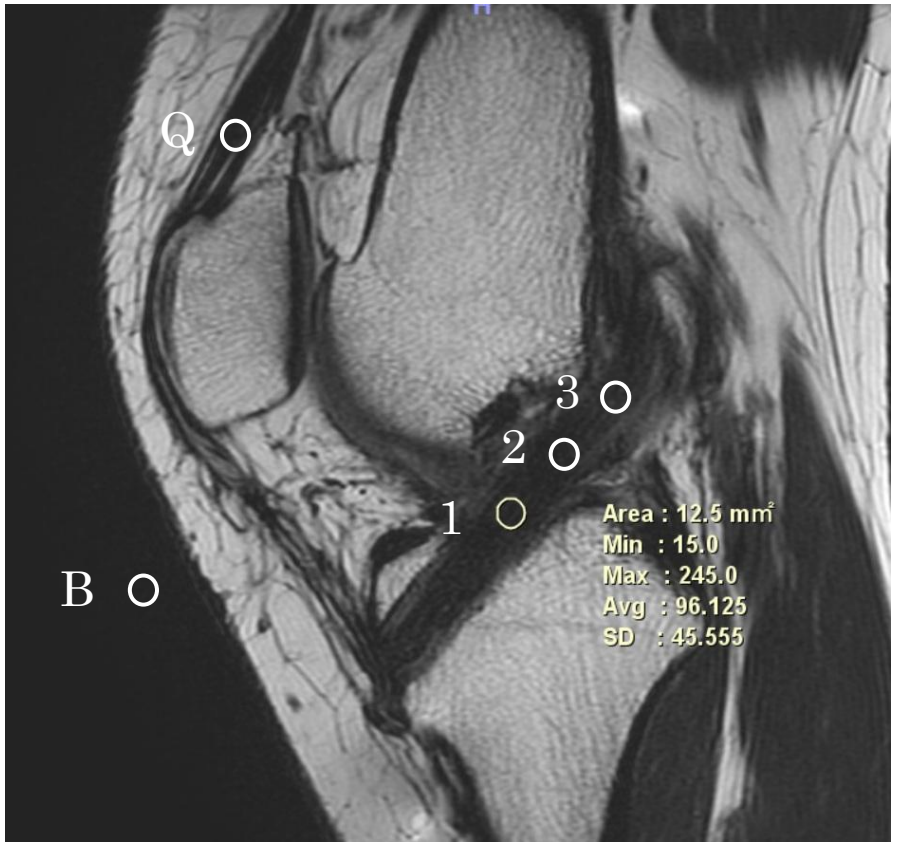
SNQ: Average signal/noise quotient ***

= ([ACL graft] – [Quad]) / Background

Δ SNQs: Amount of change in SNQ

ΔSNQ (6-12): from 6 to 12 months
ΔSNQ (12-24): from 12 to 24 months

Region of interest (ROI)



1,2,3: ACL graft, Q: Quadriceps, B: Background

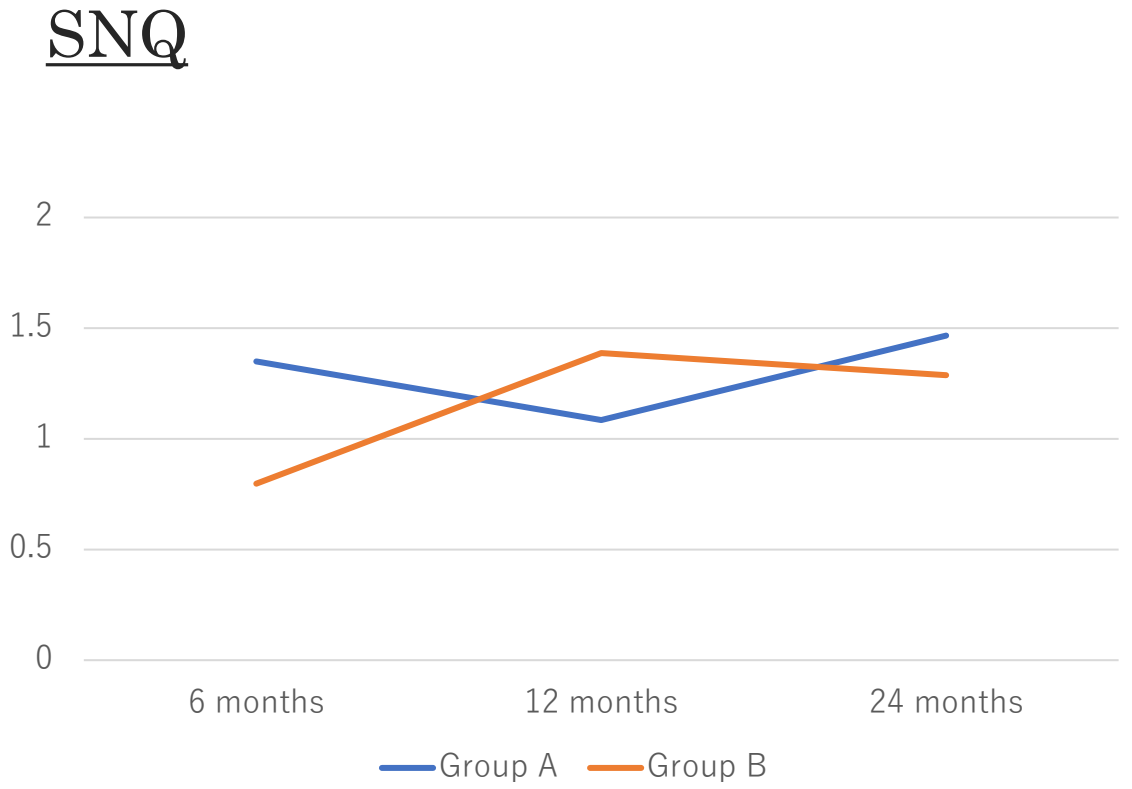
*Measured on pre-operative MRI
** Measured on CT one week after ACLR
*** Measured 6, 12, 24 months

Statistics

- Comparison between groups A and B
- Repeated-measures ANOVA to analyze variables over time
- Multivariate logistic regression analysis to elucidate the factors associated with ΔSNQs
- The significance level was set at 5%.

Results

	Group A	Group B	p value
No. of cases	83	28	
Age (y.o.)	23.3 (10.6)	18.1 (5.6)	**0.0332**
Gender (M / F)	38 / 45	10 / 18	0.4781
BMI (kg / m^2)	22.9 (3.6)	22.4 (4.4)	0.551
Time from injury to surgery (mo)	18.7 (62.1)	2.4 (1.5)	0.168
Med. PTS (degree)	4.1 (2.6)	5.1 (2.0)	0.0707
Lat. PTS (degree)	4.2 (3.6)	5.6 (3.4)	0.0731
MM injury (yes)	48	10	0.07072
LM injury (yes)	42	8	0.07084
Cartilage injury (yes)	70	0	**1.20E-16**
GBA (degree)	44.0 (5.7)	41.8 (5.7)	0.0802
Tegner (pre-injury)	7.9 (1.5)	8.1 (1.4)	0.553
Tegner (post-op.)	7.9 (1.5)	6.2 (1.1)	**0.000000615**
Time of RTP (mo)	10.4 (2.2)		



Results

Multivariate logistic regression analysis for association with Δ SNQs

ΔSNQ (6-12)

Variables	OR (95% CI)	P value
Age	0.998 (0.949-1.050)	0.954
Gender (male)	2.198 (0.838-5.768)	0.108
BMI	1.037 (0.919-1.170)	0.551
Cartilage injury	0.304 (0.074-1.245)	0.097
Post-op. Tegner score	1.175 (0.859-1.607)	0.310
RTP	3.601 (0.749-17.300)	0.109

ΔSNQ (12-24)

Variables	OR (95% CI)	P value
Age	1.004 (0.964-1.046)	0.845
Gender (male)	0.587 (0.268-1.286)	0.181
BMI	0.985 (0.893-1.086)	0.760
Cartilage injury	0.758 (0.242-2.379)	0.632
Post-op. Tegner score	1.003 (0.778-1.293)	0.983
RTP	2.118 (0.592-7.573)	0.246

Discussion: Comparison of mean SNQ with previous studies

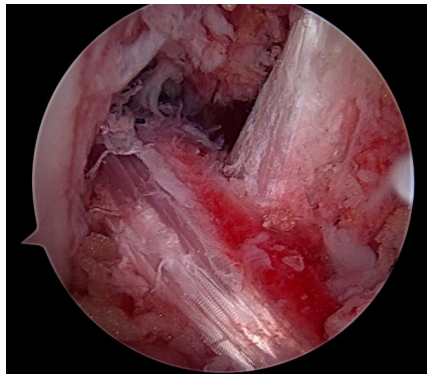
	No. of cases	6 months	12 months	24 months
Wen [5]	108	4.4	3.6	3.3
Zhang [6]	22	8.7	6.6	4.5
Cusumano [7]	23	13	9.8	Not available
Current study				
Group A	83	1.350	1.085	1.467
Group B	28	0.797	1.386	1.288

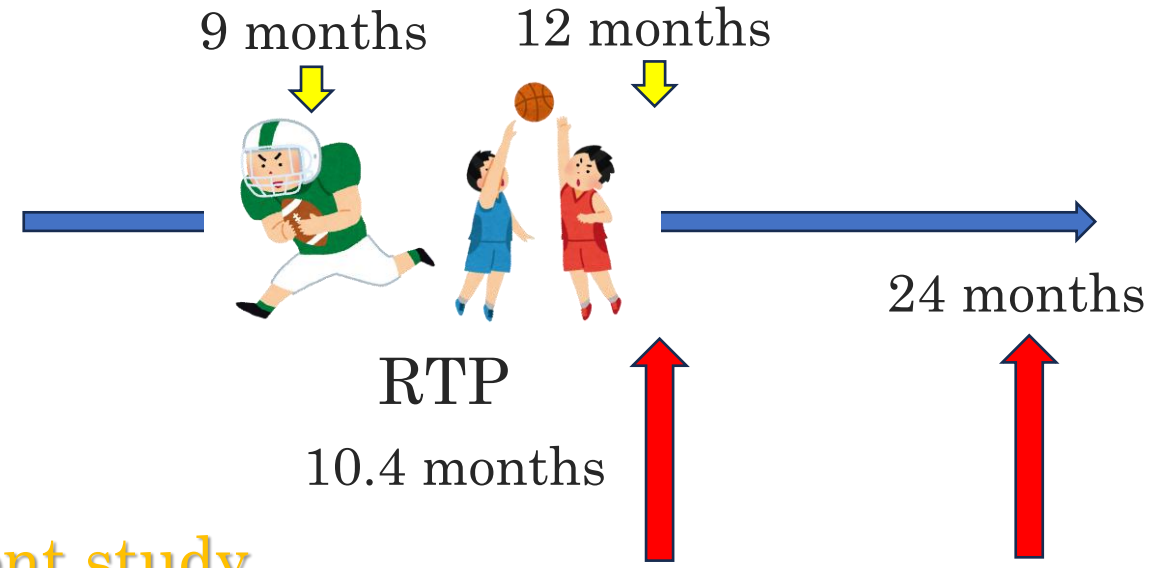
Lower from the early post-operative period

- ✓ Use of BPTB autograft [8]
- ✓ Gentler GBA [4]

Discussion: Effect of RTP on SNQ

Lower SNQ in RTP patients [9)] SNQ related to Marx activity scale [10)]





Current study

RTP did NOT affect SNQs at 12 and 24 months

Conclusions

RTP did not affect graft remodeling in 2 years after ACLR using BPTB autograft while 74.8% of patients were able to RTP around 10 months post-operatively.

References

1. Bartsch A et al.: Biomechanical and biological factors of sexual dimorphism in anterior knee pain: Current concepts.
J ISAKOS. 2024;9(4):788-793.
2. Lutz PM et al.: Anterior cruciate ligament autograft maturation on sequential postoperative MRI is not correlated with clinical outcome and anterior knee stability.
Knee Surg Sports Traumatol Arthrosc. 2022;30(10):3258-3267.
3. Ye Z et al.: Effect of anterolateral structure augmentation on graft maturity after anterior cruciate ligament reconstruction: A clinical and MRI follow-up of 2 years.
Am J Sports Med. 2022;50(7):1805-1814.
4. Tomihara T et al.: Shallow knee flexion angle during femoral tunnel creation using modified transtibial technique can reduce femoral graft bending angle in ACL reconstruction.
Knee Surg Sports Traumatol Arthrosc. 2019;27(2):618-625.
5. Wen Z et al.: Oval femoral tunnel technique is superior to the conventional round femoral tunnel technique using the hamstring tendon in anatomical anterior cruciate ligament reconstruction.
Knee Surg Sports Traumatol Arthrosc. 2020;28(7):2245-2254.
6. Zhang S et al.:Morphological changes of the femoral tunnel and their correlation with hamstring tendon autograft maturation up to 2 years after anterior cruciate ligament reconstruction using femoral cortical suspension.
Am J Sports Med. 2020;48(3):554-564.
7. Cusumano A et al.: Different timing in allograft and autograft maturation after primary anterior cruciate ligament reconstruction does not influence the clinical outcome at mid-long-term follow-up.
Knee Surg Sports Traumatol Arthrosc. 2022;30(7):2281-2290.
8. Gupta R et al.: Comparison of "ligamentization" process between preserved insertion hamstring tendon autograft and bone-patellar tendon-bone autograft.
J Orthop Sci. 2024;29(4):1020-1025.
9. Zhou T et al.: Association of graft maturity on MRI with return to sports at 9 months after primary single-bundle ACL reconstruction with autologous hamstring graft.
Orthop J Sports Med. 2024;12(5):23259671241248202.
10. Okutan AE et al.:Tibial slope, remnant preservation, and graft size are the most important factors affecting graft healing after ACL reconstruction.
Knee Surg Sports Traumatol Arthrosc. 2022;30(5):1584-1593.