

Meniscal Tears

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About Me

- UTHSCSA Class of 2012!



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About Me

- Residency-University of Florida-Gainesville, Florida
- Fellowship-Andrews Sports Medicine-Birmingham, Alabama
- Austin Sports Medicine-2017-current
 - Head Team Physician-Huston-Tillotson University
 - Assistant Team Physician-Austin FC



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Goals

- Discuss Meniscus tears
- Discuss treatment options
 - Meniscectomy
 - Repair Techniques
- Discuss Outcomes



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Epidemiology

- **Incidence: 60-70/100,000** (Nielsen, *J Trauma*, 1991; Hede, *Acta Orthop Scand*, 1990)
- **Age** (Poehling, *Clin Sports Med*, 1990)
 - 2nd, 3rd decade
 - Traumatic
 - Associated ACL injury
 - Longitudinal, radial tears
 - 4th, 5th, 6th decade
 - Degenerative tears
 - 60% prevalence in pts > 65
- **Sex**
 - Male : female ranges from 3:1



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Epidemiology-Associated Injuries

- **Acute ACL tear**
 - Lateral meniscus tears more common due to valgus load (Duncan, *AJSM*, 1995)
 - 83% lateral v. 17% medial
 - ACL injury in 1/3 of all acute meniscal tears (Poehling, *Clin Sports Med*, 1990)
- **Chronic ACL tear**
 - Medial meniscus tears more common
 - Due to MM as secondary restraint to anterior tibial translation

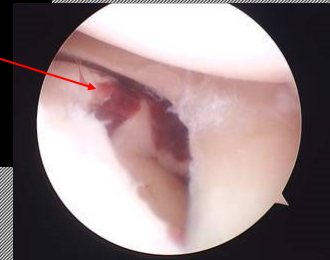


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Epidemiology-Associated Injuries

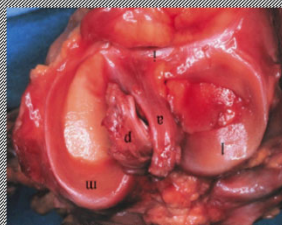
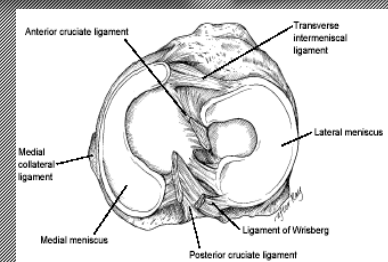
- Associated injuries
 - Fractures (Vangsness, JBJS Br, 1994)
 - 50% with tibial plateau fractures had meniscus tears
 - 50% with closed femoral diaphyseal fractures had meniscal tears



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Anatomy

- C-shaped or semi-circular fibrocartilage
- MM = 60%, LM = 80% surface area coverage of plateau
- Transverse intermeniscal ligament
 - 60% of knees
 - Connects anterior horns of menisci

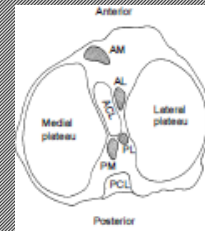
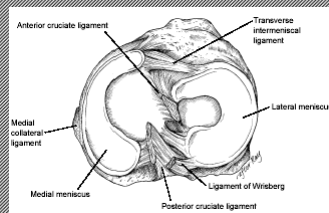


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Medial Meniscus

Morphology

- C-shaped
- Posterior horn larger than the anterior horn in the A/P dimension
- Anterior horn inserts 7mm anterior to ACL
- Continuous attachment to capsule



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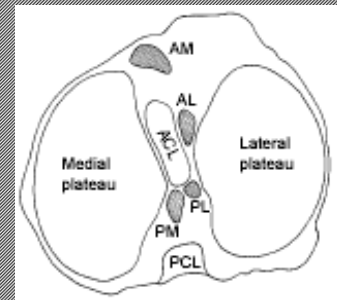
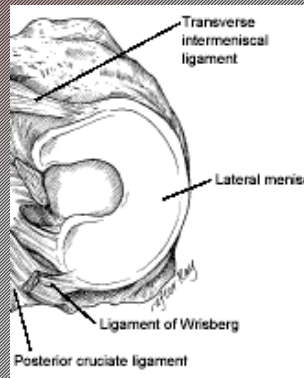
Lateral Meniscus

Morphology

- Semicircular configuration
- Covers larger portion of tibial articular surface

Bony Insertions

- Anterior horn: adjacent to ACL
- Posterior horn: behind intracondylar eminence, anterior to posterior horn of medial meniscus



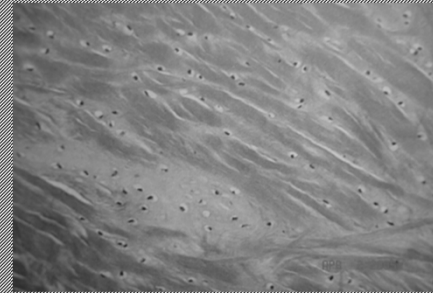
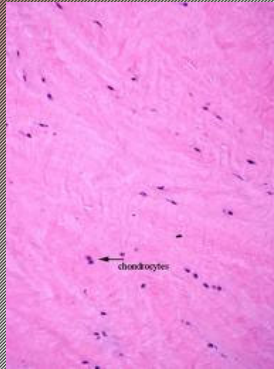
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Microstructure

• Fibrocartilage

- **Fibrochondrocytes**
 - Synthesize fibrocartilaginous matrix
- **Collagen**
 - 60 – 70% dry weight
 - Mostly type 1 (75 - 90%); 2, 3, 5, 6 present in smaller amounts
- **Elastin: 0.6%**
- **Noncollagenous proteins (8 – 13%)** McDevitt, CORR, 1990

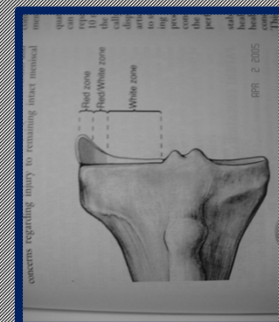
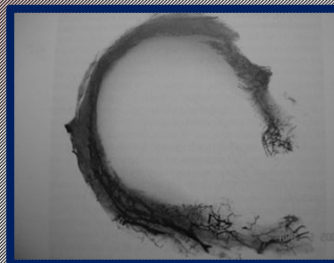


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Microstructure

• Blood supply

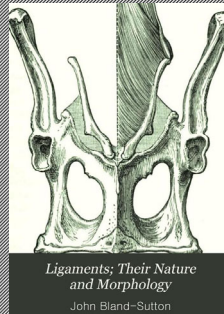
- **Changes with age**
 - Birth: entire meniscus vascular
 - 9 months: inner 1/3 avascular
 - Age 10
 - Resembles adult
 - Peripheral 1/3 vascular (10-30% for both MM and LM)



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Function

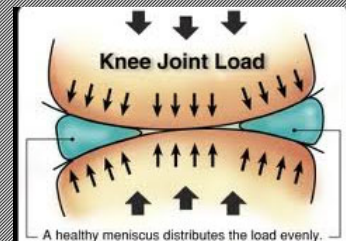
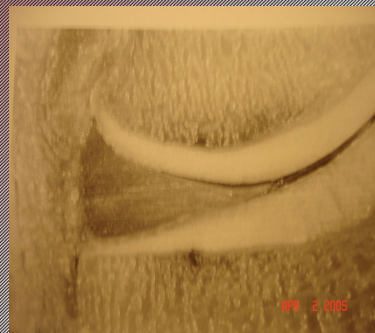
- 1897:
 - "Functionless remnant of intra-articular leg muscles" (Bland-Sutton, *Ligaments: Their Nature and Morphology*, 1897)
- Today:
 - Load-sharing
 - Joint lubrication
 - Shock absorption
 - Joint stability
 - Proprioception



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Load-sharing

- Joint congruity from intact meniscus helps distribute load over the tibial plateau
- 50% of load is transmitted through post horns in full extension, 85% in 90° flexion
- Must have horn attachments!

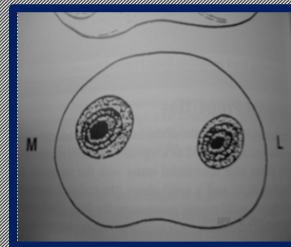


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Load-sharing

- **Medial meniscus**
 - Shares load equally with medial tibial plateau
- **Medial meniscectomy**
 - 50 – 70% reduction in femoral condyle contact area
 - 100% increase in contact stress
- **Lateral meniscus**
 - Takes 80% of load
 - **Lateral meniscectomy**
 - 40 – 50% reduction in contact area
 - 200 – 300% increase in contact stress
(Kettelkamp, JBJS, 1972)



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Function

- **Nutrition** (Mow, *Articular Cartilage and Joint Function: Basic Science and Arthroscopy*, 1990)
 - Intact meniscus improves joint congruity
 - Meniscus aids in mechanical pumping and diffusion of nutrients to local articular cartilage
- **Shock absorption**
 - Shock absorption of knee decreased by 20% after meniscectomy (Voloshin, *J Biomed Eng*, 1983)



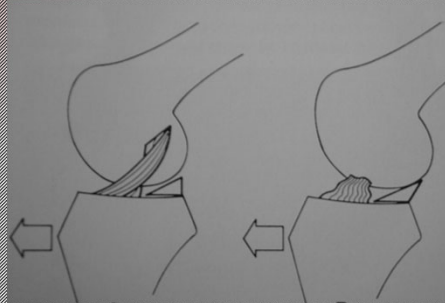
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Function

• Stability

- ACL-intact knee: menisci little effect
- ACL-deficient knee: important stabilizer
 - Posterior horn of medial meniscus most important structure resisting anterior tibial translation in ACL-deficient knee (Shoemaker, JBJS, 1986)
 - Increased anterior tibial translation of up to 58% at 90° flexion s/p medial meniscectomy (Levy, JBJS, 1982)
- Preserve menisci for stability

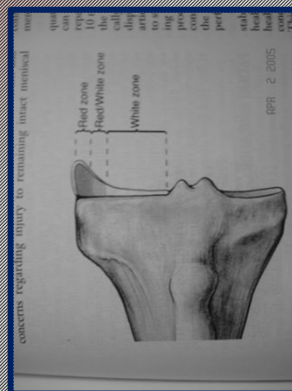


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Classification

• Vascularity

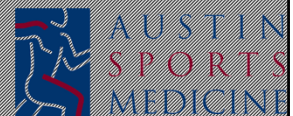
- Red-red
- Red-white
- White-white



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Classification

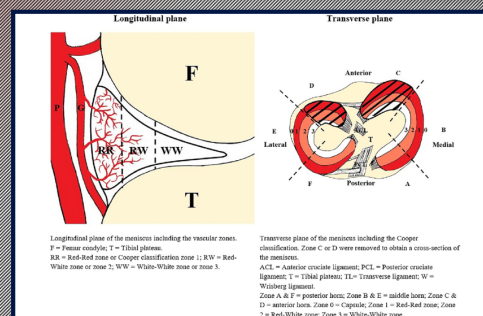
- Descriptive
 - Location
 - Position
 - Size
 - Pattern



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Classification

- Location
 - red zone (outer third, vascularized)
 - red-white zone (middle third)
 - white zone (inner third, avascular)



Intra-operative assessment of the vascularisation of a cross section of the meniscus using near-infrared fluorescence imaging
August 2021
Knee Surgery Sports Traumatology Arthroscopy 30(5)

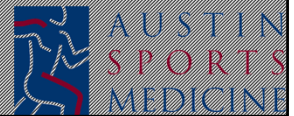


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Classification

- Pattern
 - Vertical/longitudinal
 - Bucket handle
 - Oblique/flap/parrot beak
 - Radial
 - Horizontal
 - Complex
 - Root



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Classification

- vertical/longitudinal
 - common, especially with ACL tears
 - repair when peripheral
- bucket handle
 - vertical tear which may displace into the notch

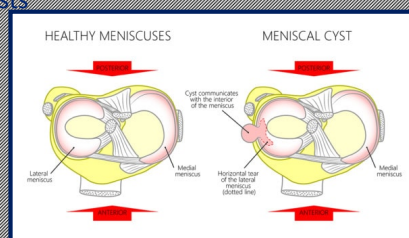


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Classification

- radial
 - complete radial tears that extend to the meniscocapsular junction are biomechanically equivalent to posterior root tears
- horizontal
 - more common in older population
 - may be associated with meniscal cysts



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Classification

- root
 - functionally equivalent to a total meniscectomy
 - lateral root tears associated with ACL tears
 - medial root tears associated with chondral injuries
 - The poor long-term outcomes associated with conservative treatment measures, namely, ipsilateral compartment osteoarthritis, warrants the surgical repair of meniscal root tears whenever possible



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Treatment

- Goal: Preserve functional meniscal tissue

- Options

- Non-operative
- Meniscectomy
- Repair
- Meniscal transplant

- Considerations

- Age
- Activity level
- Chronicity of symptoms
- Type of tear
- Associated pathology



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Operative treatment

- Indications

- Locked knee (immediate)
- Associated ACL surgery
- unstable meniscus
- Failed non-operative treatment



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Total Meniscectomy

- Indications: no longer recommended
- Natural History
 - "Fairbanks changes" (Fairbanks, JBJ, 1948)
 - Joint space narrowing (loss of articular cartilage)
 - Osteophyte formation
 - Squaring of femoral condyles
 - 20% have significant arthritic lesions and 70% have radiographic changes three years after surgery
 - 100% have arthrosis at 20 years
 - severity of degenerative changes is proportional to % of the meniscus that was removed



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Partial Meniscectomy

Principals

- Preserve functional meniscal tissue
- Contour residual tissue to prevent recurrence or propagation



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Partial Meniscectomy

- Outcomes

- Enormous heterogeneity in studies
- No universal classification system used
- Most all lumped into single “partial meniscectomy” category



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Partial Meniscectomy

- Outcomes

- Summary

- Heterogeneity of tears limits conclusions
- Very good mid-term clinical results in 80 – 95% of patients
- Poor prognosis: chronic ACL-deficiency, malalignment, and articular cartilage damage at time of arthroscopy
- Loss of meniscal tissue leads to degenerative changes with time
- Preserve meniscal tissue if possible



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Meniscus Repair

- Indications
 - Young, active patient
 - Acute, symptomatic tears
 - Complete vertical longitudinal tear > 10 mm
 - Peripheral 10 – 30% or within 3 - 4 mm of meniscocapsular junction (red-red and red-white zones)
 - Unstable tear (> 3 mm displacement with probing)
 - Stable knee
 - 90% success rate with concomitant ACL reconstruction (vs 57% without)
 - 30 – 70% success rate in unstable knees



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Meniscal Repair

- Contraindications
 - Degenerative tear in older patients
 - White-white avascular tear
 - Stable, incomplete tears
 - Infectious, rheumatoid, collagen vascular disease
 - Non-compliance with rehab



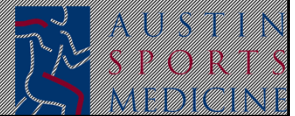
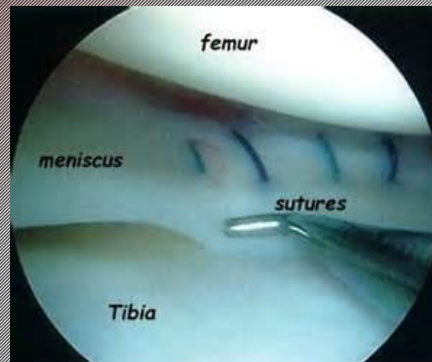
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Meniscal Repair

- Repair Techniques

- Open
- Inside-Out (gold standard)
- Outside-In
- All-Inside
 - Suture-passing hooks
 - Sutureless implant fixator
 - Suture-based devices



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Meniscal Transplant

- Indications

- controversial
- young patients with near-total meniscectomy, especially lateral

- Contraindications

- inflammatory arthritis
- instability
- marked obesity
- grade III and IV chondral changes
- malalignment (if not concurrently addressed)
- diffuse arthritis



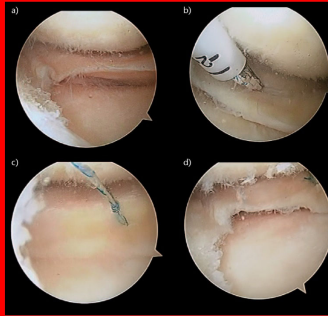
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Meniscus Transplant

- outcomes

- requires 8-12 months for graft to fully heal
- return to sports by 6-9 months
- 10 year follow-up showed:
 - persistent improvement in subjective pain and function scores
 - most had radiographic progression of degenerative changes
 - re-tears or extrusion are common



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THANK YOU!



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