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Quadriceps versus Hamstring Autografts for Anterior Cruciate Ligament Repair in Adolescent Athletes: Comparing Graft Signal Intensity on MRI

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I receive royalties from Arthrex, Inc. I am a consultant for Arthrex, Inc.

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- Hamstring tendon autograft (HTA) is a common graft choice for anterior cruciate ligament reconstruction (ACLR) in skeletally immature patients.
- There is currently a lot of interest in the orthopedic community in comparing the use of a soft tissue quadriceps autograft versus the more common hamstring tendon autograft in children and adolescents.
- There have been many recent studies comparing clinical outcomes of both graft types, namely re-tear rates, hamstring and quadriceps strength and post-operative pain scores.
- In 2016, Albright et al reported that in the first 24 months after surgery, the adjusted risk or hazard of graft failure in the Quadriceps-Patellar Bone group was 0.38 [95% CI: 0.09 to 1.6, $P = 0.1850$] times the risk of graft failure in the Quadruple Hamstring group.¹

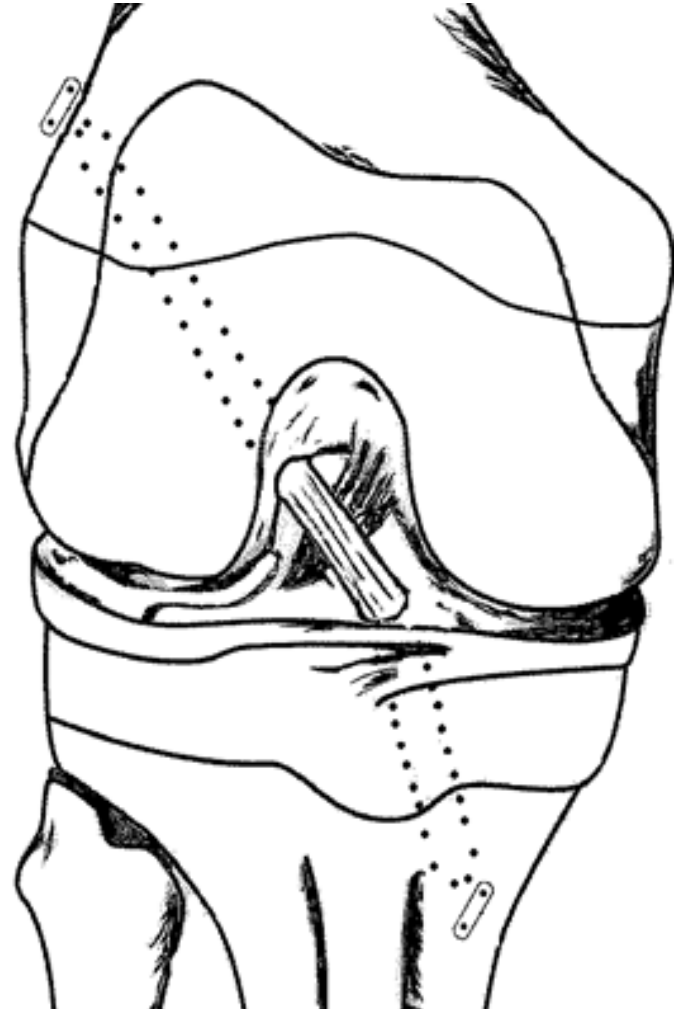
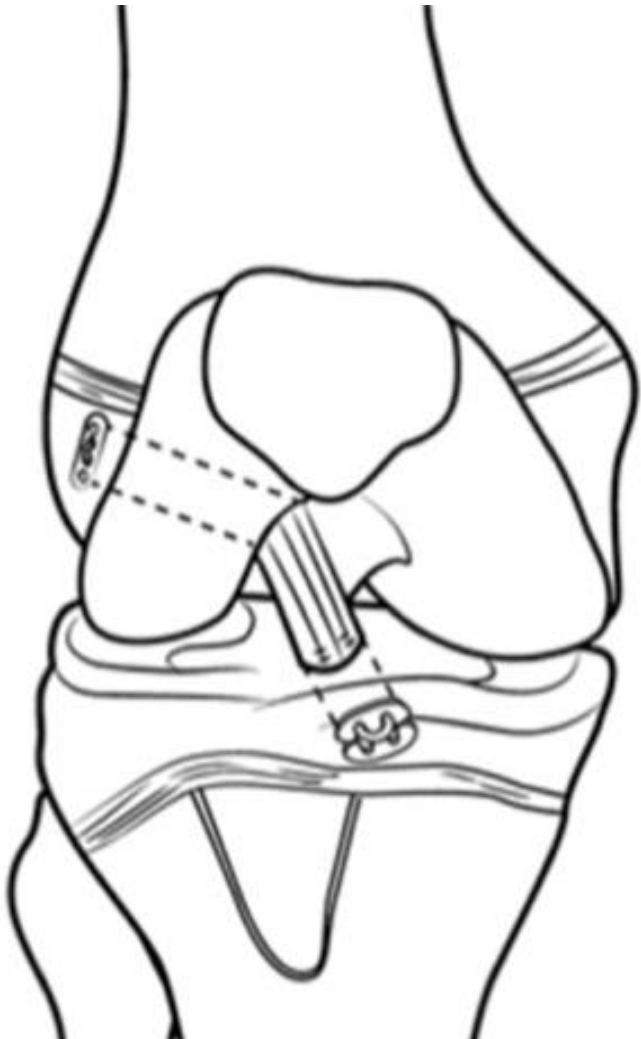
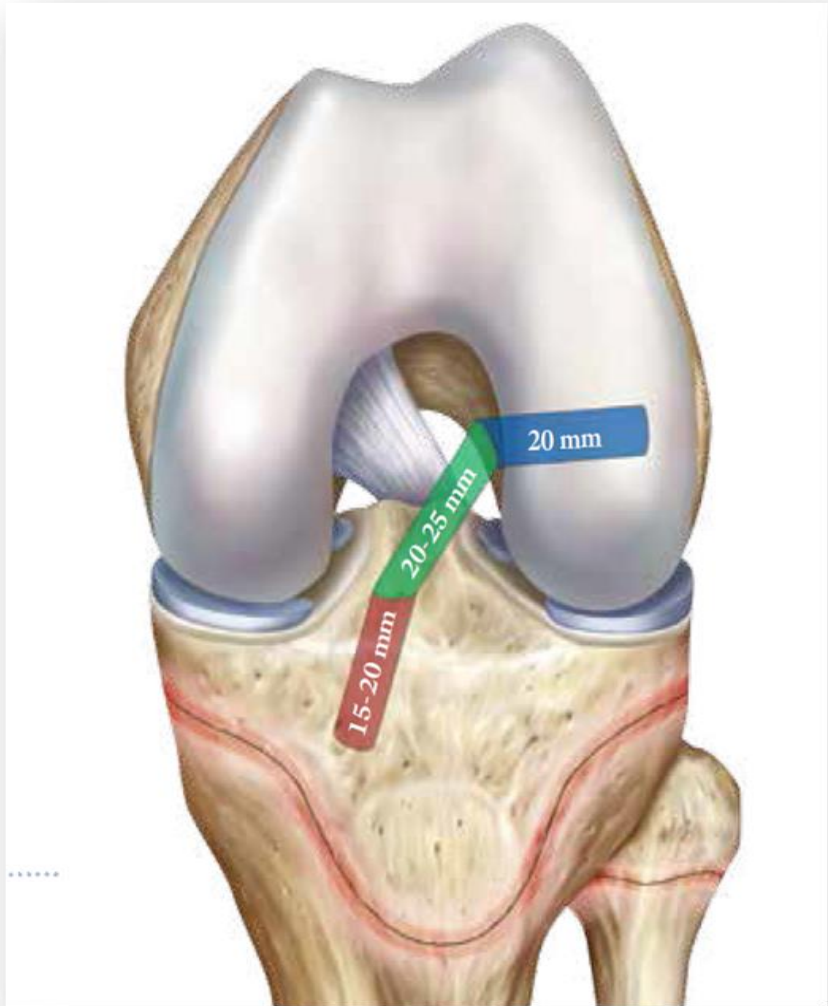
Purpose: To determine if there is a statistically significant difference in signal intensity on post operative MRI between QTA and HTA at 6- and 12-months post ACL reconstruction in a skeletally immature population, and if signal changes significantly within each group over time.

Hypothesis: Given the promising preliminary results of QTA reconstructions in our center, we hypothesized that QTA would have lower signal than HTA at both 6 and 12 months.

To our knowledge, this is the first study of its kind to look at MRI signal intensity as a surrogate for graft maturation to compare all soft tissue QTAs to HTAs at both 6-month and 1-year follow-up.

- All patients under the age of 18 who underwent a primary ACL reconstruction by the senior authors using either a HTA or QTA were retrospectively reviewed.
- Signal intensity ratio (SIR) was measured on sagittal MRI by averaging the signal at three regions of interest (ROIs) along the ACL graft and dividing by the signal of the tibial footprint of the PCL.
- Statistical analysis was performed to determine interrater reliability and differences between time points and groups.

METHODS – Surgical Technique





- Postoperative sagittal MRI 11.7 months after ACL reconstruction with QTA.
- White circles represent the ROI circles used to measure signal intensity.
- Identical ROI circles were placed at 3 different locations along the length of the graft with another ROI circle placed on the full width tibial insertion of the PCL.

RESULTS

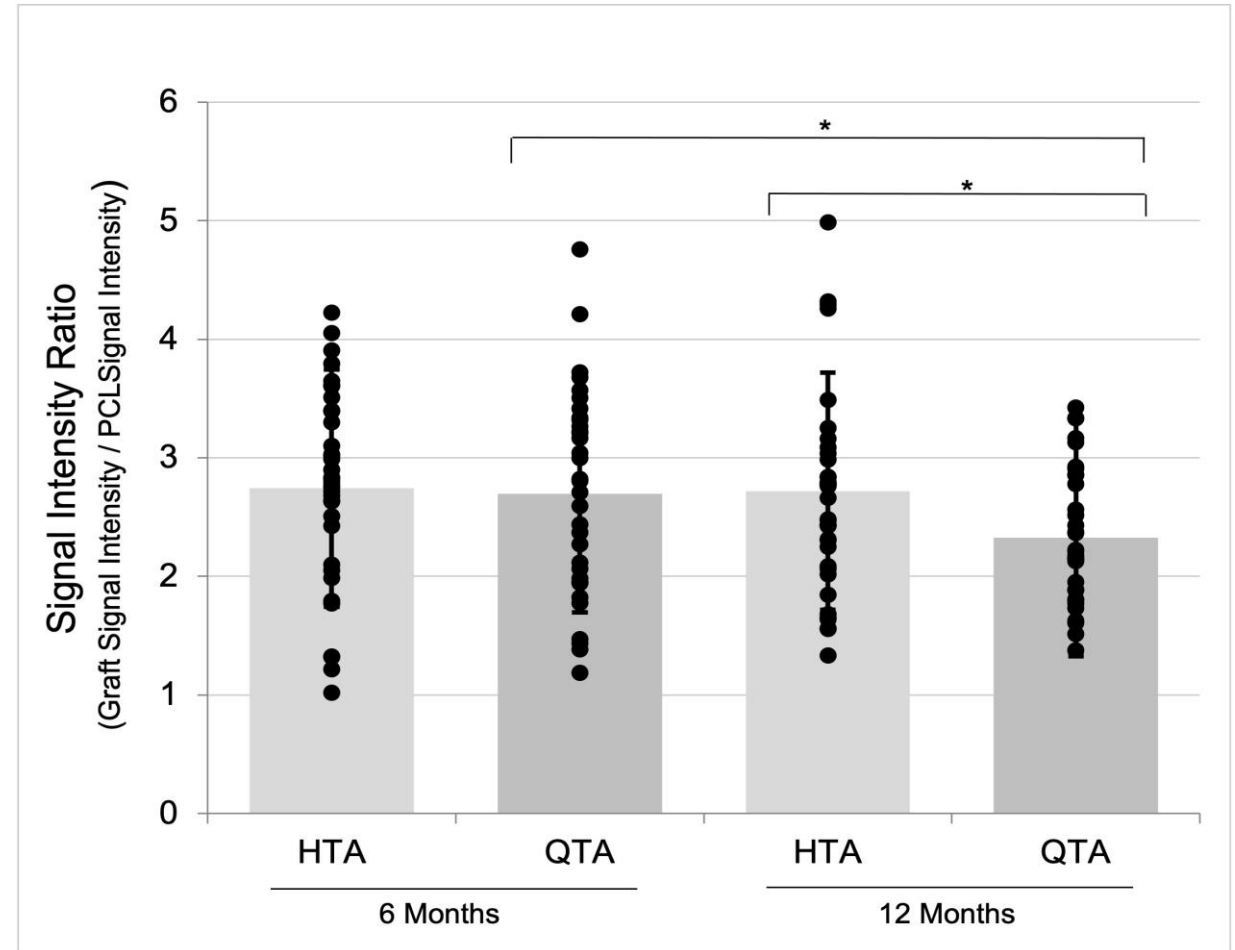


- Seventy skeletally immature patients (37 in the HTA group and 33 in the QTA group) with an available MRI at 6 and 12 months post-operatively were included.
- Age, sex, and type of surgery were not associated with any differences in SI.

	All (n=70)	HTA Group (n=37)	QTA Group (n=33)	p-value
Age (years)	13.4 ± 1.3	13.1 ± 1.4	13.7 ± 1.2	.058
Sex				.895
Male	43 (61%)	23 (62%)	20 (61%)	
Female	27 (39%)	14 (38%)	13 (39%)	
Laterality				.323
Right knee	32 (46%)	19 (51%)	13 (39%)	
Left knee	38 (54%)	18 (49%)	20 (61%)	
Procedure				.166
All Epiphyseal	38 (54%)	23 (62%)	15 (45%)	
Complete Transphyseal	32 (46%)	14 (38%)	18 (55%)	

RESULTS

- There was no significant difference in SIR between groups on the 6-month MRI. However, the SIR of the QTA group was significantly less than that in the HTA group on the 12-month MRI ($p=.028$).
 - Within the HTA group, there was no significant difference in SIR at either MRI time point.
 - In the QTA group, there was a significant decrease in SIR between the 6 month and 12-month post-operative MRI ($p=.045$).



RESULTS: 6 month post-operative MRI

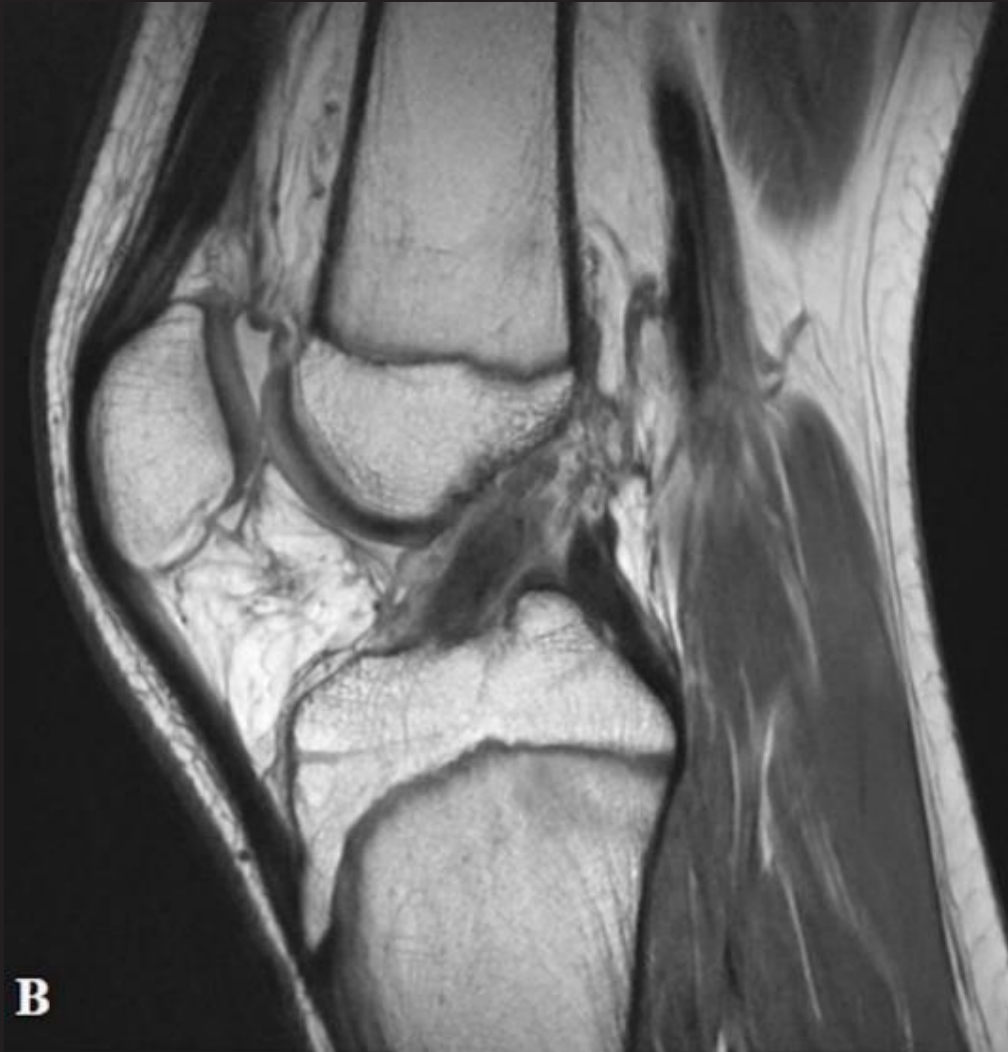


**Sagittal MRI after ACL
reconstruction with HTA**



**Sagittal MRI after ACL
reconstruction with QTA**

RESULTS: 12 month post-operative MRI



Sagittal MRI after ACL reconstruction with HTA
(same patient as in panel A)



Sagittal MRI after ACL reconstruction with QTA
(same patient as in panel C)

- These findings suggest improved graft maturation, remodeling and structural integrity of the QTA as compared to the HTA between 6 and 12 months post-operatively.
- This provides evidence that one year postoperatively, QTA may have a superior rate of incorporation and synovialization as compared to the HTA.
- This preliminary radiographic evidence suggests that QTA is a superior graft to HTA with regards to graft maturation in this high-risk athletic population.

This study has been accepted for publication at AJSM²

Thank you!

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1. Albright J, Lepon AK, Mayer S. Anterior Cruciate Ligament Reconstruction in Pediatric and Adolescent Patients Using Quadriceps Tendon Autograft. *Sports Med Arthrosc.* 2016;24(4):159-169. doi:10.1097/JSA.0000000000000128
2. Aitchison AH, Alcoloumbre D, Mintz DN, Hidalgo Perea S, Nguyen JT, **Cordasco FA**, Green DW. Quadriceps Tendon Autograft Has Lower MRI Signal Than Hamstring Tendon Autograft in Anterior Cruciate Ligament Reconstructions of Adolescent Athletes. *Am J Sports.* Accepted May 2021