Anatomic vs Radiographic Based MPFL Reconstruction – A Comparative Analysis

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Disclosure Statement

- No authors have financial relationships with industry
- I'd be happy to start some!

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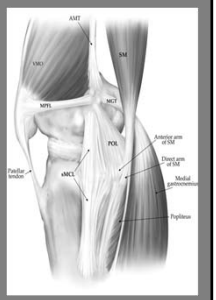
Medial Patellofemoral Ligament

- First described by Kaplan, 1957, as transverse reinforcement between base of patella and tendon of medial head of gastrocnemius (Bull Hosp Joint Dis)
- 1979, Warren and Marshall described MPFL as second layer between medial epicondyle and patella (JBJS/CORR)
- Instrumental in preventing lateral patellar translation during knee ROM and resisting patellar dislocation



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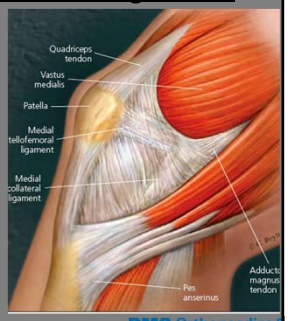
Medial Patellofemoral Ligament

- MPFL extends into secondary layers below deep fascia & superficial to joint capsule along with superficial band of MCL
- Patellar attachment usually wider than femoral, located at most prominent medial edge of patella



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Introduction

- Over last 30° of extension, patella is outside bony limits of femoral trochlea
  - Becomes dependent on soft tissue restraints
    - Heegard et al, 1994, CORR
- Studies have demonstrated the MPFL provides the majority of the restraining force to lateral displacement of the patella.[4, 5]
- At ***20° flexion, MPFL provides ~60% of total medial restraining force*** against lateral patellar displacement
  - Medial patellomeniscal ligament – 13%
  - Medial retinaculum – 3%
  - MPTL – 3%
    - Desio et al, 1998, AJSM

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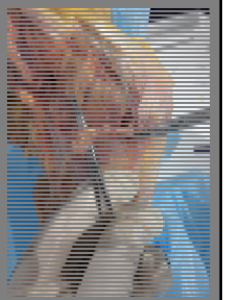
Introduction

- MPFL experiences maximal loads at full extension or during early flexion as quad activation pulls patella toward trochlea
  - Bicos et al, 2007, AJSM
- MPFL very taut at 0° flexion, slightly relaxed at 15-30°, and relatively taut at 45-150° flexion
  - Nomura et al, 2000, Knee
- Patella is most easily subluxated laterally at 20° flexion
  - Amis et al, 2003, Knee



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Introduction

- How do you know you are in the right location?
- Many believe the graft should be in an isometric position
- Others feel XR position most reproducible
- Still others feel Anatomic best
- Bottom line: Do any of these reproduce intact MPFL Properties?

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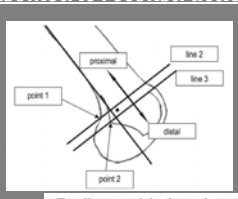
Introduction

- Shottle *et al.* described radiographic landmarks to find the femoral attachment site for a relatively ***isometric reconstruction.***[17]



Radiographic Landmarks for Femoral Tunnel Placement in Medial Patellofemoral Ligament Reconstruction

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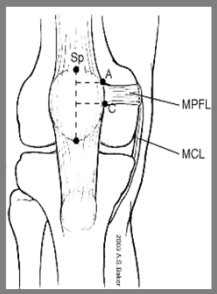
Introduction

- Prior research in our lab (Houdek, *et al, J Knee Surg,* 2015) has shown that as the knee gets into deeper flexion angles, less tension is seen at the native MPFL
  - ***Native MPFL isn't necessarily isometric***
- Attempting to reconstruct the ligament to most closely resemble its ***anatomic dynamics*** is preferred to help prevent a non-anatomic reconstruction that may have excess tension leading to increased medial patellofemoral pressure.[1, 8, 18]



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Purpose

- To compare the intact native medial patellofemoral ligament (MPFL) and the resected MPFL state
- Two different reconstructions of the MPFL
  - Anatomic (intact-like) reconstruction (AR)
  - Radiographic-based (isometric) reconstruction (RR)
- Outcomes measured:
  - Strain
  - Displacement
  - maximum load
  - isometry

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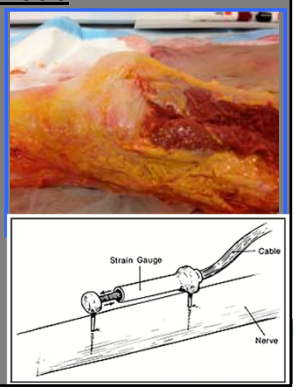
Methods

- 8 fresh frozen human cadaveric knees
- Knees were dissected to expose the native MPFL
  - Fixed in custom made aluminum pots.
  - 3.0 mm stroke Microminiature DVRT (digital variable reluctance transducer) linear displacement transducer (Microstrain, Williston, VT)



Methods

- Protocol:
  - Native MPFL was tested by translating the patella laterally 1 cm while the knee was ranged from 0° to 120°, at 10° increments.
  - Cut State
  - Repair #1
  - Repair #2
    - Repair order randomized

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Methods - Reconstructions

- Performed using an adductor magnus autograft
- Anatomic (Intact-Like) Reconstruction
  - Tensiometer assisted
  - Point where tension decreased as knee flexed
- Radiographic reconstruction
  - "Schottle's Point" was identified using fluroscopy

ROM with Proper Tension

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Methods

- Both reconstructions were attached to the patella with a #2 high tensile strength suture in a 4.5mm suture anchor at the patellar insertion site of the MPFL at 20 deg
- Set up described previously:
  - A two pound weight was sutured to the quadriceps tendon to simulate a small quadriceps force

The Biomechanics of Medial Patellofemoral Ligament Repair Followed by Lateral Retinacular Release

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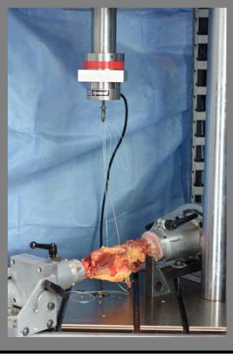
Methods

- Testing Apparatus
- Measuring:
  - Strain
  - Displacement of reconstruction
- Statistics
  - One-Way Anova and Kruskal-Wallis test
  - Data adjusted w/ Bonferroni correction



Results

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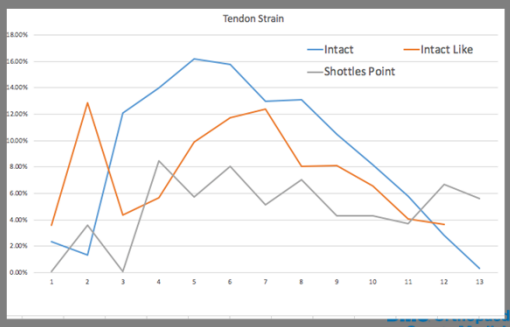
- Avg distance between the tunnels drilled for RR and the AR was 11.86+/-2.06mm.
- **Max Load:**
  - No difference between either reconstruction and intact state
- **Stiffness:**
  - No difference between either reconstruction and intact state except for at 40°
  - At 40° both reconstructions showed higher stiffness than intact state ($p<0.05$)
- **Strain**
  - RR significantly lower than that of the intact state at
    - 70, 90, and 120 degrees of flexion

Strain



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Conclusions

- Finding the appropriate femoral insertion point for MPFL reconstruction has been an evolving topic
- Relative Isometry of the graft may be achieved by performing a radiographic-based reconstruction at Shottle's point
- However, this study found that ***the native MPFL is not isometric through deeper flexion*** and ***using an isometric point for reconstruction alters the tension mechanics of the graft and could lead to over constraining the patella in greater degrees of flexion.***

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Thanks!

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