

MENISCAL INJURY

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OBJECTIVES

- Epidemiology
- Anatomy
- Mechanism of Injury
- Diagnosis
- Treatment

EPIDEMIOLOGY

- Incidence of acute meniscal tears is 61/100,000
- Over 1 million meniscal surgeries in US and 400,000 in Europe yearly
- **Medial meniscus** is most commonly injured in the stable knee or in the chronic anterior cruciate ligament (ACL)-deficient knee.
- The **lateral meniscus** is most commonly injured with an acute ACL tear



The #1 Work-Related Injury:



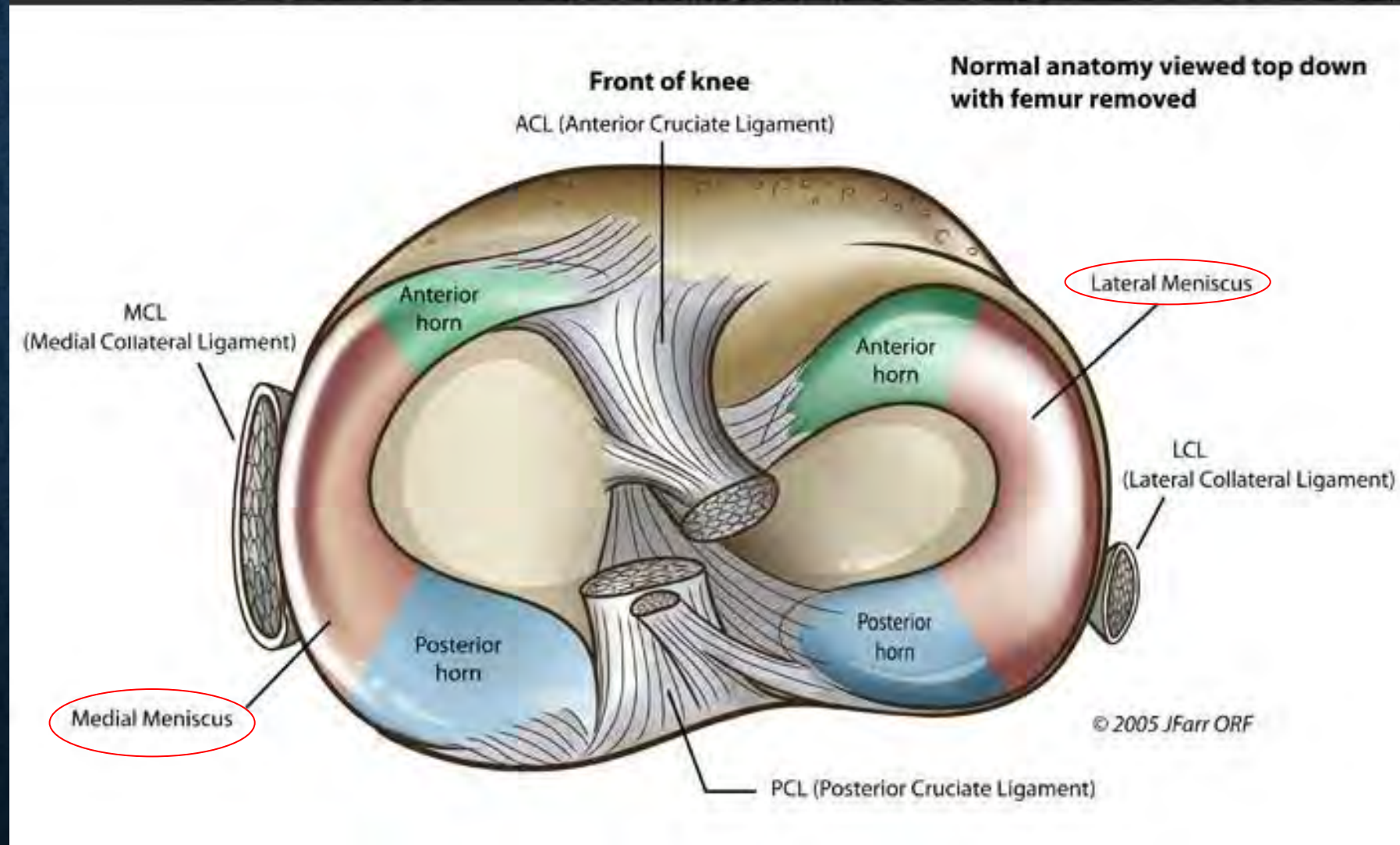
ANATOMY - MEDIAL AND LATERAL MENISCI

Medial Meniscus

- “C” Shaped
- Surrounded by ACL, PCL, and MCL
- Shares medial fibers with MCL

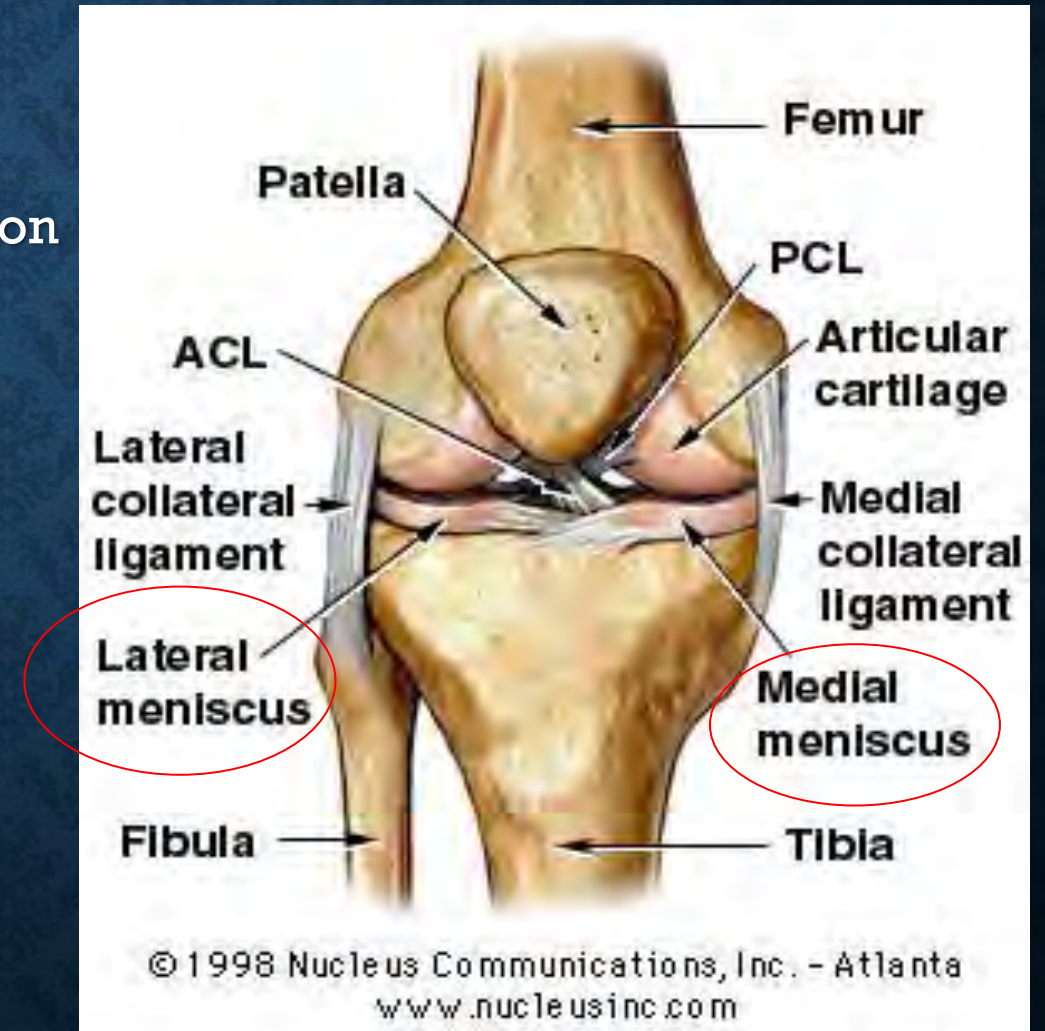
Lateral Meniscus

- Circular
- Surrounded by PCL, LCL, and partially by ACL
- Shares medial fibers with ACL



ANATOMY - MEDIAL AND LATERAL MENISCI

- Rest atop the tibial plateau
- House each femoral condyle to secure the joint
- Both structures translate during flexion/extension of the knee
- Translate with slight rotation at the knee



BLOOD SUPPLY & INNERVATION

Blood Supply

- Typically avascular
- Arnoczky & Warren (1982) showed blood supply located at peripheral 10-30% (red-red zone)
- Inner free margins nourished by synovial fluid (white-white zone)

Innervation

- Peripheral
- Nociceptors (free nerve endings)
- Mechanoreceptors
 - Ruffini corpuscles
 - Pacinian corpuscles
 - Golgi tendon organs



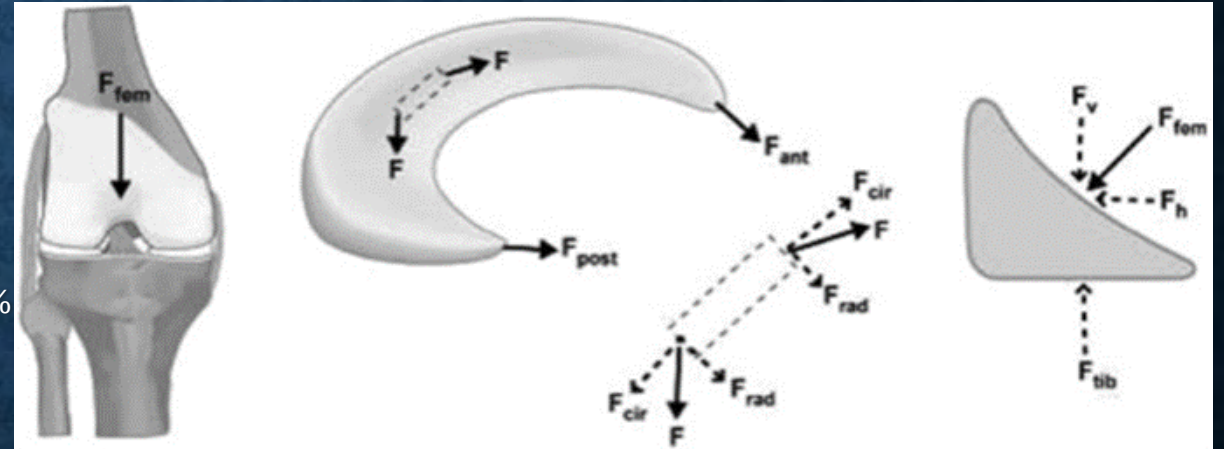
Arnoczky SP, Warren RF. Microvasculature of the human meniscus. Am J Sports Med. 1982;10:90-95.

“HOOP” STRESS PRINCIPLE

- Weightbearing produces axial forces
- Meniscal compression results in circumferential (hoop) stress
- Axial forces are converted to tensile stress along circumferential collagen fibers

Seedhom and Hargreaves (1979)

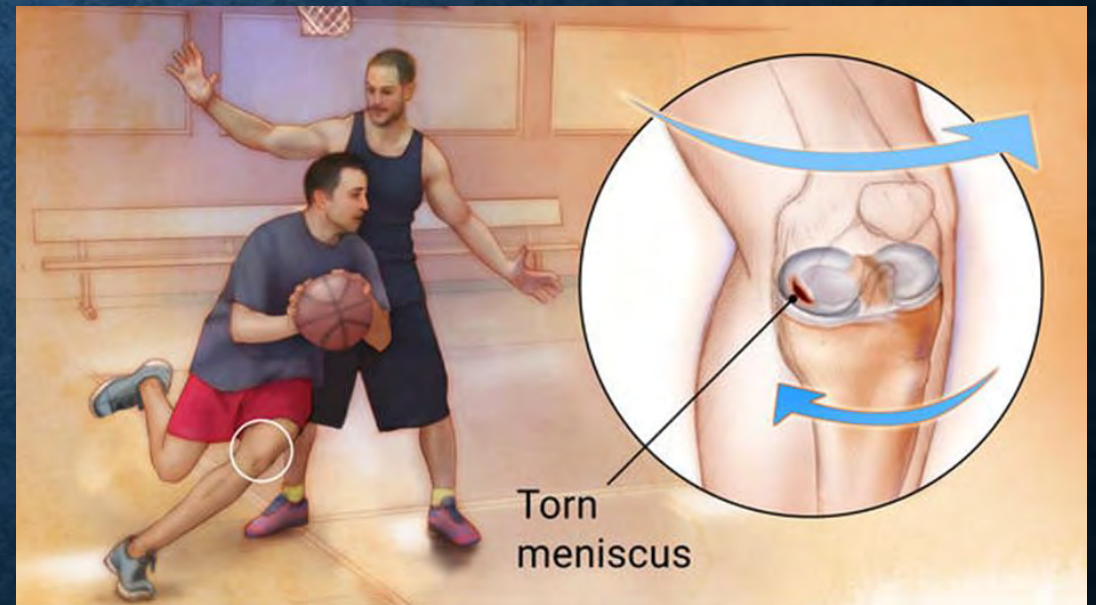
- Reported 70% of the load in the lateral compartment and 50% of the load in the medial compartment are transmitted through the menisci
- Compressive Load
- 50% through posterior horns in extension
- 85% transmission of load at 90° flexion



Fox, A. J. S., Bedi, A., & Rodeo, S. A. (2012). The Basic Science of Human Knee Menisci. *Sports Health: A Multidisciplinary Approach*, 4(4), 340–351. <https://doi.org/10.1177/1941738111429419>

MECHANISM OF INJURY

- Internal or external rotation of the knee upon a flexed knee during a weightbearing task with or without ligamentous injury
- Fall or direct contact with object
 - Can be an excessive force on a healthy meniscus or a normal force on a degenerative meniscus
- “Giving way” – end of day fatigue



MECHANISM OF INJURY

Acute/Traumatic Tears

- Commonly the result of physical activity
- Men present with overall higher incidence; often with bucket-handle tears
- Women present with more peripheral detachment
- Have a specific pattern (horizontal, vertical, radial, oblique or complex)
- Often treated with surgery (meniscal repair, meniscectomy, meniscal allograft) followed by physical therapy

Chronic/Degenerative Tears

- Commonly observed in older individuals (55+)
- Requires minimal stress or trauma
- Can be managed with a combination of anti-inflammatories and physical therapy

MENISCAL TEAR TYPES

6 TYPES OF MENISCUS TEARS



**Intrasubstance/
Incomplete Tear**



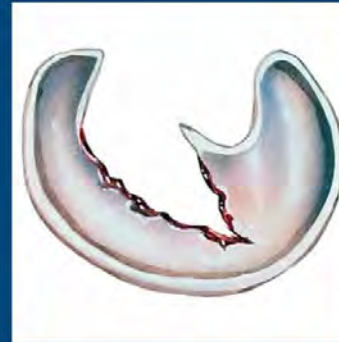
Radial Tear



Horizontal Tear



Flap Tear



Complex Tear



**Bucket-Handle
Tear**

DIAGNOSIS

History

- Pre-existing disease (old injury/surgery/osteoarthritis)
- Previous similar problems?
- Type of pain, location, duration, severity, modifying factors
- Pain with twisting, locking, catching, giving way = **suggest meniscal tear**
- Startup pain, nonmechanical aching = suggest possible underlying DJD exacerbation

PHYSICAL EXAM

- Localize tenderness, swelling
- Test ligamentous stability, ROM
- Muscle strength
- Neurologic/Vascular status
- Special tests: McMurray's, Thessaly, Pivot shift, Lachman's, etc.

MCMURRAY'S TEST

- Patient Position: Supine lying with knee completely flexed.
- Physician Position: on the side to be tested.
- Proximal Hand: holds the knee and palpates the joint line, thumb on one side and fingers on the other
- Distal Hand: holds the sole of the foot and acts to support the limb and provide the required movement through range.
- **Procedure:** From a position of maximal flexion, extend the knee with internal rotation (IR) of the tibia and a VARUS stress, then return to maximal flexion and extend the knee with external rotation (ER) of the tibia and a VALGUS stress
- IR of the tibia + Varus stress = **lateral** meniscus
- ER of the tibia + Valgus stress = **medial** meniscus
- Sensitivity and specificity to be 70% and 71%

MCMURRAY'S TEST



THESSALY TEST

- The patient stands flat footed on one leg while the examiner supports the patient by holding their outstretched hands.
 - The uninjured leg is tested first so that the patient may be trained with regard to how to keep the knee in the flexed position.
- The patient then flexes the knee to 5° and rotates the femur on the tibia medially and laterally three times, while maintaining the 5° flexion.
 - Repeat at 20° of knee flexion
- The test is considered positive for a meniscus tear if the patient experiences medial or lateral joint line discomfort or a sense of locking/ catching in the knee
- Sensitivity: 64-66%; Specificity: 39-53%



TYPICAL PATIENT

- Presents with fall/twisting type injury
- Intermittent episodes of severe joint line pain and swelling; exacerbated with pivoting. May be completely asymptomatic between episodes
- Negative X-Rays; Positive McMurray's/Thessaly test at 6 weeks out; Specific joint line tenderness
- No history of previous knee injury/pain
- MRI positive

COMMON DIAGNOSES

- Contusion/mild sprain (knee stable)
- MCL sprain (some instability/nonop)
 - pain with valgus stress at 30° knee flexion, which isolates the superficial MCL
 - gapping of medial joint line
- Muscle strain/tear (Quad/Patellar/Gastroc)
- Osteochondral Injury
 - may present very similarly
 - differentiated with imaging (MRI)
- Plica syndrome
 - pain is typically in the medial parapatellar region
 - may have palpable medial parapatellar cord

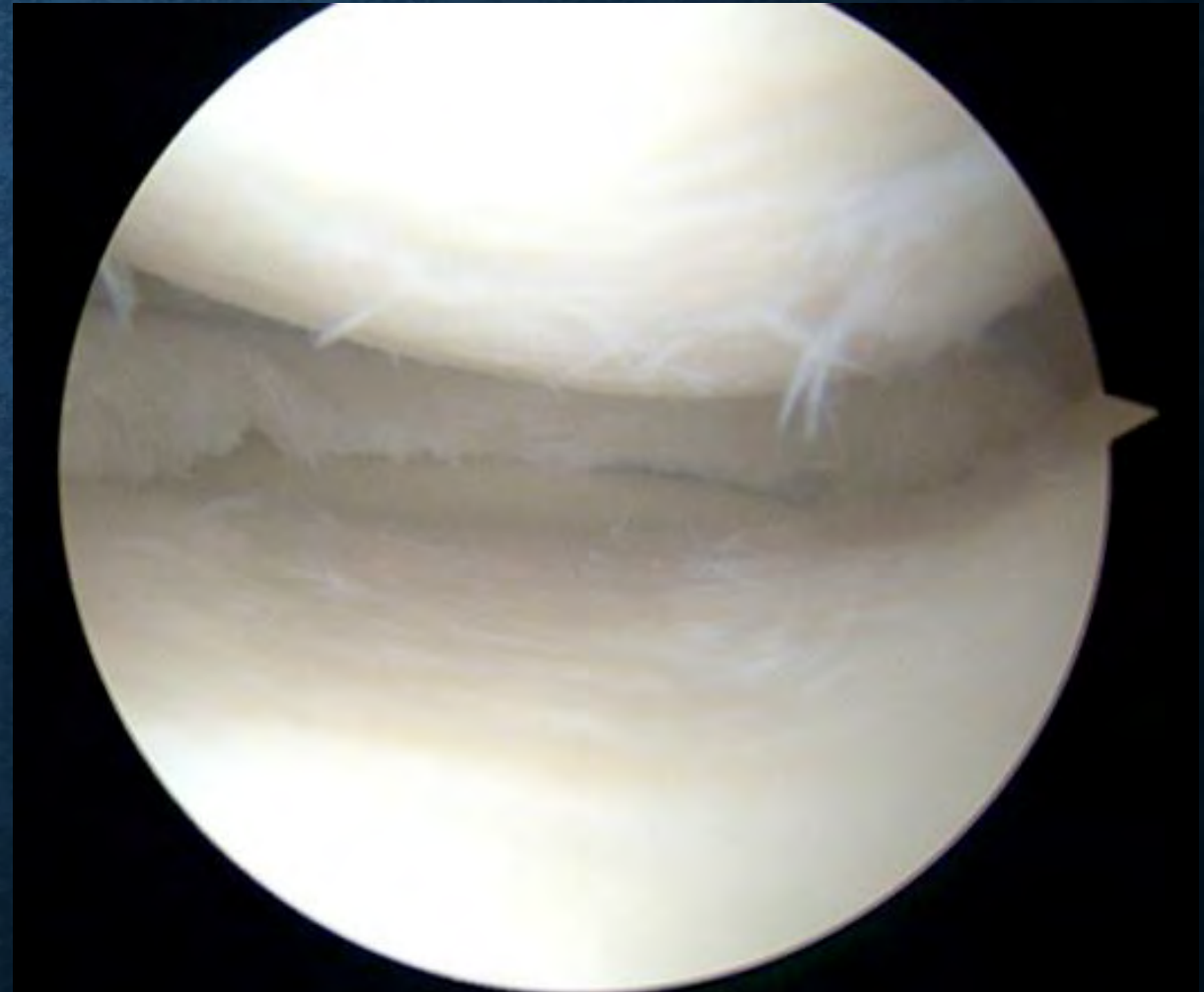
TREATMENT

- Nonoperative: RICE (rest, ice, compression, elevation), NSAIDs, Physical therapy
 - Indications
 - first line treatment for degenerative tears
 - Outcomes
 - improvement in knee function following physical therapy
 - "noninferior" when compared to arthroscopic partial meniscectomy

TREATMENT

- Operative: Arthroscopic partial meniscectomy
 - Indications
 - tears not amenable to repair (complex, degenerative, radial tear patterns)
 - repair failure >2 times
 - Outcomes
 - >80% satisfactory function at minimum follow-up
 - 50% have Fairbanks radiographic changes (osteophytes, flattening, joint space narrowing)
 - predictors of success
 - age <40yo
 - normal alignment
 - minimal or no arthritis
 - single tear

POST PARTIAL MENISCECTOMY



POSTOPERATIVE

- Early active range of motion
- Quadriceps and hamstring strengthening
- **Gradual** return to activities
- Return to play = 6 weeks

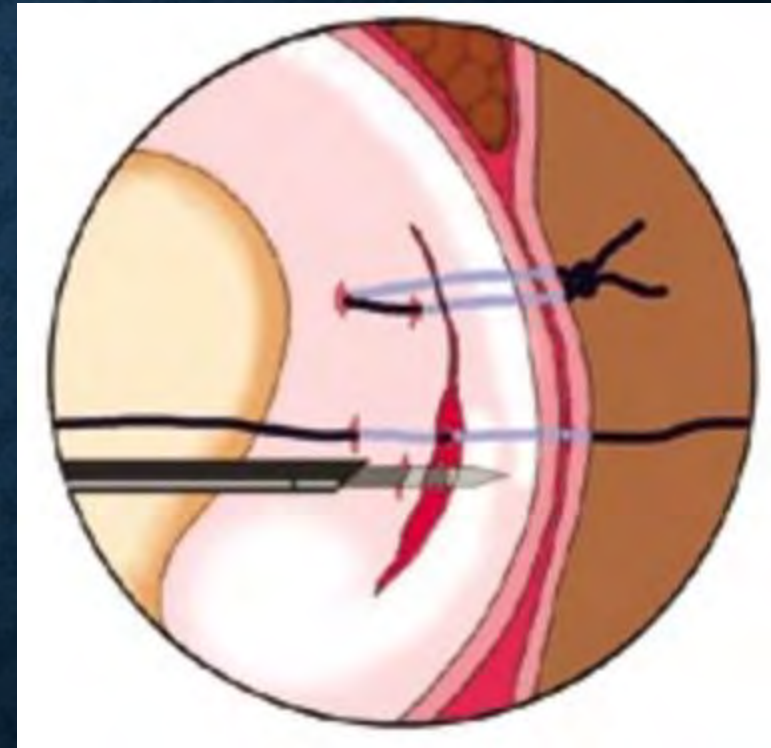
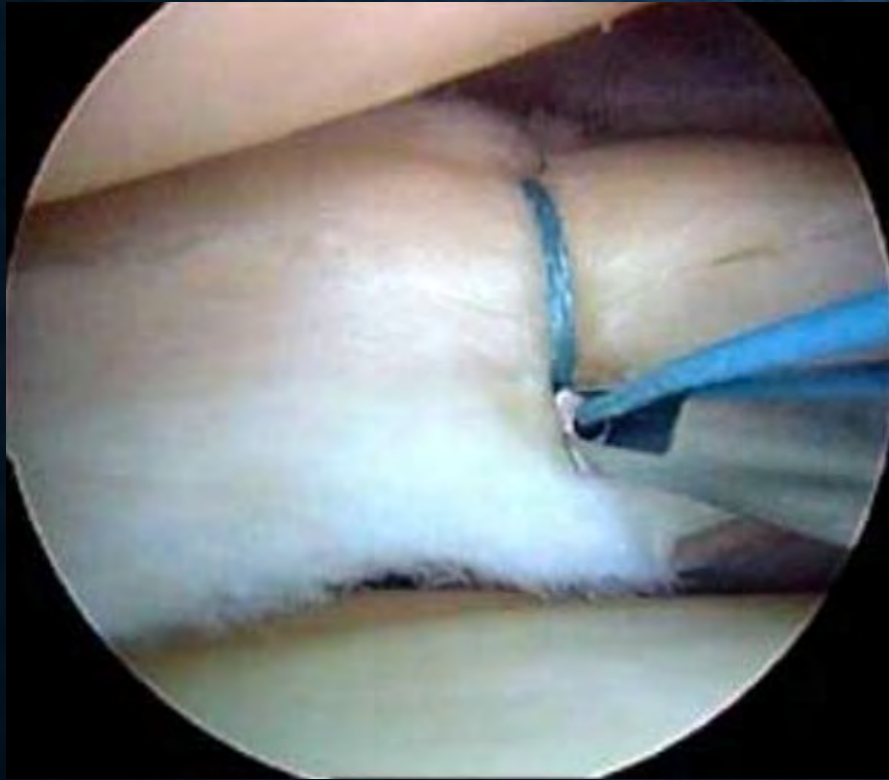
TREATMENT

- Operative: Arthroscopic meniscal repair
 - Indications
 - peripheral in the **red-red zone** (vascularized region)
 - lower rim width correlates with the ability of a meniscal repair to heal
 - rim width is the distance from the tear to the peripheral meniscocapsular junction (better blood supply).
 - vertical and longitudinal tear
 - bucket handle meniscus tear
 - 1-4 cm in length
 - root tear
 - acute repair combined with ACL reconstruction
 - traditional literature report higher healing rates with concurrent ACL reconstruction
 - current literature shows no difference in healing for 2nd generation all-inside repairs with/without concomitant ACL reconstruction

TREATMENT

- Outcomes
 - 70-95% successful
 - highest success when done with concomitant ACL reconstruction (90%)
 - **modest result when done with an intact ACL (60%)**
 - poor results with untreated ACL-deficiency (30%)

MENISCAL REPAIR

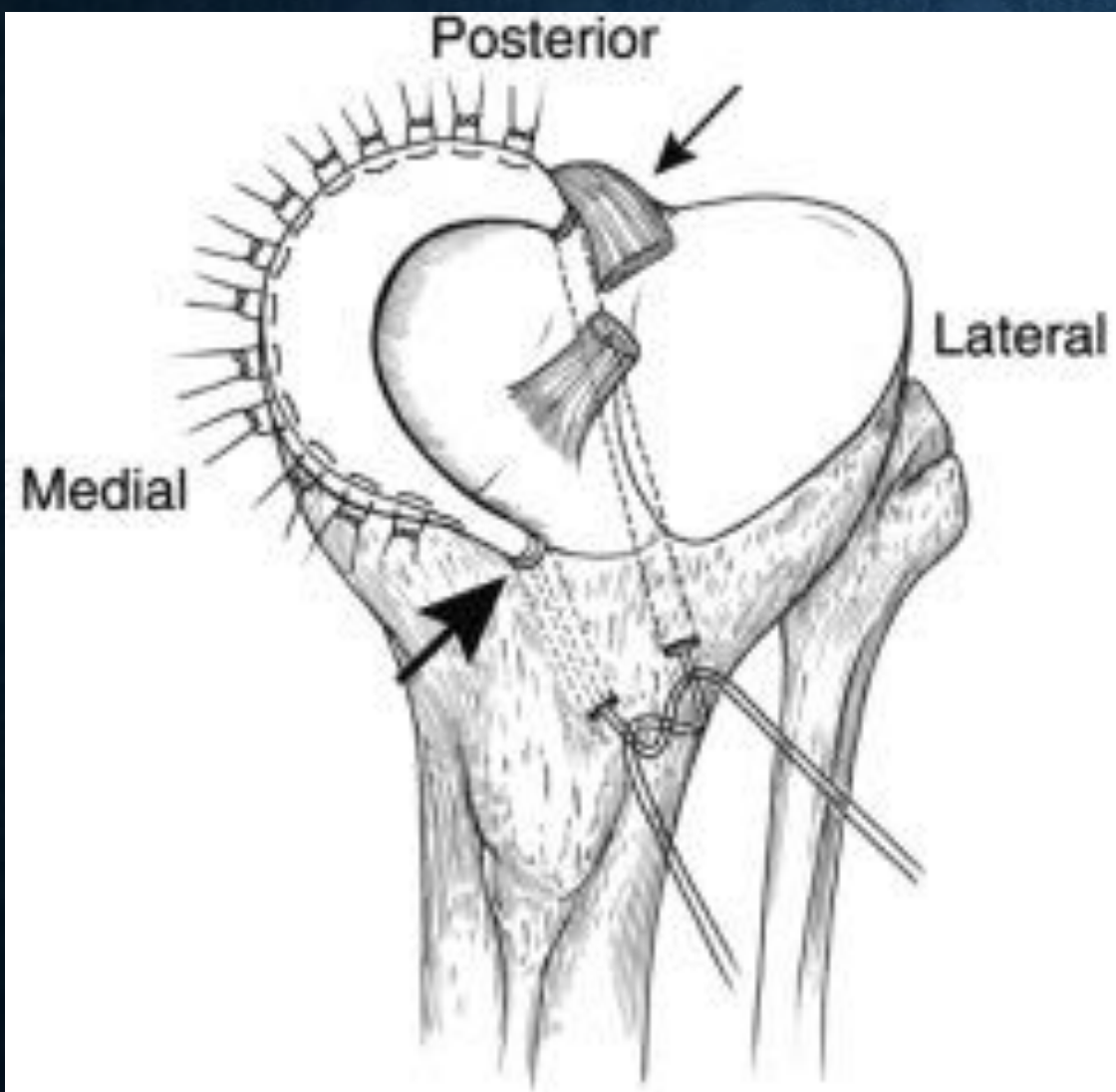


POSTOPERATIVE

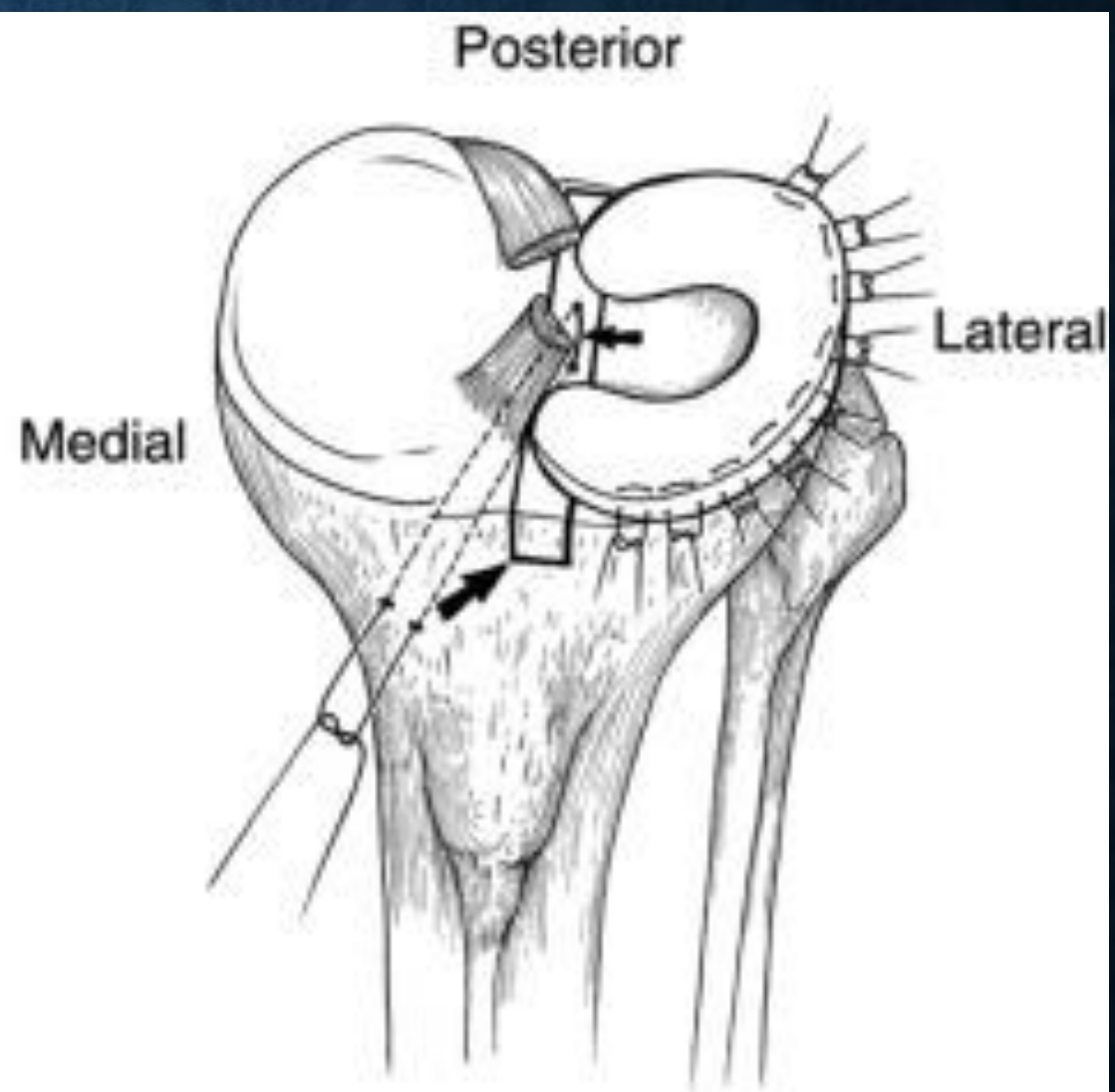
- Knee flexion beyond 90 degrees should be avoided until at least 4 weeks post op
- Various opinions on weightbearing status and bracing
- Peripheral tear
 - WBAT in locked hinged knee brace x 4 weeks, ok to unlock for ROM when not weightbearing
 - Will use crutches for ambulation for first 2 weeks
 - Return to play = 6 months
- Radial tear
 - NWB in locked hinge knee brace x 4 weeks, ok to unlock for ROM when not weightbearing
 - Return to play = 7-8 months

TREATMENT

- Operative: Meniscal transplantation
 - 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



A



B

POSTOPERATIVE

- 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



THANK YOU