ACL Injuries-Which Graft Do You Use?

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ACL Injury and Reconstruction

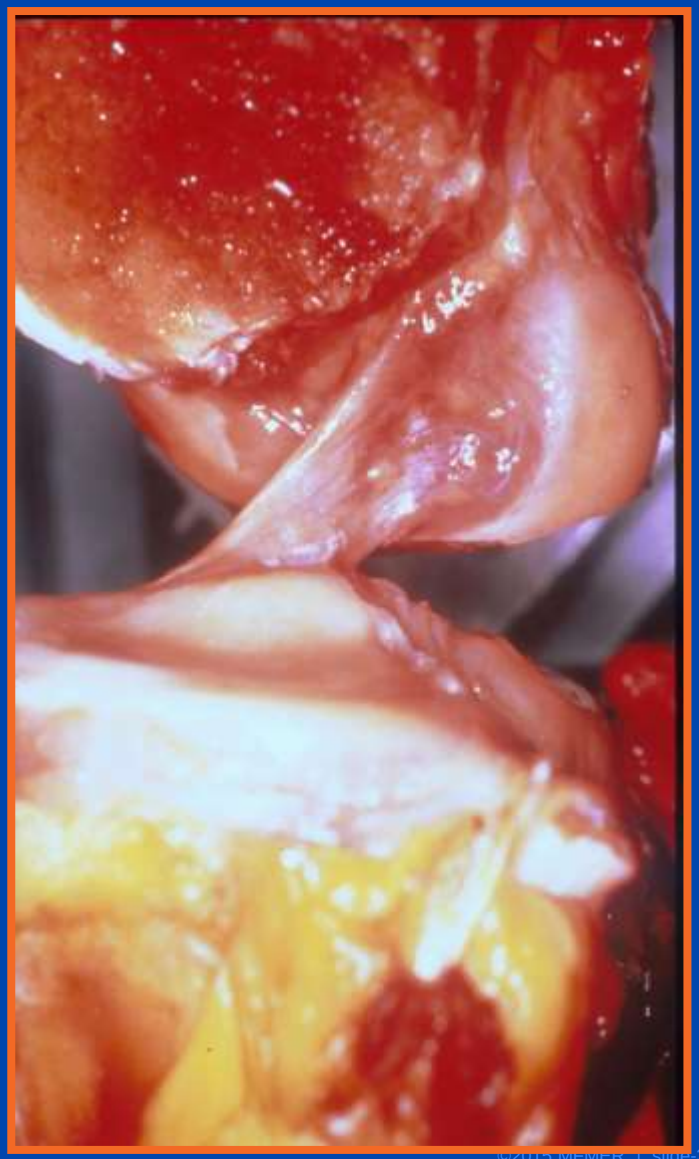
- 50% of all sports related knee injuries
- Limited data on primary repair and internal bracing
- Gold standard is reconstruction

Widner et al. Current Review Musculoskeletal medicine, 12/2019

“Ideal Graft”

1) Reproduces anatomy and biomechanics of native ACL
2) Allows rapid and complete biological incorporation
3) Strong initial fixation
4) Minimizes morbidity

Does it exist?



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Options

Autograft

- Bone-Patella Tendon-Bone
- Hamstrings
- Quadriceps Tendon
  - Ipsilateral vs. Contralateral

Allograft

- Patellar tendon
- Achilles
- Tibialis anterior
- Hamstrings
- Other

Considerations

1) Strength
2) Stiffness
3) Cross-sectional area
4) Biological Properties

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Mechanical Properties

	Strength (N)	Stiffness (N/mm)	Cross Sec Area (mm^2)
Intact ACL	2160	242	
B-PT-B (10mm)	2367	812	34.5
Quadruple Hamstring	4108	776	52.9
Quad Tendon (10mm)	2352	463	61.9

Hamner *JBJS* 1999
Woo *AJSM* 1991

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Patellar Tendon Autograft

Advantages

- Mechanical/biological properties
- Ease of Harvest
- Initial fixation
- Faster Biological incorporation

Bone to bone healing: 6-8 weeks

Tendon bone healing: 8-12 weeks

Rodeo *JBJS* 1993

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Patellar Tendon Autograft

Disadvantages- Graft Site Morbidity

- Patellofemoral pain
  - 52% at two years (17% in HS)
- Kneeling pain
  - 65% at two years (35% in HS)

-No difference between the groups at 15 year f/u

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Patellar Tendon Autograft
Disadvantages- Graft Site Morbidity

- Cosmesis
- Quadricep weakness
- Numbness/Dysesthesia incision site
- Patella fracture- 0.4%-1.3%
    - Irregularity with saw cuts
- Patella tendonitis
- Patella tendon rupture- 0.18%-0.25%
    - Poor centralization during harvest

Rosenberg; *Am J Sports Med* 1992
Miller; *Arthroscopy* 1999
Simonian; *Am J Knee Surg* 1995

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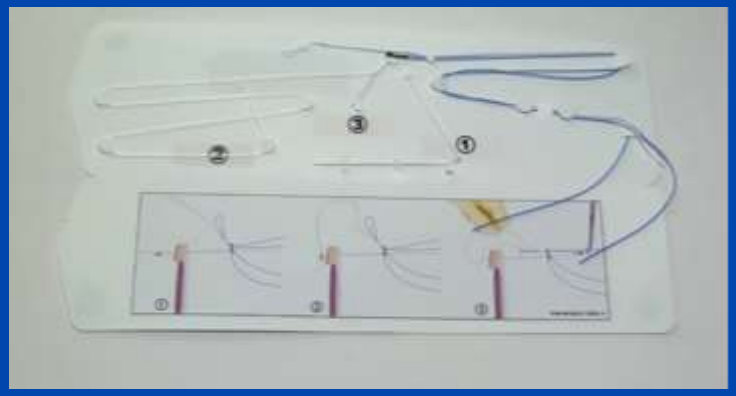
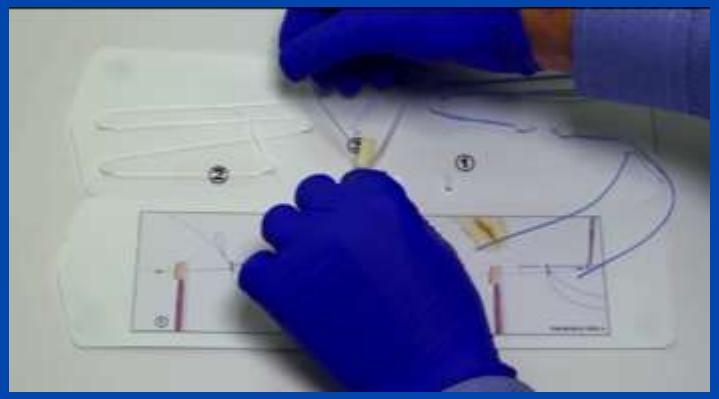
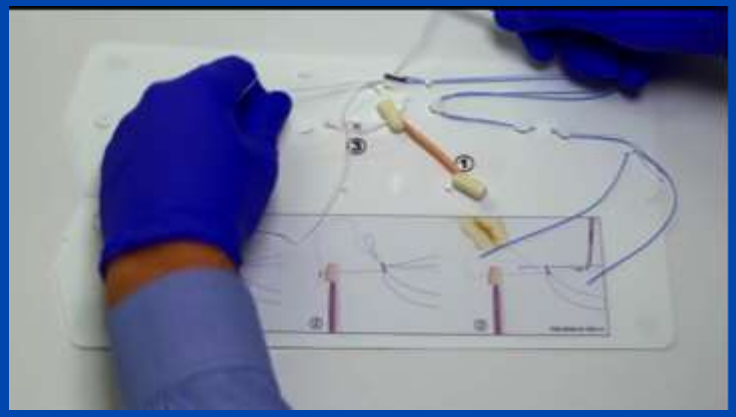
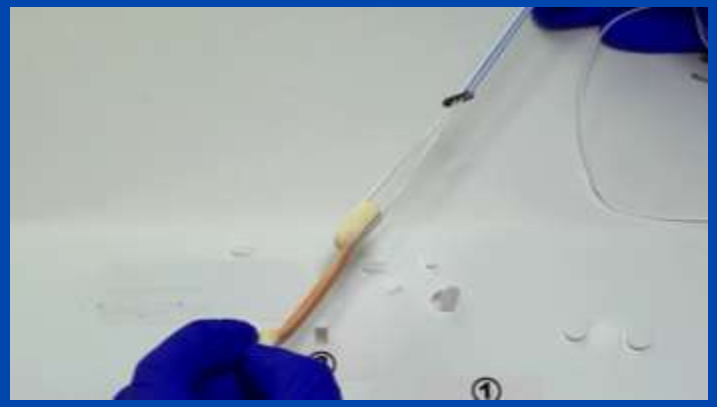
Graft Prep BPTB









https://www.arthrex.com/resources/video/yhw13PtuSEOVAAE3pX58EA/btb-tightrope

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Quadrupled Hamstrings

Advantages

- Preserves extensor mechanism
- Cosmetic
- Less anterior knee pain
- No Graft Tunnel Mismatch

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Quadrupled Hamstrings

Disadvantages

- Still some anterior knee pain
- Flex/extension and internal rotation strength deficit-seem to resolve with time
- Requires tendon healing to bone
- Morphological changes in hamstring muscles
  - Avoid in sprinters
- Sensory deficit- 40-88%
  - Disruption saphenous nerve

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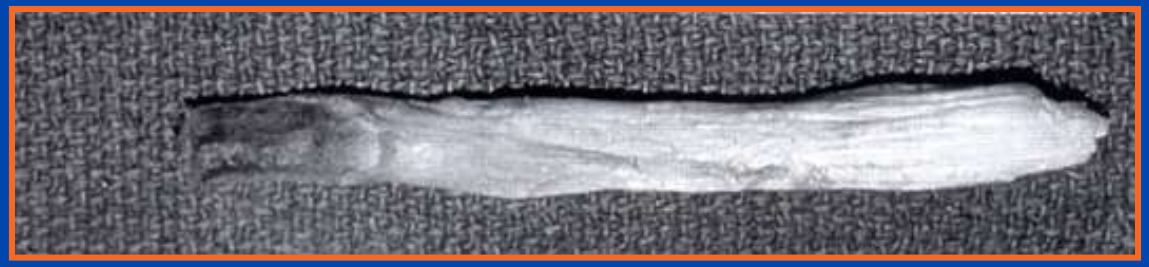
Graft Prep Hamstring

https://www.arthrex.com/resources/animation/sjjf3PkEEeCRTQBQVoRHOw/speedwhip-technique-with-fiberloop

Quadriceps Tendon

Advantages

- Increased Size & Strength vs BPTB
  - 64.4mm^2 vs 36.8mm^2
  - 136% stronger
- No numbness
  - Avoids infrapatellar branch saphenous nerve
- Decreases surgical time
  - Can harvest while performing notchplasty



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Quadriceps Tendon

Disadvantages

- Strength deficits
- Some anterior knee pain
- Technique less well defined
- Change rehab protocols

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Allograft Considerations

1) Safety

- Concerns of rejection
  - Immune response in 35%
  - No clinically significant effects

    Harner, *Am J Knee Surg*, 1993
- Concerns of infection
  - 1 in 1.5 million

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Allograft Considerations

2) Allograft selection

- Patellar tendon
- Achilles tendon
- Tibialis anterior
- Hamstrings
- Other

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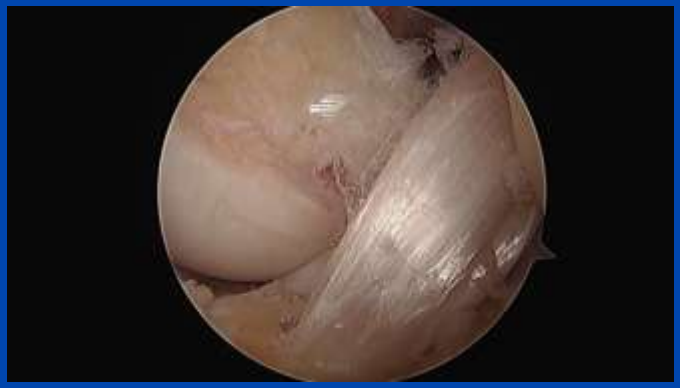
Allograft Considerations

3) Graft Incorporation

- Follows similar course to autograft tissue
- Cellular repopulation, revascularization, and collagen remodeling progress more slowly

DW Jackson, et al, CORR, 1996



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Allograft Considerations

4) Cost

- $1000 - $1500
- But decreased OR time

5) Availability

6) Higher retear rate up to 25% in young patients

7) Post-op Rehab

- Less “aggressive”
- “Return to play” - 6-9 mos

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So How Do We Decide?

What is the right answer?

Scenario #1

21 y/o M college level football player injured during spring practice junior year presents with ACL tear, meniscus tear with no other ligament injury. Aspirations to continue to play football in future. Which graft choice is best for him?

a.) Quadrupled HS

b.) Allograft

c.) Quad tendon

d.) BPTB autograft

e.) ACL repair with internal brace

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How do we decide? BPTB

YES

- "High Demand"
- Young Athlete
- Football
- History of ligamentous laxity

NO

- Pre-existing patella pain/chondrosis
- jumping or deep squatting sports (relative contraindication)
- Lifestyle (job, religion)

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Scenario #2

15 y/o F high school soccer player with isolated ACL injury. No meniscal pathology. History of dislocation of R shoulder. Which graft choice is best for her?

a.) Quadrupled HS

b.) Allograft

c.) Quad tendon

d.) BPTB autograft

e.) ACL repair with internal brace

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How do we decide? Hamstring

YES

- Recreational athletes
- Return to play > 6 mos
- Cosmetic
- Open growth plates

NO

- Sprinters, speed athletes
- Increased ligament laxity

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Scenario #3

27 y/o M former hockey player with previously reconstructed R ACL with BPTB, presents with recurrent R knee ACL tear. Still playing ‘high level’ recreation hockey and wants to continue. Which graft choice is best for him?

a.) Quadrupled HS

b.) Allograft

c.) Quad tendon

d.) BPTB autograft

e.) ACL repair with internal brace

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How do we decide? Quad

YES

- Revision when you want to use autograft

NO

- Not primary graft choice with my surgeon
- ?change in rehab protocol
- ?bone block vs. soft tissue
- ?gold standard

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Scenario #4

45 y/o M with failed R knee ACL reconstruction with hamstring due to infection. Has had I&D and no evidence of infection. Had first stage revision with allograft bone grafting. Ready for re implant. Which graft choice is best for him?

a.) Quadrupled HS

b.) Allograft

c.) Quad tendon

d.) BPTB autograft

e.) ACL repair with internal brace

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How do we decide? Allograft

1) Revision ACL

- Autograft already used
- Tunnel expansion
- May allow alternative techniques

2) Multi-ligament injuries

- Reduce surgical morbidity
- Reduce time and iatrogenic swelling

3) Primary ACL reconstruction

- Patient request
- “Older” patients (>40)
- “Lifestyles” – religion, occupation
- Special considerations
  - ligamentous laxity with “small” knees

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Summary

- **No ideal graft**
- **Must individualize**
  - **based on age, sport, expectations, and pre-existing pathology**
- **Trend is for autos in younger patients**
- **Studies can defend anything you do**
- **Need to discuss with patients!**
- **Be flexible !!!!!!**

"Use all graft types and have specific indications for each."

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Thank You!