Physical Therapy

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BIOMECHANICS AND MOVEMENT SCIENCE

AMERICAN ACADEMY OF SPORTS PHYSICAL THERAPY

Healing Trajectory of the Patellar Tendon after Anterior Cruciate Ligament Reconstruction with Bone-Patellar Tendon-Bone Autograft

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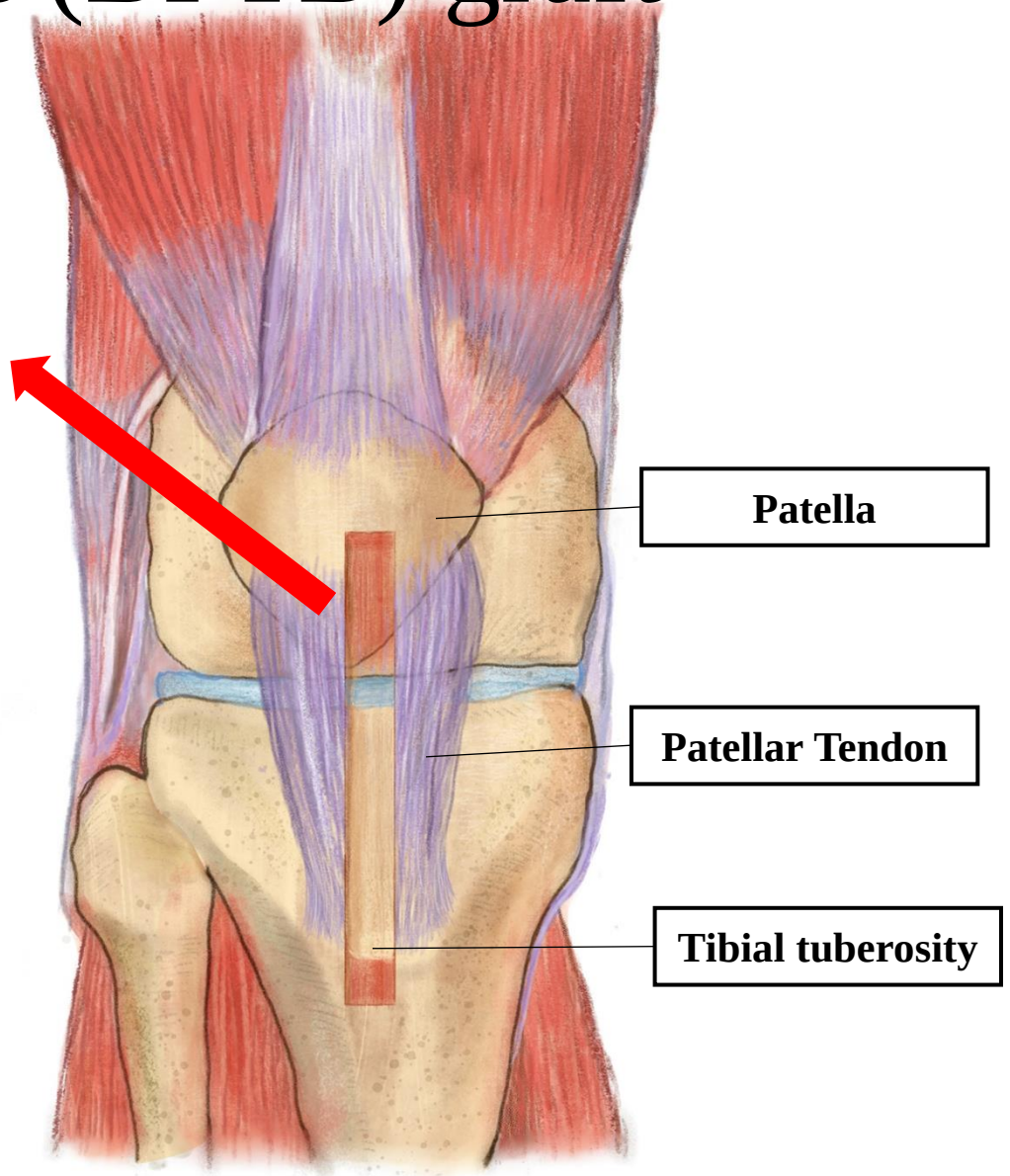
Bone-Patellar Tendon-Bone (BPTB) graft

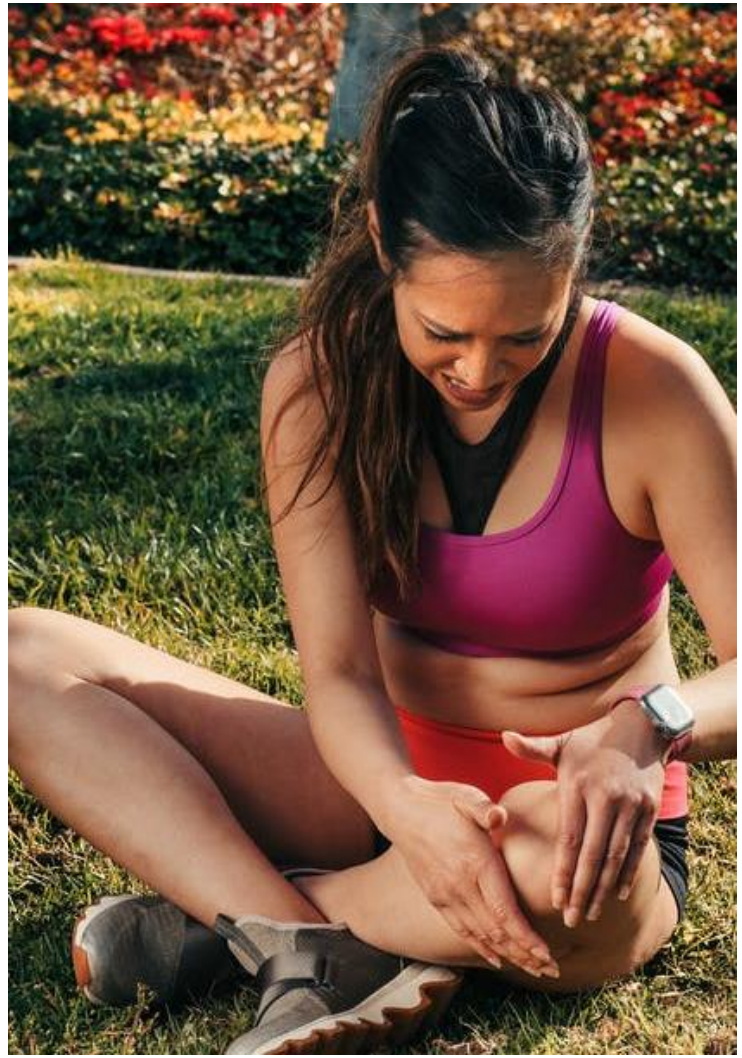
- Central third of the tendon + bone
- Common graft type in the US
- Better graft maturation compared to other graft types
- Lower reinjury rates in young, active athletes compared to other graft types



BPTB autograft comes with a cost….

Compared to alternative graft types:

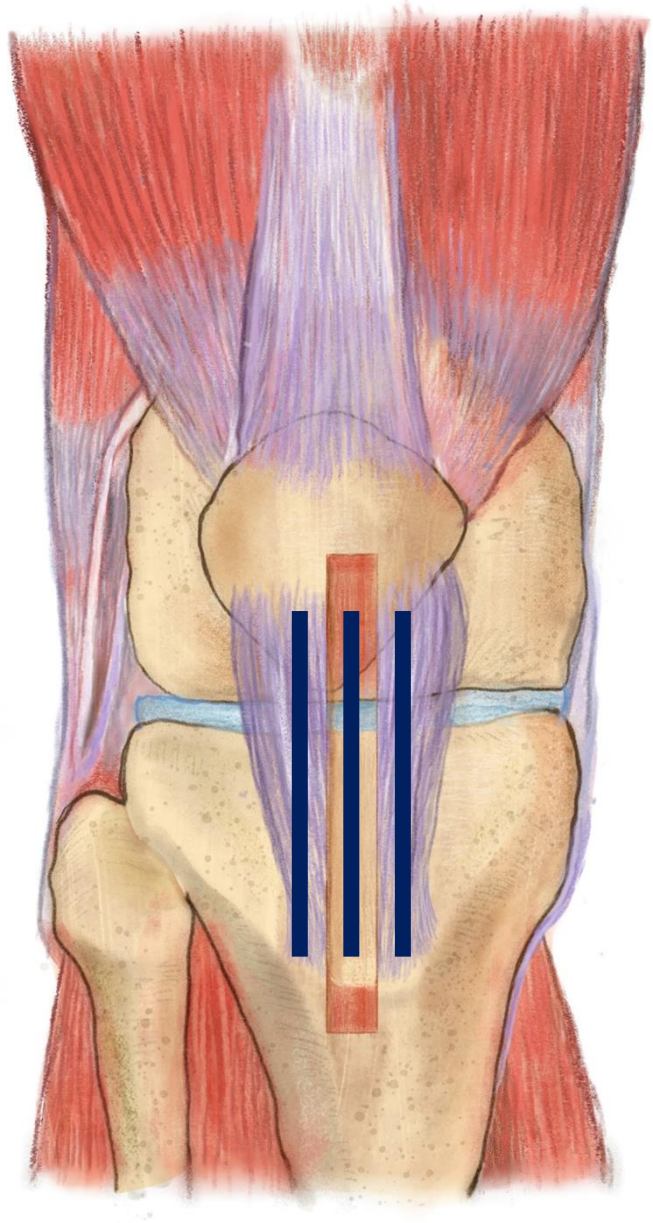
- More anterior knee pain impacting rehab
- Prolonged quadriceps weakness
- Possible heightened risks of post-traumatic knee osteoarthritis long-term



Tendon morphology

- Important for Quadriceps Performance
- Few studies have considered the graft site tendon
  - What is the thickness?
  - What is the cross-sectional area?
  - Is there presence of blood flow?
  - What are the changes over time?

- **Graft site tendon structure over the course of rehabilitation is not well understood**



Purpose

Present descriptive preliminary findings from an ongoing prospective cohort study on the healing trajectory of the patellar tendon after BPTB graft harvest over the course of rehabilitation after ACL Reconstruction Surgery

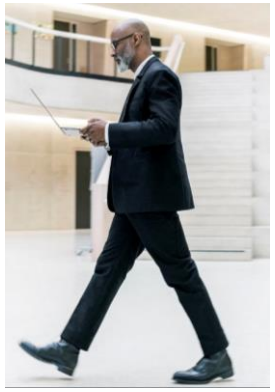
Study Design

- Unilateral ACL reconstruction using BPTB autograft
- Age: 13-45 years
- 3 Timepoints

Review > Sports Health. 2022 Sep-Oct;14(5):770-779. doi: 10.1177/19417381211056873. Epub 2021 Dec 13.

ACL Reconstruction Rehabilitation: Clinical Data, Biologic Healing, and Criterion-Based Milestones to Inform a Return-to-Sport Guideline

Alexander W Brinlee [1], Scott B Dickenson [1], Airelle Hunter-Giordano [1], Lynn Snyder-Mackler [1]



1 Month

Intermediate Post-Operative Phase

- "Normal" gait pattern
- Full Range of Motion
- Resumption of ADLs

3-4 Months

Transitional Phase II

- Initiation of running
- Independence with strength training program

6-9 Months

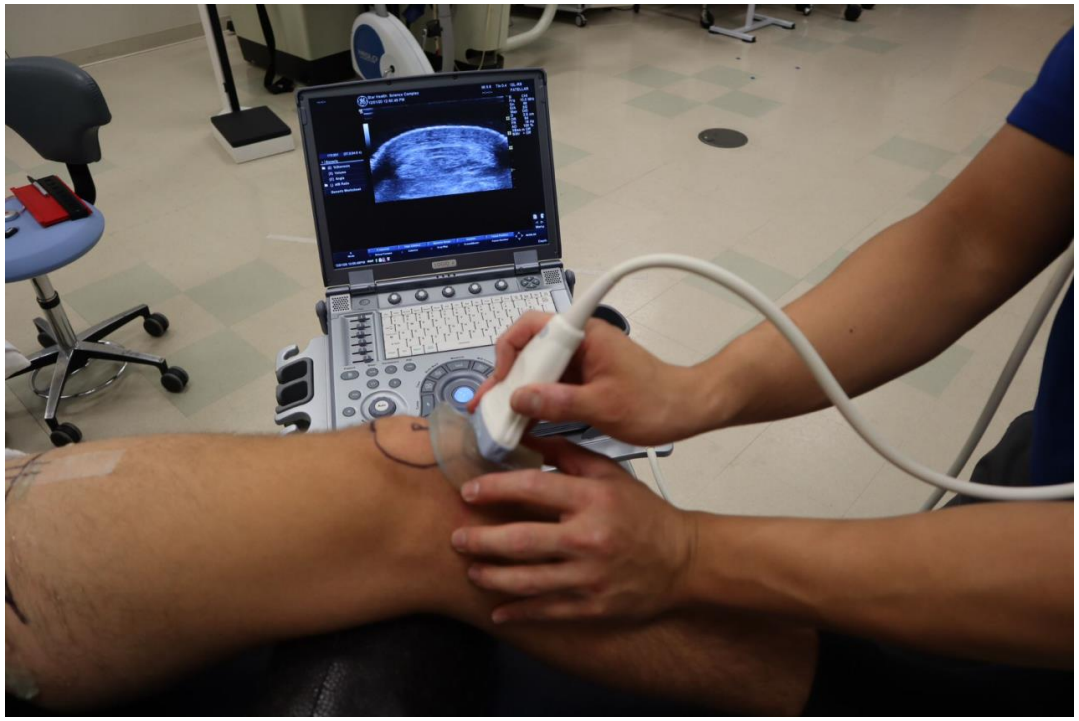
Transitional Phase IV

- Sport specific skills
- Reconditioning to pre-injury levels

Ultrasound Imaging

Patellar Tendon

- Cross Sectional Area
- Thickness (Central third)
- Doppler Ultrasound (blood flow)



GE LOGIQ e Ultrasound with a linear probe

Parameters
Frequency: 10MHz
Depth: ~3cm (adjusted as needed)
Focus: ~1cm
Gain: Optimally visualize tendon

Position

- Supine
- Foam roller under knees
- ~30deg of knee flexion

Patient Demographics (n = 35)

Sex: 17 Female | 18 Male

Age: 22.6 ± 7.2 years

Body mass index: 25.0 ± 3.5 kg/m^2

Mechanism of injury:

11 Contact | 24 Non-Contact

Level of Sport:

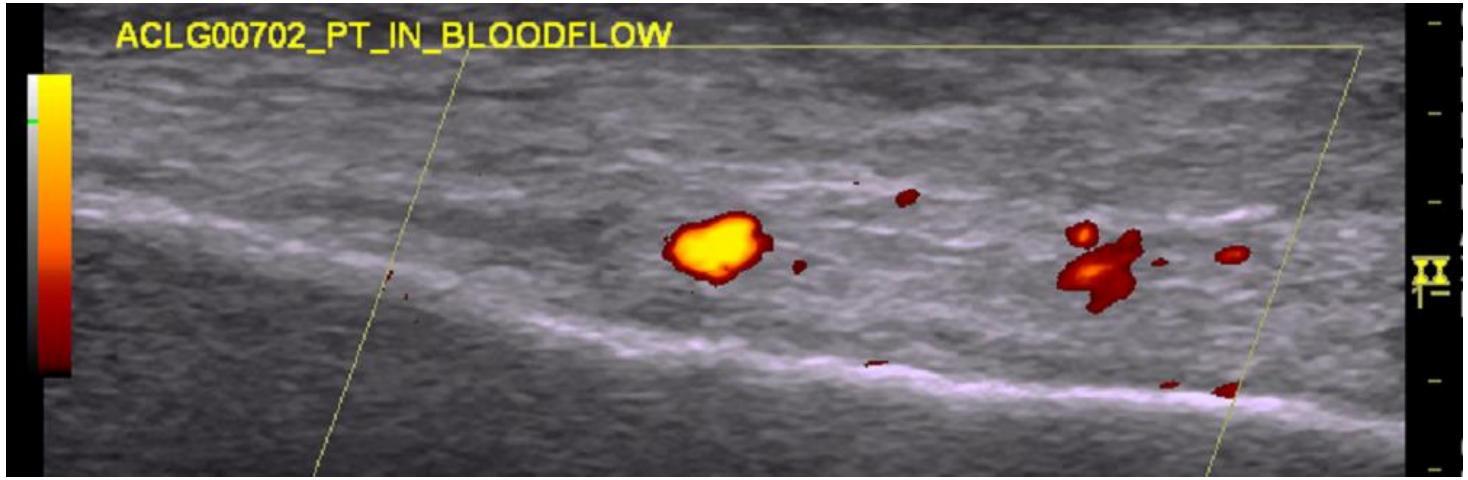
31 Level I | 3 Level II | 1 Level III

Prevalence of neovascularization

1 month: 100% (27/27)

3-4 month: 100% (32/32)

6-9 month: 74% (17/23)



- Neovascularization is present after BPTB graft harvest
- They persist in most up to 6-9 months after ACLR

Cross Sectional Area and Thickness

Patellar Tendon Structure after Bone-Patellar Tendon-Bone Graft Harvest

		1 Month (n=27)		3-4 Months (n=32)		6-9 Months (n=23)	
Measure	Side	Mean	SD	Mean	SD	Mean	SD
Thickness (cm)	in	0.90	0.19	0.83	0.16	0.76	0.19
	un	0.42	0.10	0.42	0.10	0.42	0.08
Cross-sectional Area (cm^2)	in	1.80	0.53	1.73	0.50	1.54	0.46
	un	0.88	0.15	0.91	0.18	0.91	0.17

Note:

in = involved knee, un = uninvolved knee

- Graft site patellar tendon is thicker and larger after surgery
- Becomes thinner, and smaller over the course of rehabilitation
  - Still larger at 6-9 months after ACLR

Clinical Implication

- Vascularization may indicate timeframe for targeted interventions such as tendon loading protocols to be effective
- The patellar tendon remains thicker and larger 6-9 months after ACLR
- Patellar tendon vasculature and morphology may have to be considered in rehabilitation
- Future research will study implications of morphology and vasculature on patient outcomes after ACLR

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