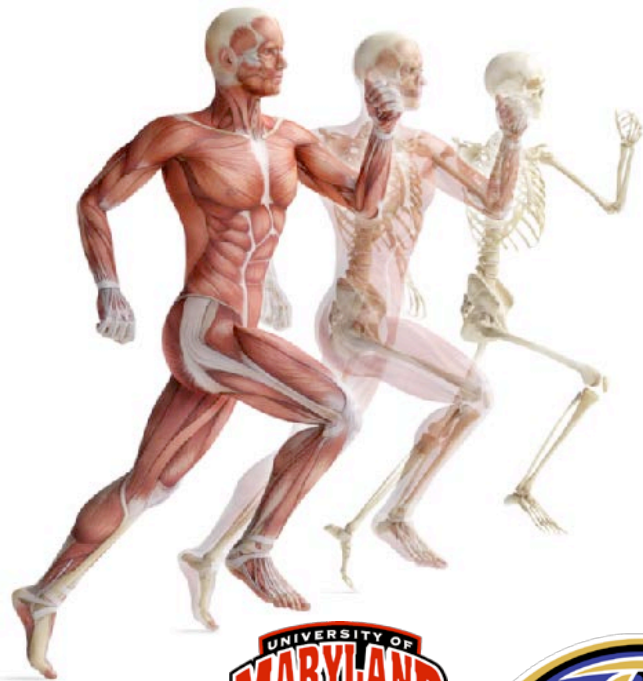


# Topics in Sports Medicine: Physical Examination of the Knee and Ankle



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PRIMARY CARE SPORTS MEDICINE  
UNIVERSITY OF MARYLAND**



# Objectives



- **Develop a standardized, evidence-based history and physical examination of patients with knee injuries**
- **Enable health care professionals to accurately diagnose common knee and ankle injuries for patients of all ages.**



# Assessing Knee Pain

3

- **Components of the assessment include**
  - Focused history
  - Attentive physical examination
  - Thoughtfully ordered imaging studies

# Focused History Questions

4

- **Onset of Pain**

- Acute vs. Chronic
- Improving or worsening?

- **Location of pain**

- Anterior – Patellofemoral syndrome, bursitis, Osgood-Schlatter's disease, patellar tendinitis, patellar fracture
- Medial – meniscus, MCL, DJD, pes anserine bursitis
- Lateral – Meniscus, LCL, DJD, iliotibial band friction syndrome, fibular head dysfunction
- Posterior – hamstring injury, tear of posterior horn of medial or lateral meniscus, Baker's cyst, neurovascular injury (popliteal artery or nerve)

# Focused History Questions

5

- **Mechanism of Injury**

- **Contact or noncontact injury?**

- ✦ **If contact, what part of the knee was contacted?**

- Anterior blow?
- Valgus force?
- Varus force?



\*\*Think ACL INJURY any time you have a patient with a significant NON-CONTACT injury with foot planed on the ground (foot planted then knee twisted or body changed direction, felt a pop, immediate swelling, could not continue playing)

# Focused History Questions

6

- **Injury-Associated Events**
  - \*\*Swelling after injury (immediate vs delayed)
  - Catching / Locking
  - Buckling / Instability (“giving way”)
  - Pop heard or felt?

# Focused History Questions<sub>5</sub>

7

- **Aggravating Factors**

- Activities, changing positions, stairs, kneeling

- **Relieving Factors/treatments tried**

- Ice, medications, crutches

- **History of previous knee injury or surgery**

# Historical Clues to Knee Injury Diagnoses

8

Noncontact injury with “pop”	ACL tear
Contact injury with “pop”	MCL or LCL tear, meniscus tear, fracture
Acute swelling	ACL tear, PCL tear, fracture, knee dislocation, patellar dislocation
Lateral blow to the knee	MCL tear
Medial blow to the knee	LCL tear
Knee “gave out” or “buckled”	ACL tear, patellar dislocation
Fall onto a flexed knee	PCL tear



# PHYSICAL EXAMINATION



# Physical Exam - General

10

- **Develop a standard routine!**
  - Helps insure complete examination
  - Put in gown/shorts

## GENERAL STEPS

- 1) Inspection
- 2) Palpation
- 3) Range of motion
- 4) Strength testing
- 5) Special tests



# Physical Exam - Exposure

11

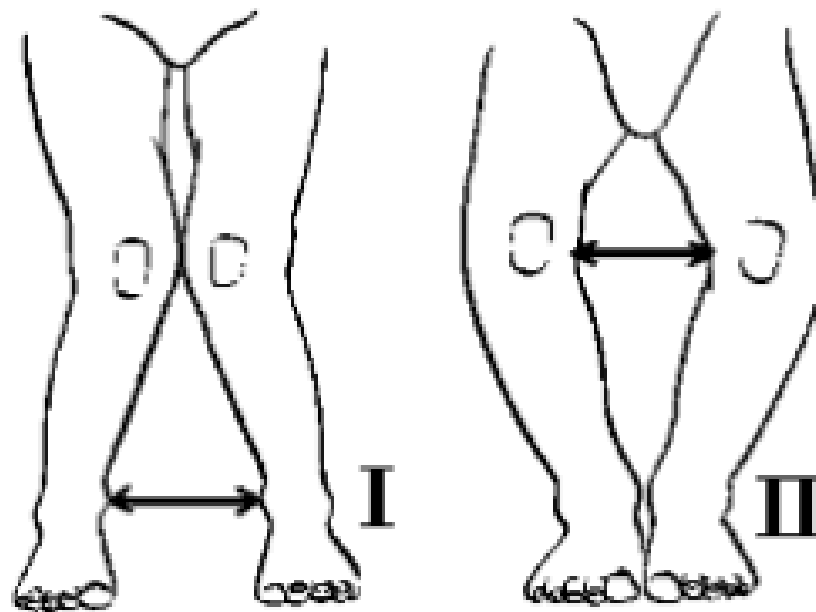
- Adequate exposure - groin to toes bilaterally
- Examine in supine position
- Compare knees



# Observe – Static Alignment

12

- Patient then brings medial aspects of knees and ankles in contact
  - ✦ Knees – genu valgum (I), genu varum (II)



Genu valgum

Genu varum

(<http://www.orthoseek.com/articles/img/bowl1.gif>)

# Observe – Dynamic Alignment

13

- **Pronation/Supination may be enhanced with ambulation**
- **Antalgic gait indicates significant problem** (anti = against, algic = pain)

# Inspect Knee

14

- Evidence of local trauma
  - Abrasions
  - Contusions
  - Lacerations
- Patella position
- Muscle atrophy
- Warmth
- Erythema
- Effusion\*

# Inspect Knee-Related Muscles

15

- **Quadriceps atrophy**
  - Long-standing problem
- **Vastus medialis atrophy**
  - After surgery



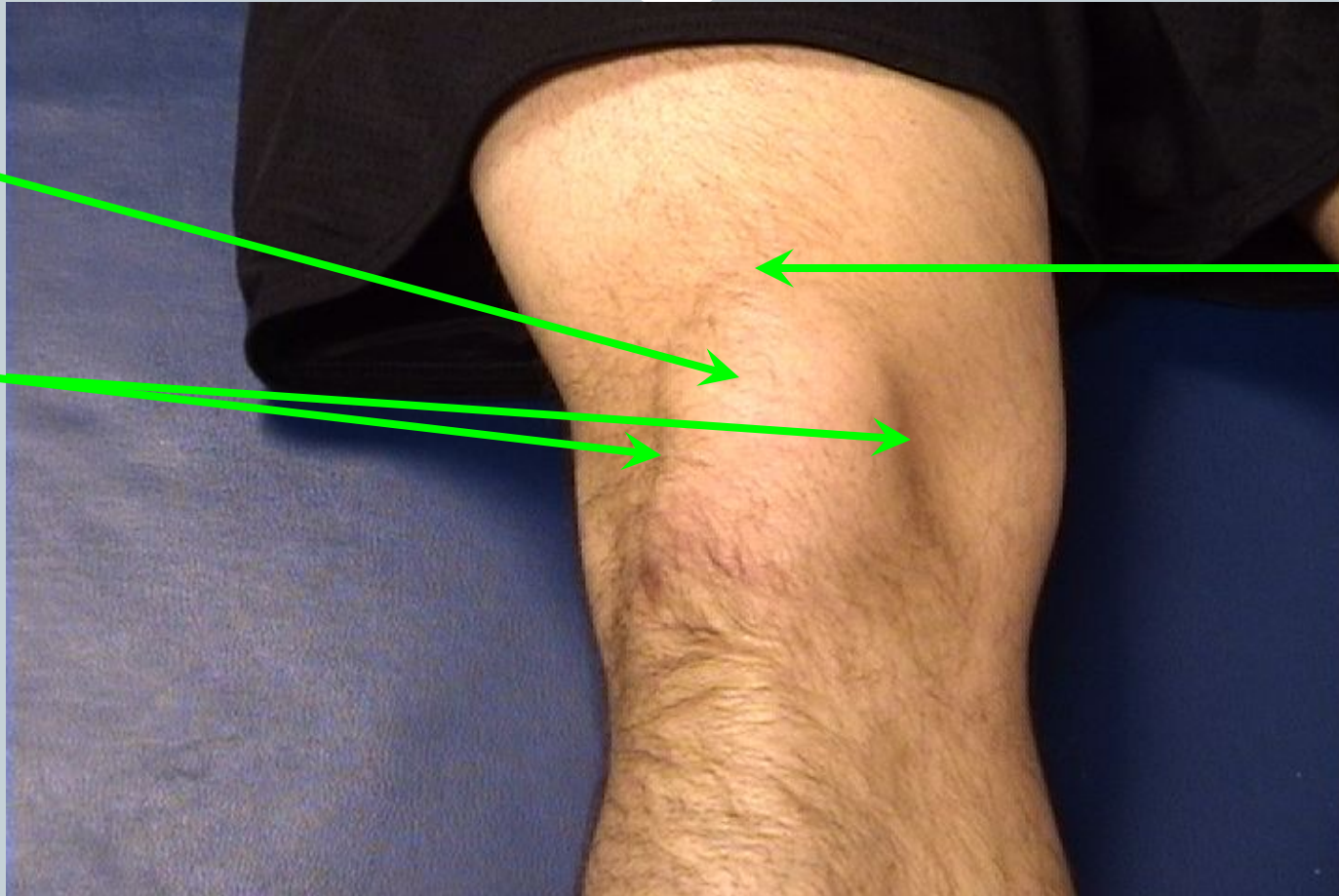
<http://www.neuro.wustl.edu/neuromuscular/pics/people/patients/Hands/ibmquadratrm.jpg>

# Surface Anatomy – Anterior\*

16

Patella

Hollow



Indented



# Surface Anatomy - Anterior, Flexed

17

Patella

Head  
Of  
Fibula

Tibial  
Tuberosity



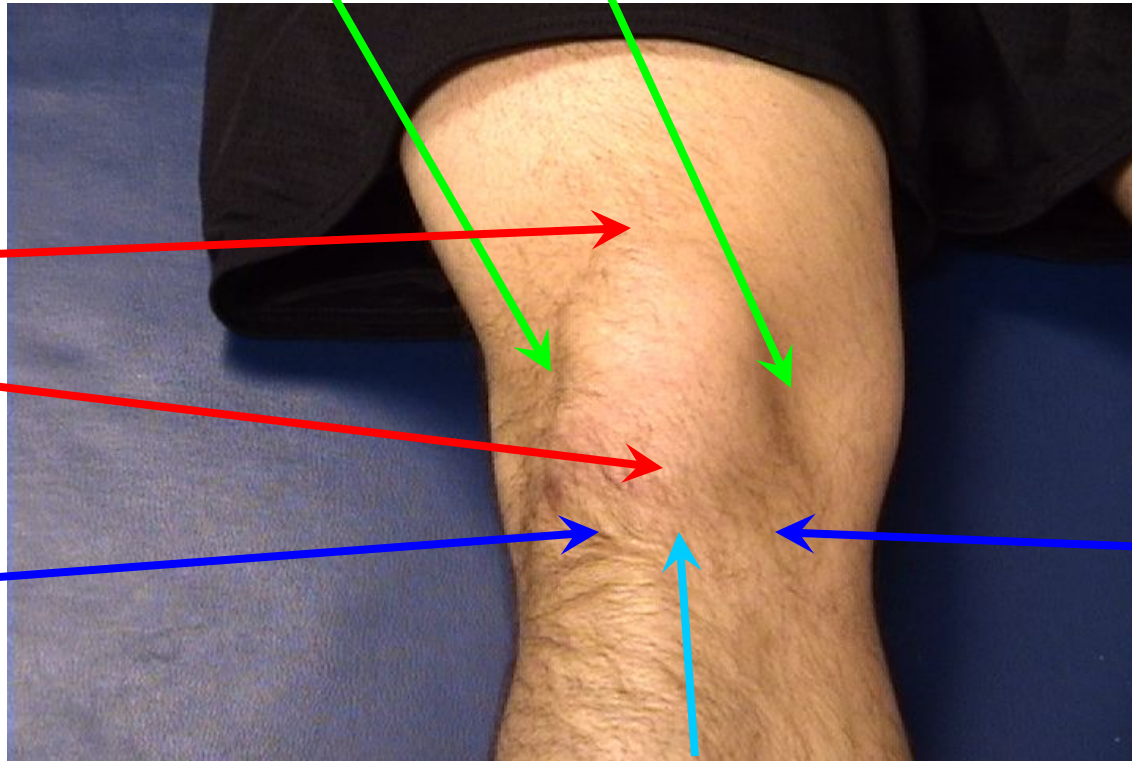
# Palpation – Anterior\*

18

Patella:

Lateral and Medial Patellar Facets

Superior  
And  
Inferior  
Patellar Facets  
Lateral Fat Pad



Medial Fat  
Pat

Patellar Tendon\*\*

# Surface Anatomy - Medial

19

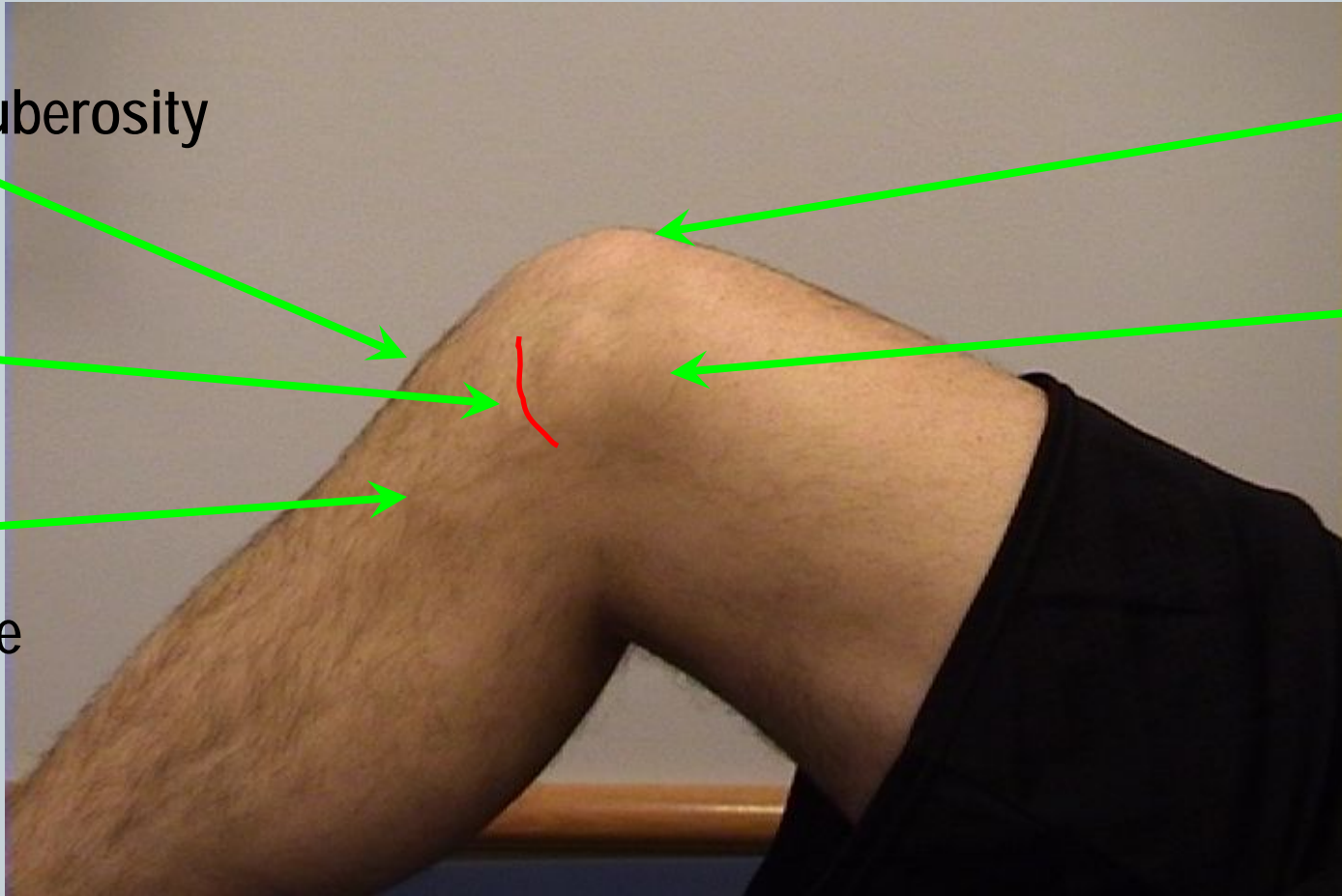
Tibial Tuberosity

Patella

Joint  
Line

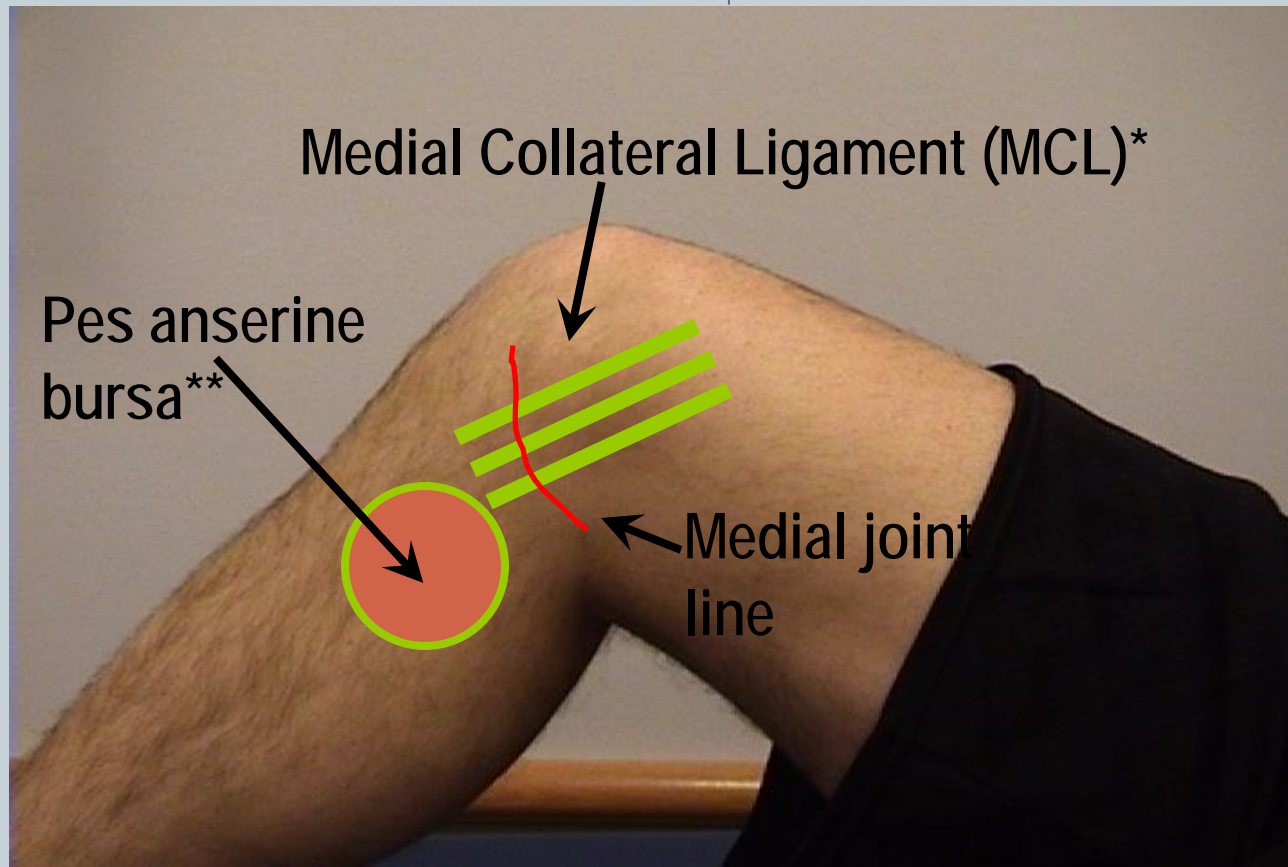
Medial  
Femoral  
Condyle

Medial  
Tibial  
Condyle



# Palpation - Medial

20





# Surface Anatomy – Lateral

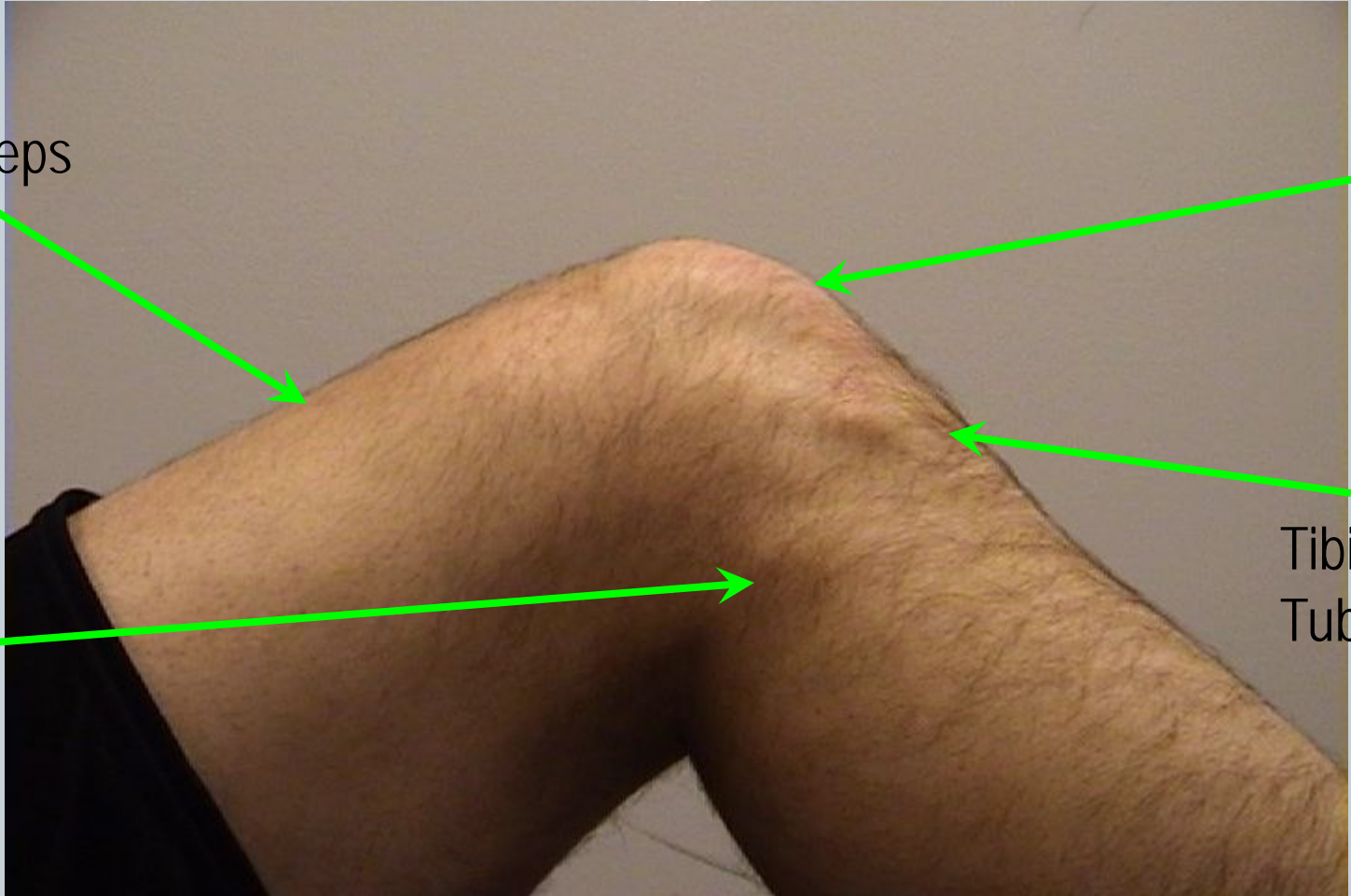
21

Quadriceps

Patella

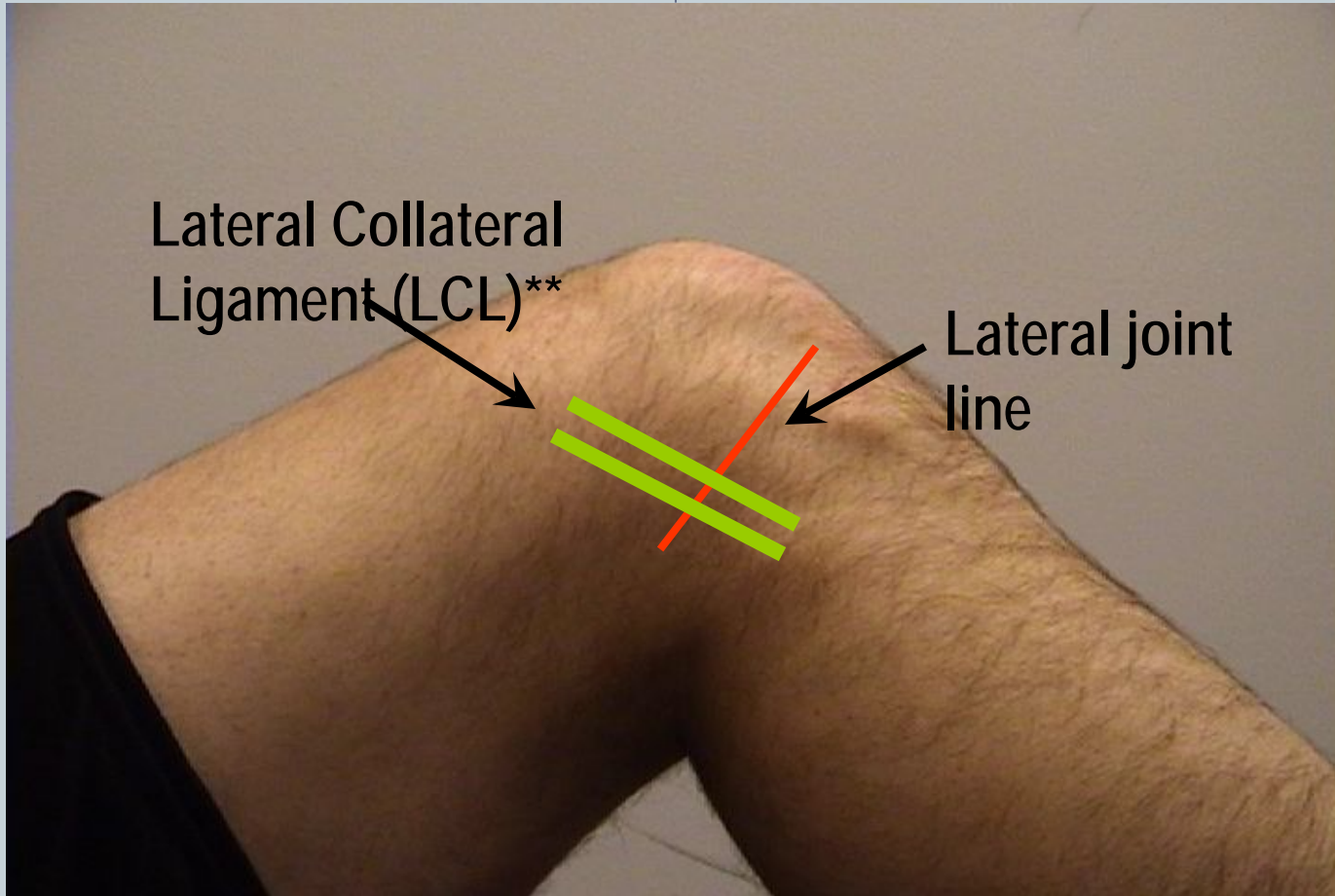
Head  
Of  
Fibula

Tibial  
Tuberosity



# Palpation – Lateral

22



# Palpation - Posterior


23

- **Popliteal fossa\***
- **Abnormal bulges**
  - Popliteal artery aneurysm
  - Popliteal thrombophlebitis
  - Baker's cyst



# Range Of Motion Testing

24

- Extension  $0^{\circ}$   Flexion  $135^{\circ}$
- Describe loss of degrees of extension
  - ✦ Example: “lacks 5 degrees of extension”
- Locking\* = patient unable to fully extend or flex knee due to a mechanical blockage in the knee (i.e., loose body, bucket-handle meniscus tear)



# Strength Testing

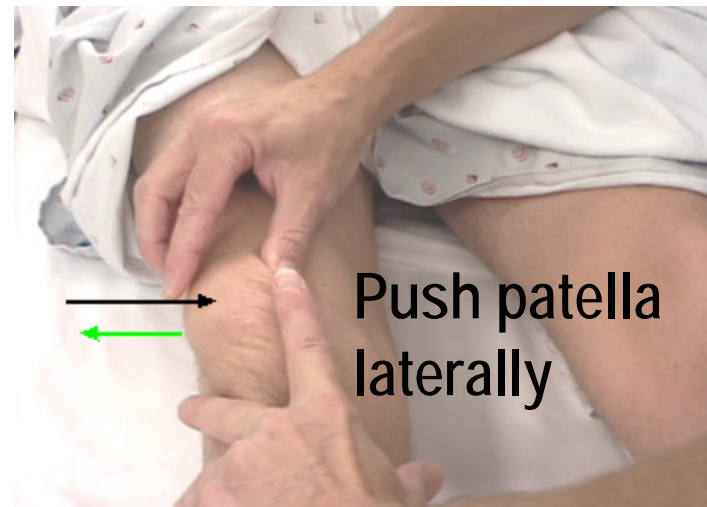
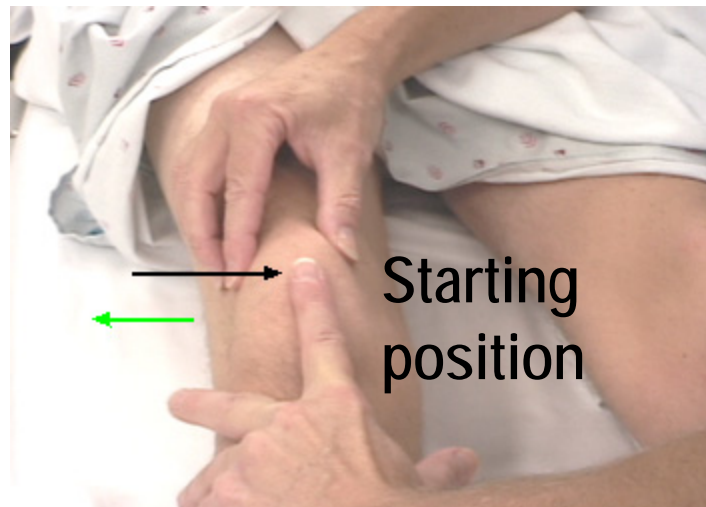
25

- **Test knee extensors (quadriceps) and knee flexors (hamstrings)**
  - Can test both with patient in seated position, knees bent over edge of table
  - Ask patient to extend/straighten knee against your resistance
  - Then ask patient to flex/bend knee against your resistance
  
- **Compare to unaffected knee**

# Special Tests – Anterior Knee Pain

26

- **Patellar apprehension test\***



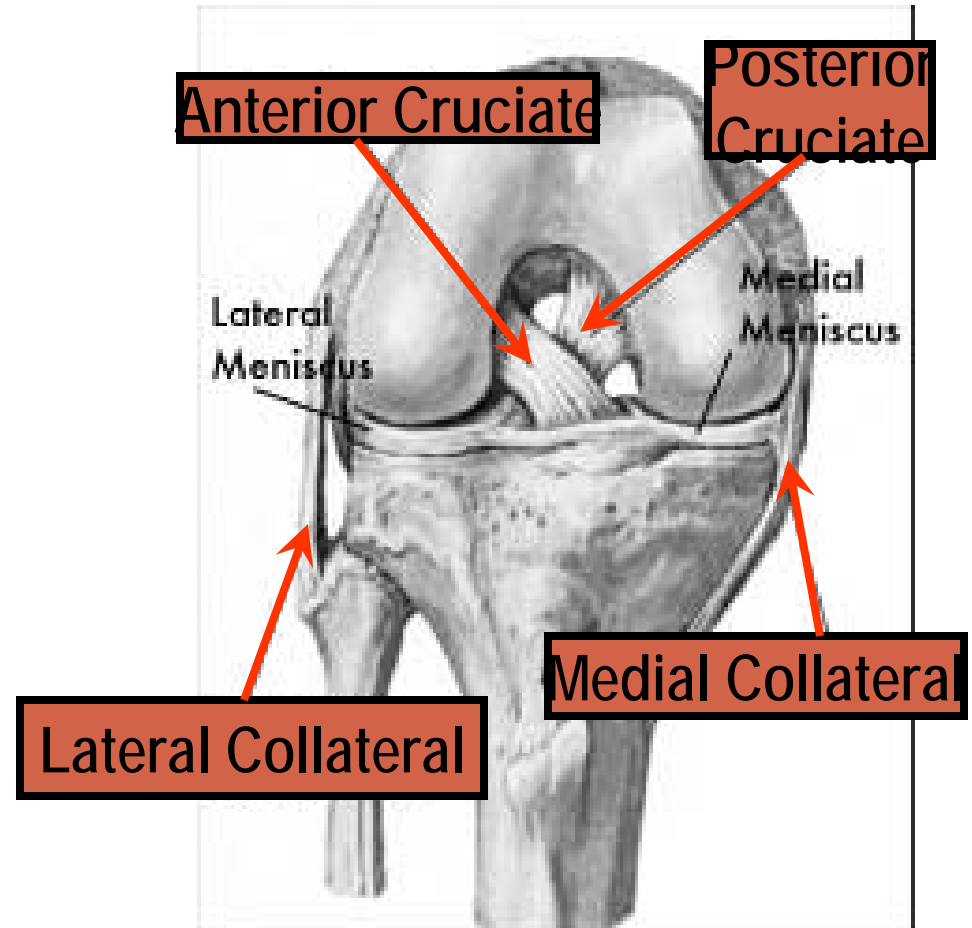
([http://www.sportsdoc.umn.edu/Clinical\\_Folder/Knee\\_Folder/Knee\\_Exam/lateral%20patellar%20apprehension.htm](http://www.sportsdoc.umn.edu/Clinical_Folder/Knee_Folder/Knee_Exam/lateral%20patellar%20apprehension.htm))

- **Patellofemoral grind test\*\***

# Special Tests - Ligaments

27

- Assess stability of 4 knee ligaments via applied stresses\*



# Stress Testing of Ligaments

28

- **Use a standard exam routine**
  - Direct, gentle pressure
  - No sudden forces
  
- **Abnormal test**
  1. Excessive motion = laxity
  
  2. Soft/mushy end point\*\*

# Collateral Ligament Assessment

29



# Valgus Stress Test for MCL\*

30



Note Direction Of Forces



# Varus Stress Test for LCL\*

31



Note direction of forces

# Lachman Test\*

32

- Patient Position
- Physician hand placement





# Anterior Drawer Test for ACL

33

- Physician Position & Movements\*
- Patient Position



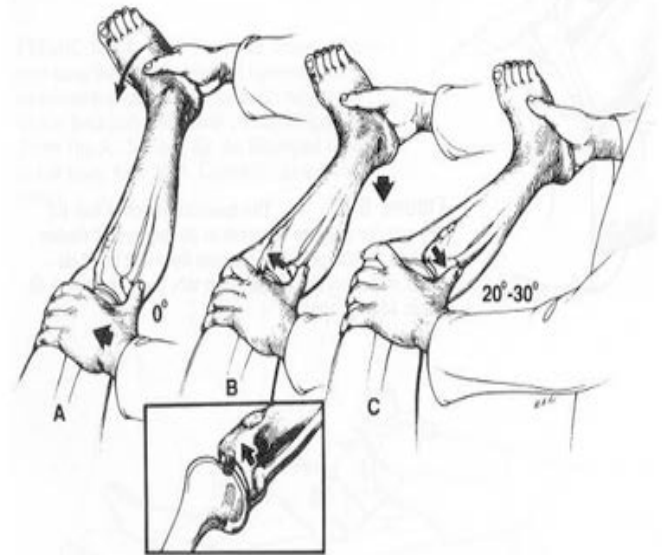
# Pivot Shift Test for ACL



- Start with knee extended and internally rotates
- Examiner applies inward (valgus force) on lateral knee with one hand
- Examiner holds foot with other hand and flexes affected knee

## Pivot Shift Test

• Has high specificity for detecting ACL injury.



# Review of Evidence – ACL\*

Table 3. Comparison of 3 Clinical Examination Techniques for Diagnosing Anterior Cruciate Ligament Tears\*

Study (Reference)	Lachman Test		Anterior Drawer Test		Pivot Test	
	Sensitivity	Specificity	Sensitivity	Specificity	Sensitivity	Specificity
Boeree and Ackroyd (14)	0.63	0.90	0.56	0.92	0.31	0.97
Hardaker et al. (40)	0.74	NA	0.18	NA	0.29	NA
Donaldson et al. (41)	0.99	NA	0.35	NA	0.70	NA
Jonsson et al. (42)	0.87	NA	0.33	NA		
Liu et al. (43)	0.95	NA	0.61	NA		
Braunstein (59)	0.91	1.0				
Torg et al. (71)	0.95	NA	0.61	NA	0.71	NA
Katz and Fingerroth (75)	0.89	NA	0.41	0.95	0.78	0.98
Noyes et al. (76)		NA	0.56	NA	0.89	NA
Lee et al. (79)	0.89	NA	0.78	1.0		
Hughston et al. (81)			0.58	0.23		
Summary statistic (95% CI)	0.87 (0.76–0.98)	0.93 (0.89–0.96)	0.48 (0.38–0.59)	0.87 (0.83–0.91)	0.61 (0.40–0.82)	0.97 (0.93–0.99)

(Jackson JL, et al.) 578 | 7 October 2003 | Annals of Internal Medicine | Volume 139 • Number 7

- **Lachman Test**                      **Sens 87%**              **Spec 93%**
- **Anterior Drawer**                      **Sens 48%**              **Spec 87%**
- **Pivot Shift Test**                      **Sens 61%**              **Spec 97%**

# Posterior Drawer Testing- PCL\*

36

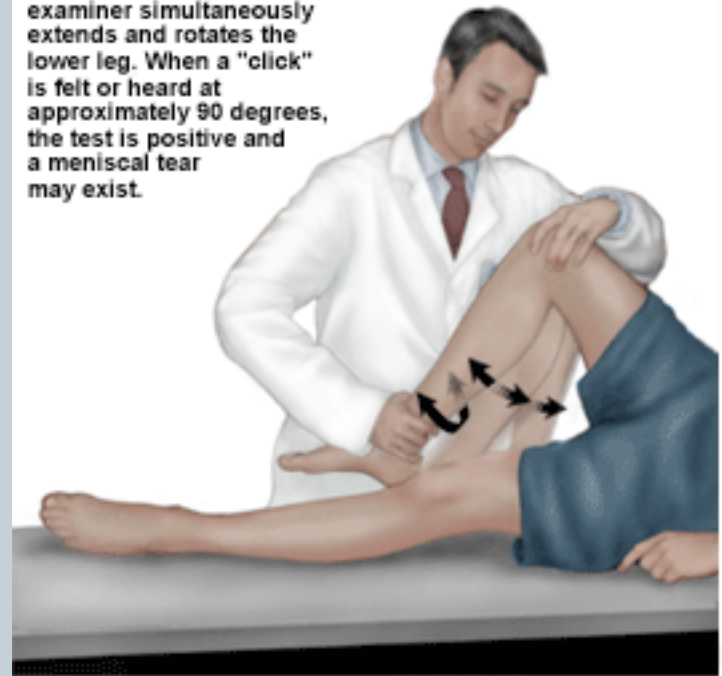


# Assess Meniscus

37

- **Joint line tenderness\*\***
  - Flexion of the knee enhances palpation of the anterior half of each meniscus
- **McMurray Test**

During a McMurray test, the examiner simultaneously extends and rotates the lower leg. When a "click" is felt or heard at approximately 90 degrees, the test is positive and a meniscal tear may exist.



# Posterior Sag Sign for PCL



- Have the patient in a position of 45 degrees hip flexion and 90 degrees of knee flexion.
- Examiner observes for an asymmetric sagging as the tibial plateau sinks below level of the patella



# Review of Evidence - Meniscus

Table 4. Comparison of 2 Common Physical Examination Tests for Meniscal Pathology\*

Study (Reference)	Joint Line Tenderness		McMurray Test	
	Sensitivity	Specificity	Sensitivity	Specificity
Anderson and Lipscomb (38)	NA	NA	0.58	0.95
Noble and Erat (39)	0.67	0.13	0.63	0.58
Fowler and Lubliner (63)	0.85	0.29	0.29	0.95
Barry et al. (83)	0.76	0.43	0.56	1.0
Summary statistic (95% CI)	0.76 (0.65–0.87)	0.29 (0.10–0.46)	0.52 (0.35–0.68)	0.97 (0.87–0.99)

\* NA = not assessed.

- **Joint Line Tenderness**                      **Sens 76%**      **Spec 29%**
- **McMurray Test**                              **Sens 52%**      **Spec 97%**

# Ankle Examination

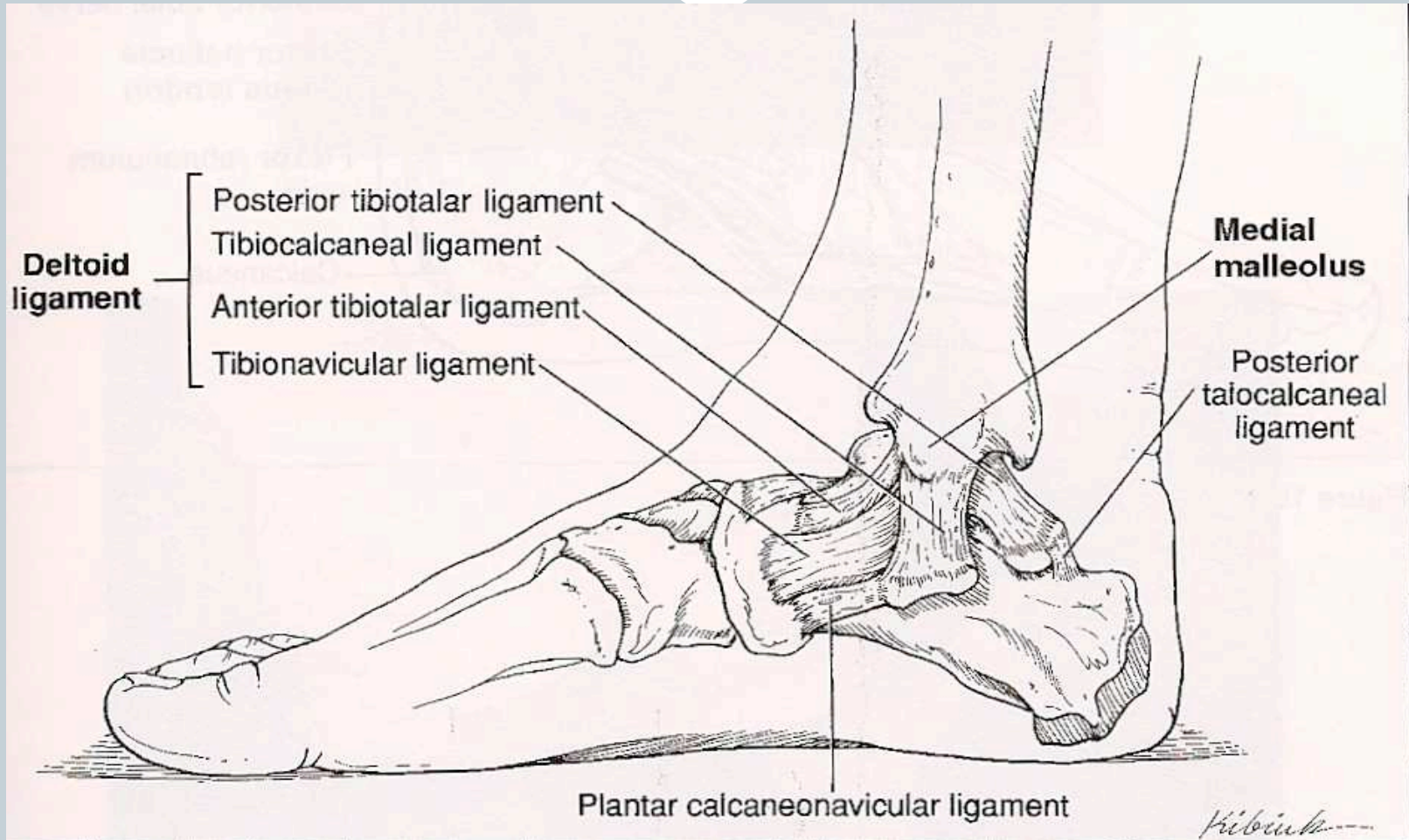


# General

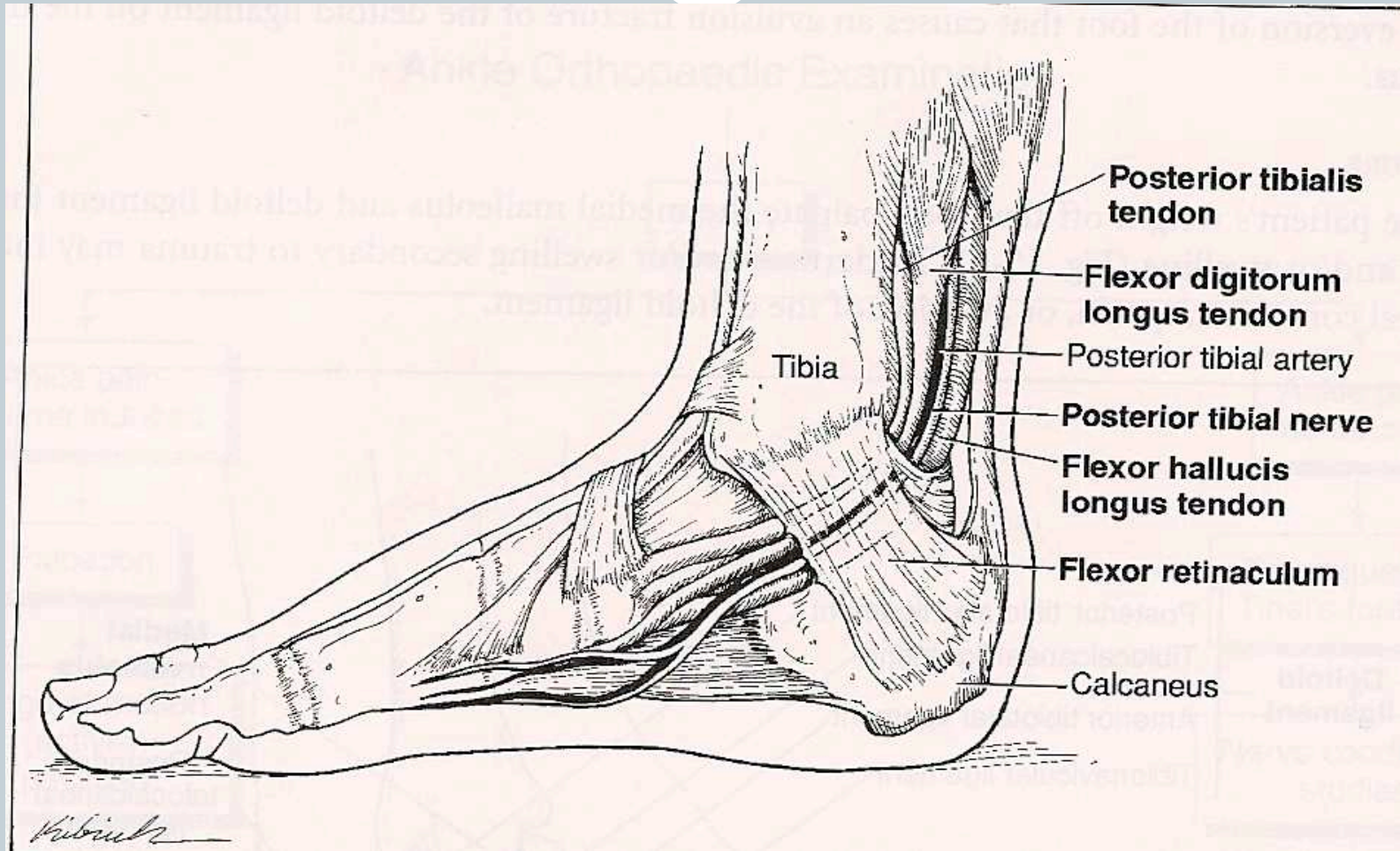


- **Inspection**
- **Palpation**
- **Range of Motion**
- **Strength Testing**
- **Special Tests**

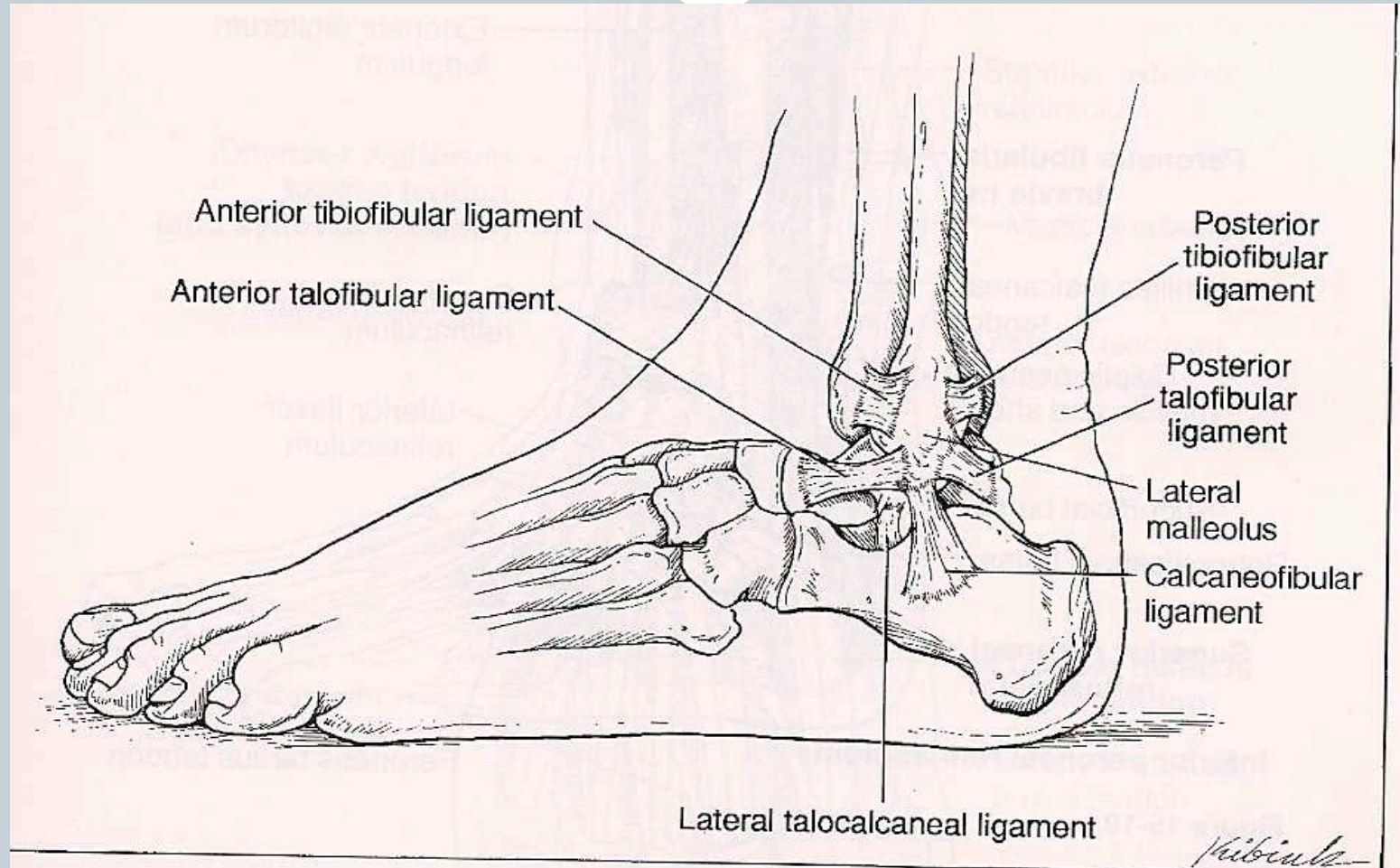
# Medial Aspect



# Medial Tendons



# Lateral Malleolus & Attached Ligaments





# Peroneus Longus and Peroneus Brevis Tendons

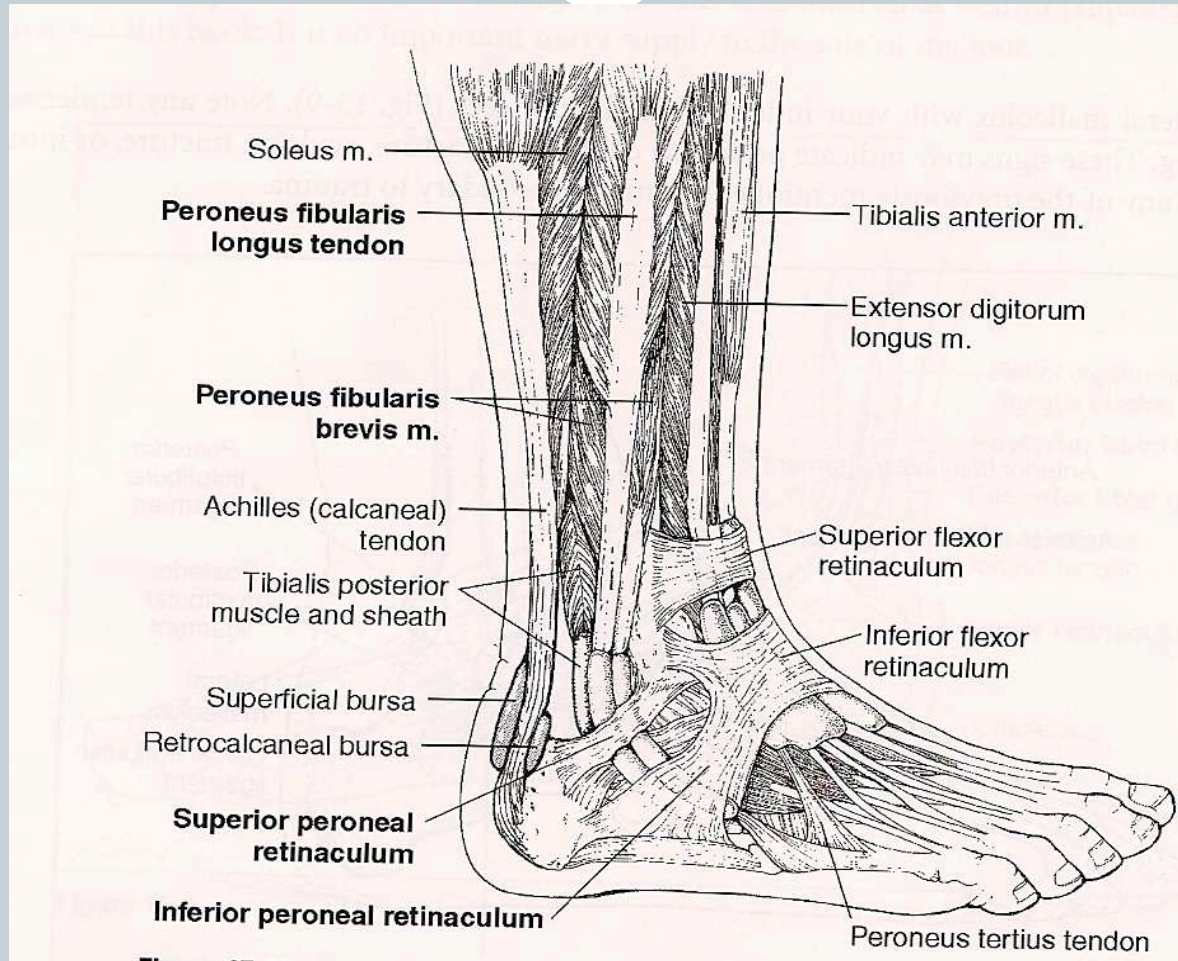
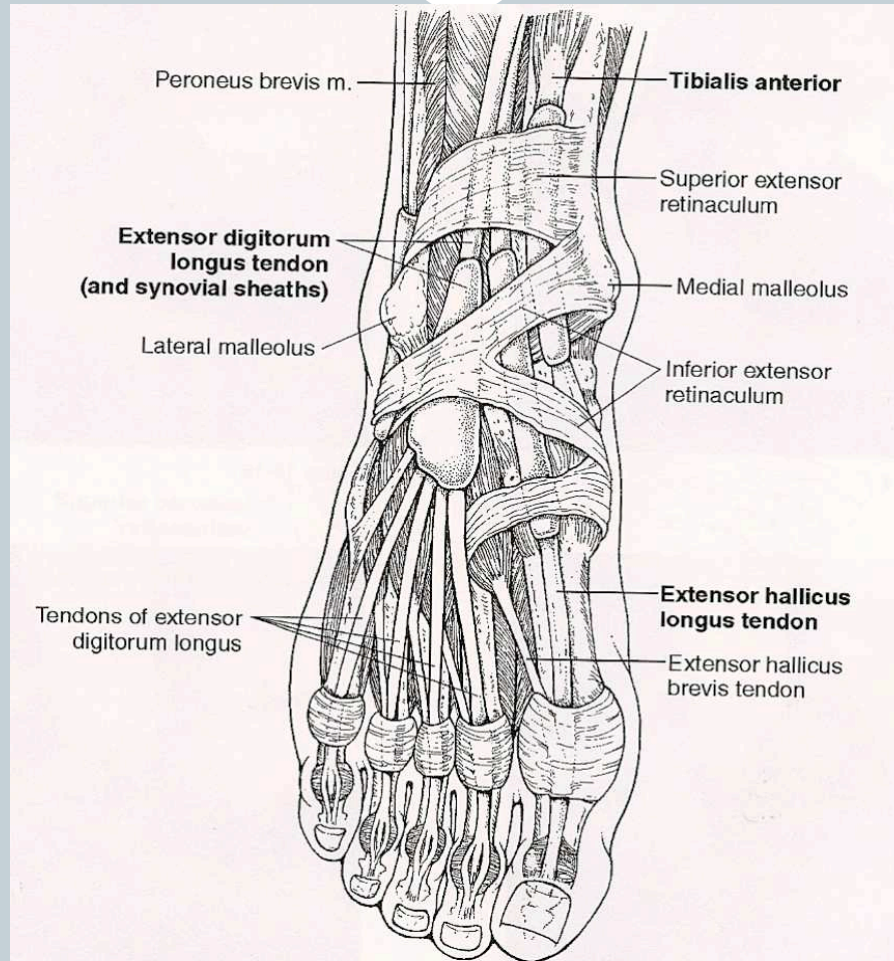
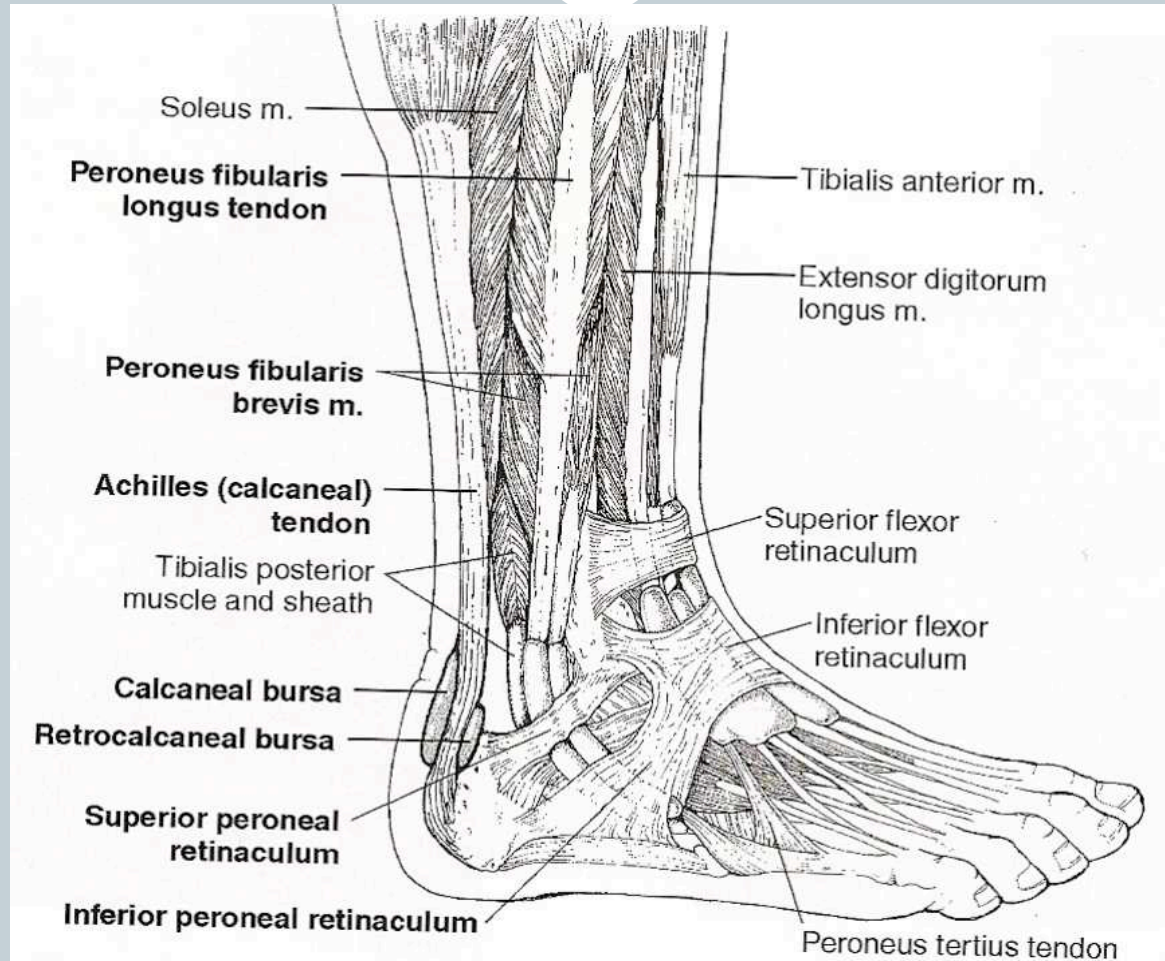


Figure 15-10

# Anterior Aspect



# Posterior Aspect



# Ligamentous Instability



- **Ligaments**
  - Anterior and posterior talofibular, anterior tibiofibular, and deltoid ligaments.
- If any of these ligaments are torn, the tibia can separate from the fibula and the talus may become unstable.
- Common mechanism of injury is a supination or inversion force.



# Ligamentous Instability



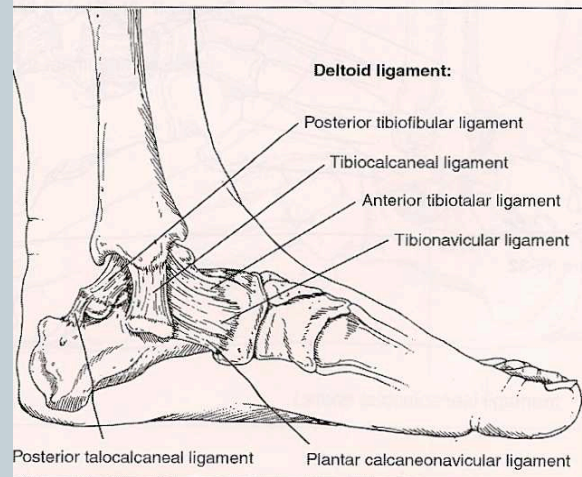
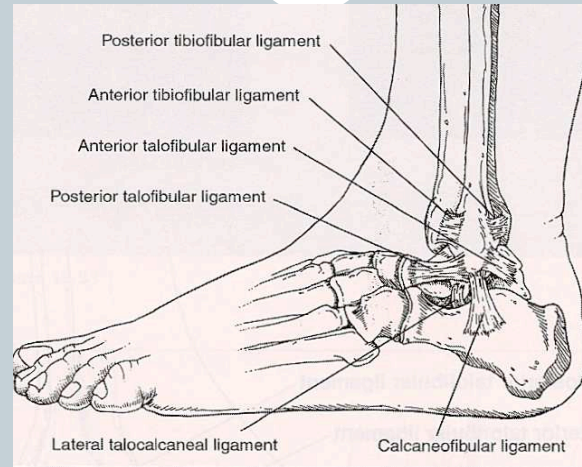
- The foot turns under the ankle after walking or running on uneven surfaces or when landing on an inverted foot after a jump.
- The most common injured ligament is the anterior talofibular ligament.
- Ligament laxity can lead to chronic ankle sprains.

# Ligamentous Instability



- **Clinical Signs and Symptoms**
  - Ankle swelling
  - Static ankle pain
  - Pain on passive motion
  - Tenderness over affected ligament

# Ligaments



# Drawer's Foot Sign



- **Procedure:** Patient supine. Stabilize ankle with one hand. Press posterior on tibia with the other hand. Next, grasp anterior aspect of the foot with one hand and the posterior aspect of the tibia with the other. Pull anterior.
- **Rationale:**
  - Gapping with posterior push – tear anterior talofibular
  - Gapping with anterior pull – tear posterior talofibular

# Inspection

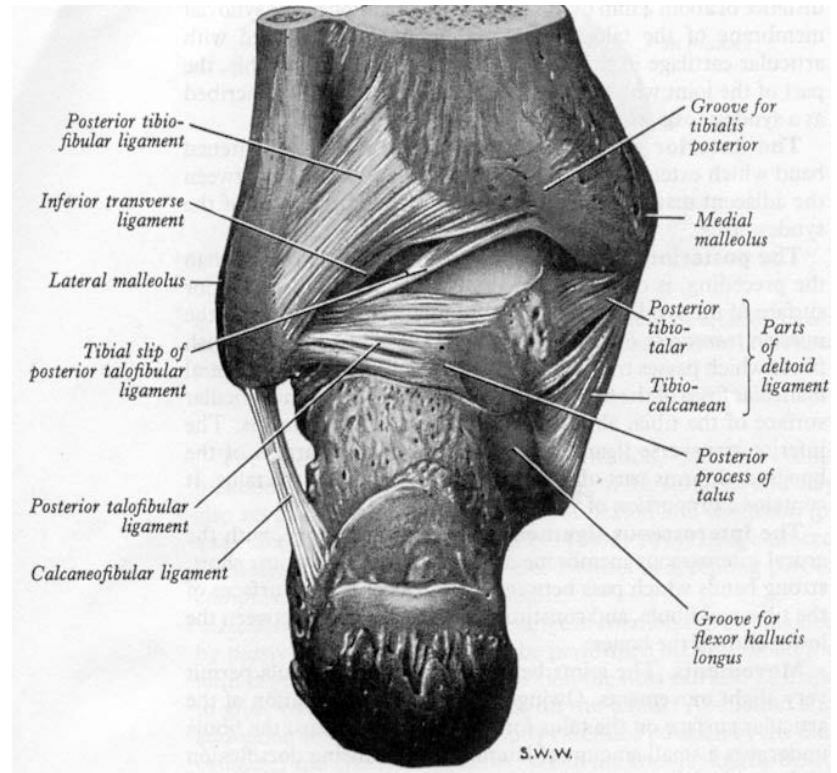


- **Alignment (neutral? valgus? varus?)**
- **Foot shape: Pes Planus/Cavus**
- **Toe shape: Clawed, Hammer, Mallet toes?**
- **Swelling/ Masses**
- **Discoloration**
- **Scars / Cuts / Abrasions**
- **Ulcers**

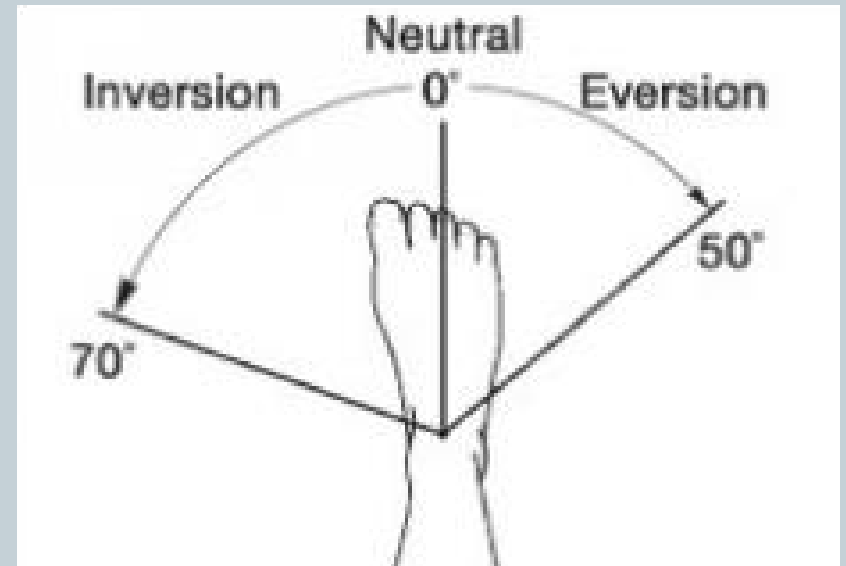
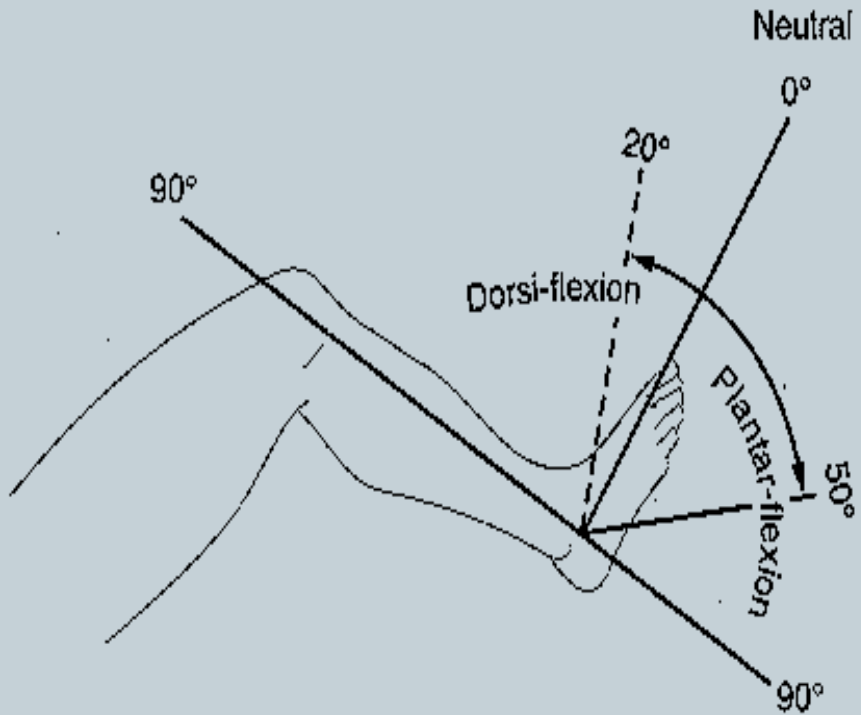
# Palpation of Ankle

54

- ATFL
- CFL
- Distal tibiofibular
- Syndesmosis
- Deltoid ligament
- Lateral malleolus
- Medial malleolus
- Base 5<sup>th</sup> metatarsal



# Range of Motion



# Strength Testing



## **ANKLE DORSIFLEXION**

- **Tibialis Anterior**
- **EHL**
- **EDL**





# Strength Testing



- **INVERSION**
  - Posterior Tibialis
  - Flexor Digitorum Longus
  - Flexor Hallucis Longus



# Strength Testing



- **EVERSION**
  - Peroneus Longus
  - Peroneus Brevis



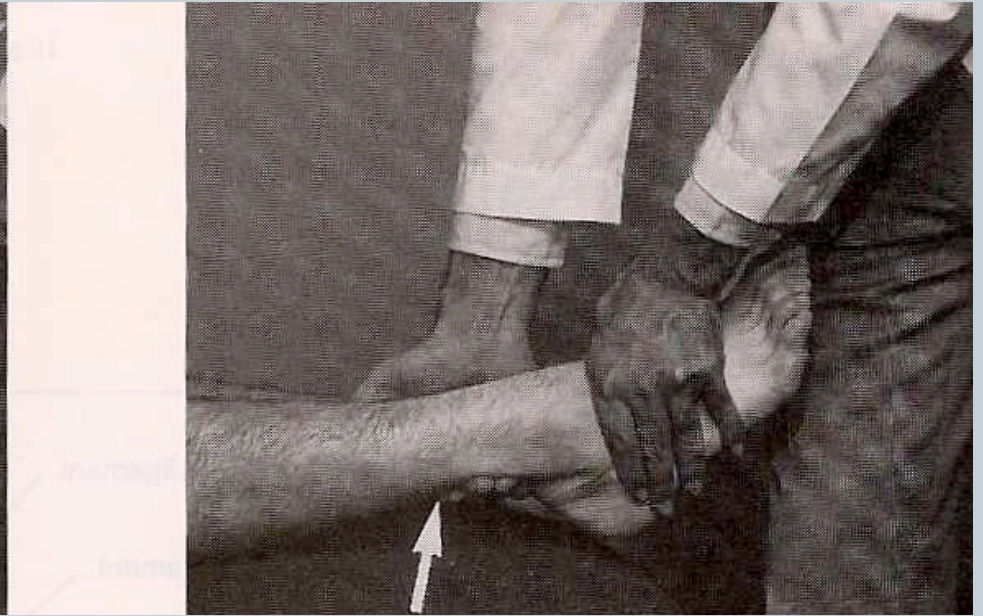
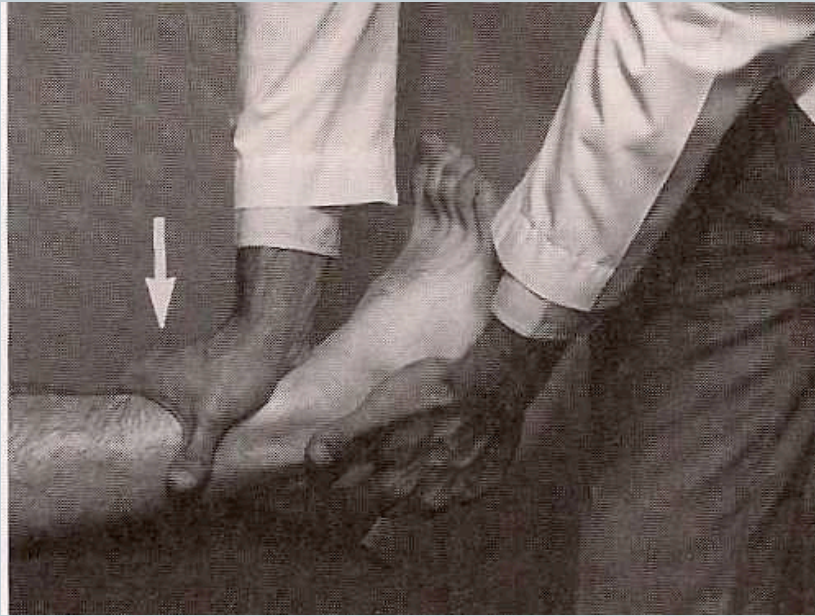
# Strength Testing



- **PLANTAR FLEXION**
  - Gastrocnemius
  - Soleus
  - Heel Rise



# Drawer's Foot Sign



# Drawer's Foot Sign

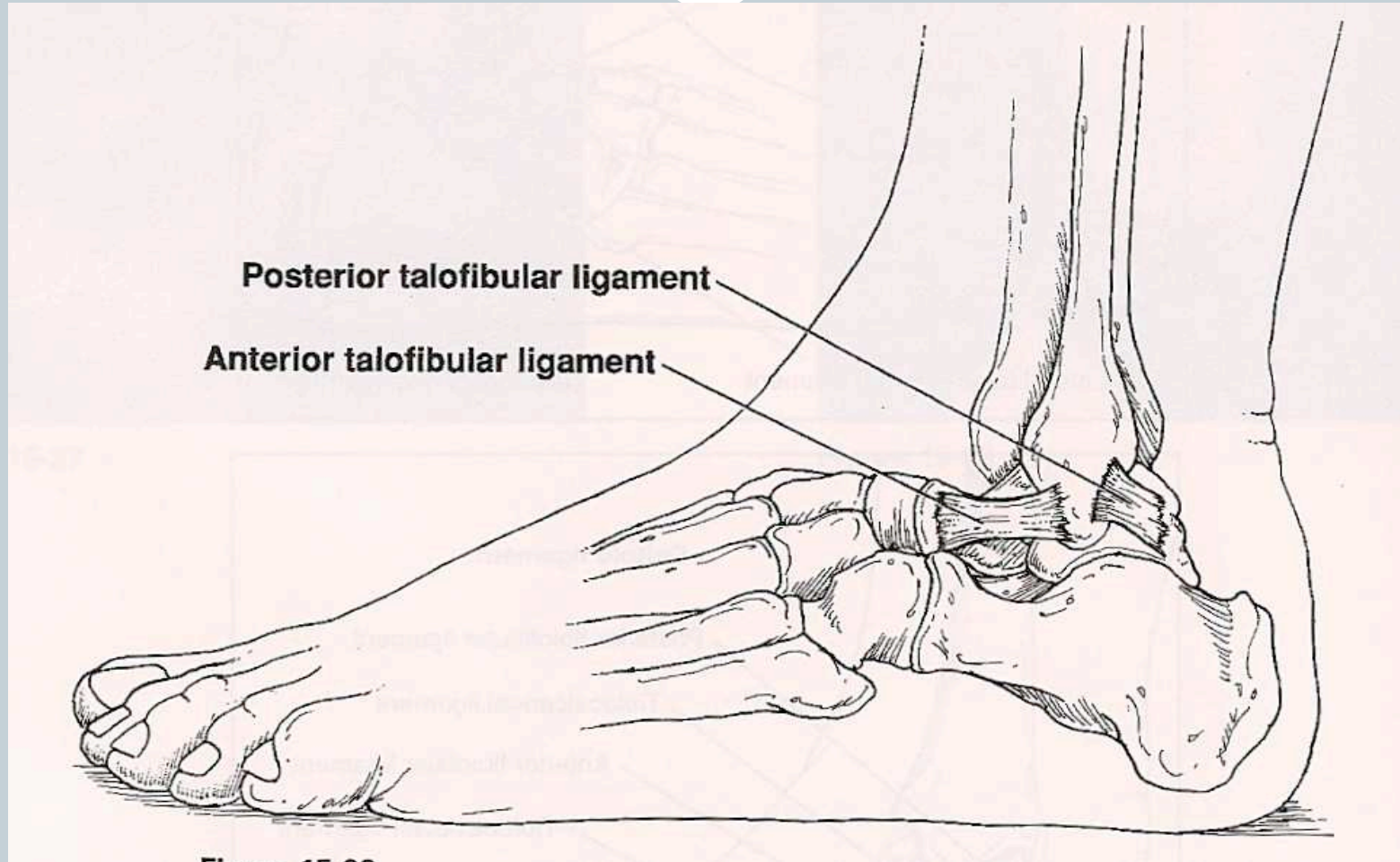


Figure 45-28

# Lateral Stability



- **Procedure:** Patient supine. Passively invert foot.
- **Rationale:** Gapping secondary to trauma. Suspect tear of anterior talofibular ligament or calcaneofibular ligament.

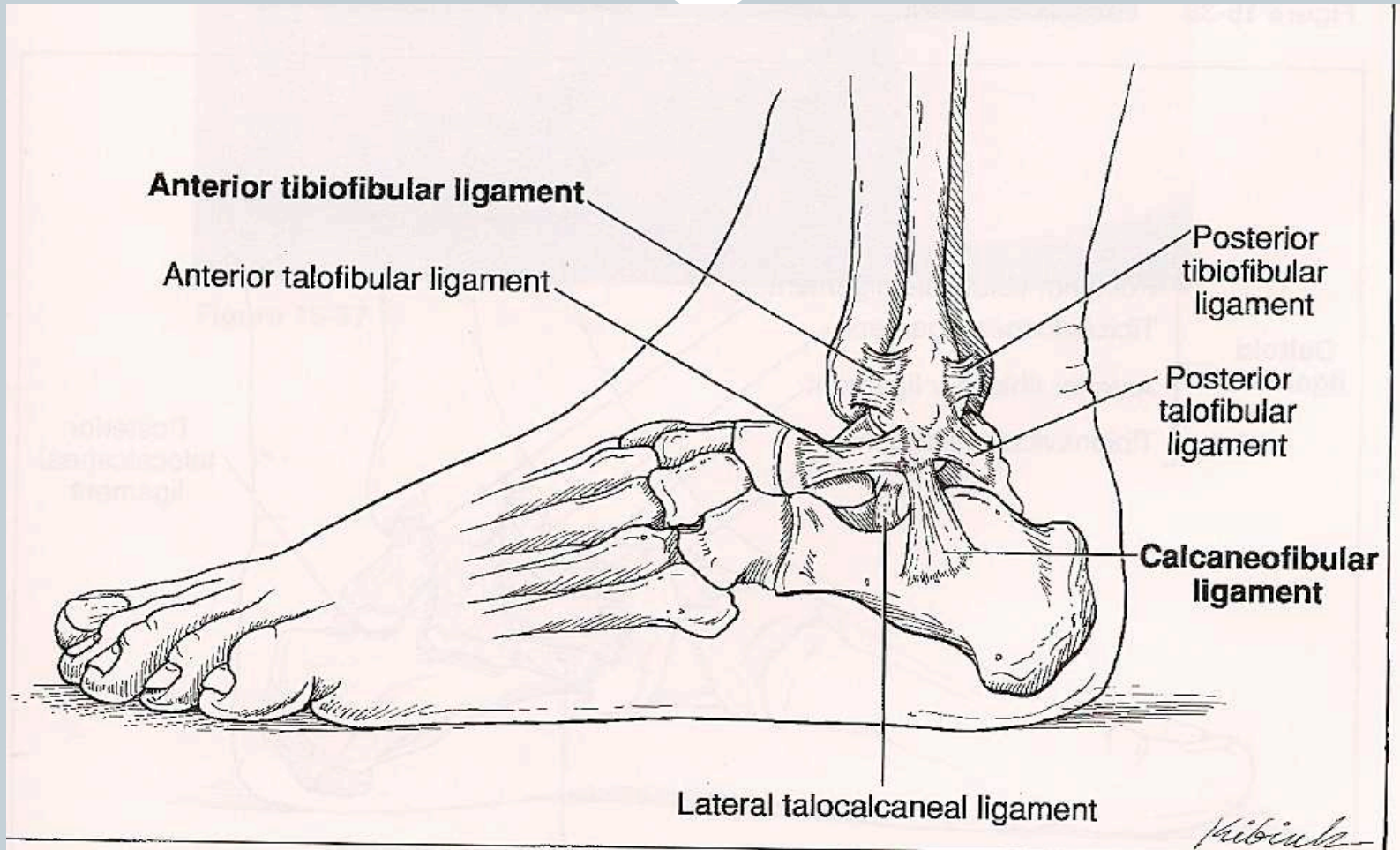


# Lateral Stability





# Lateral Stability

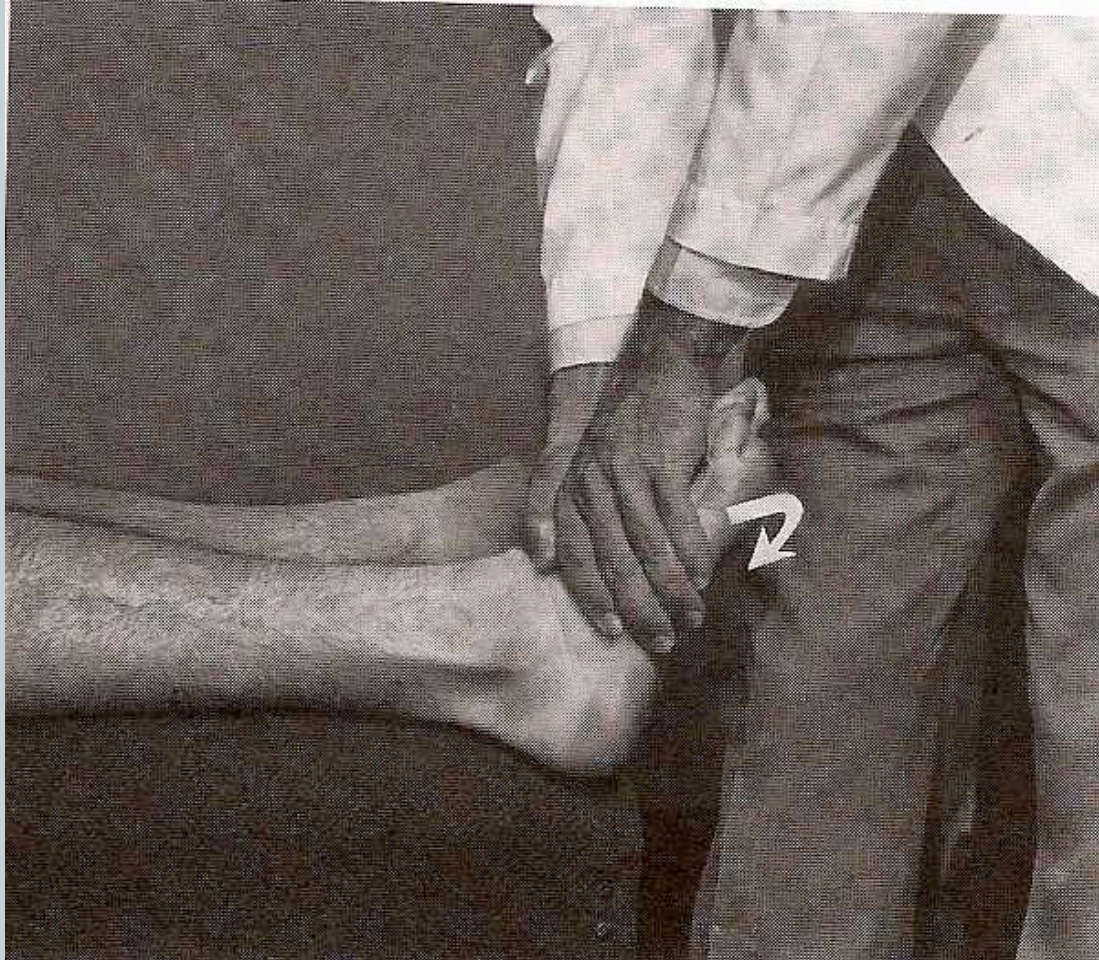


# Medial Stability



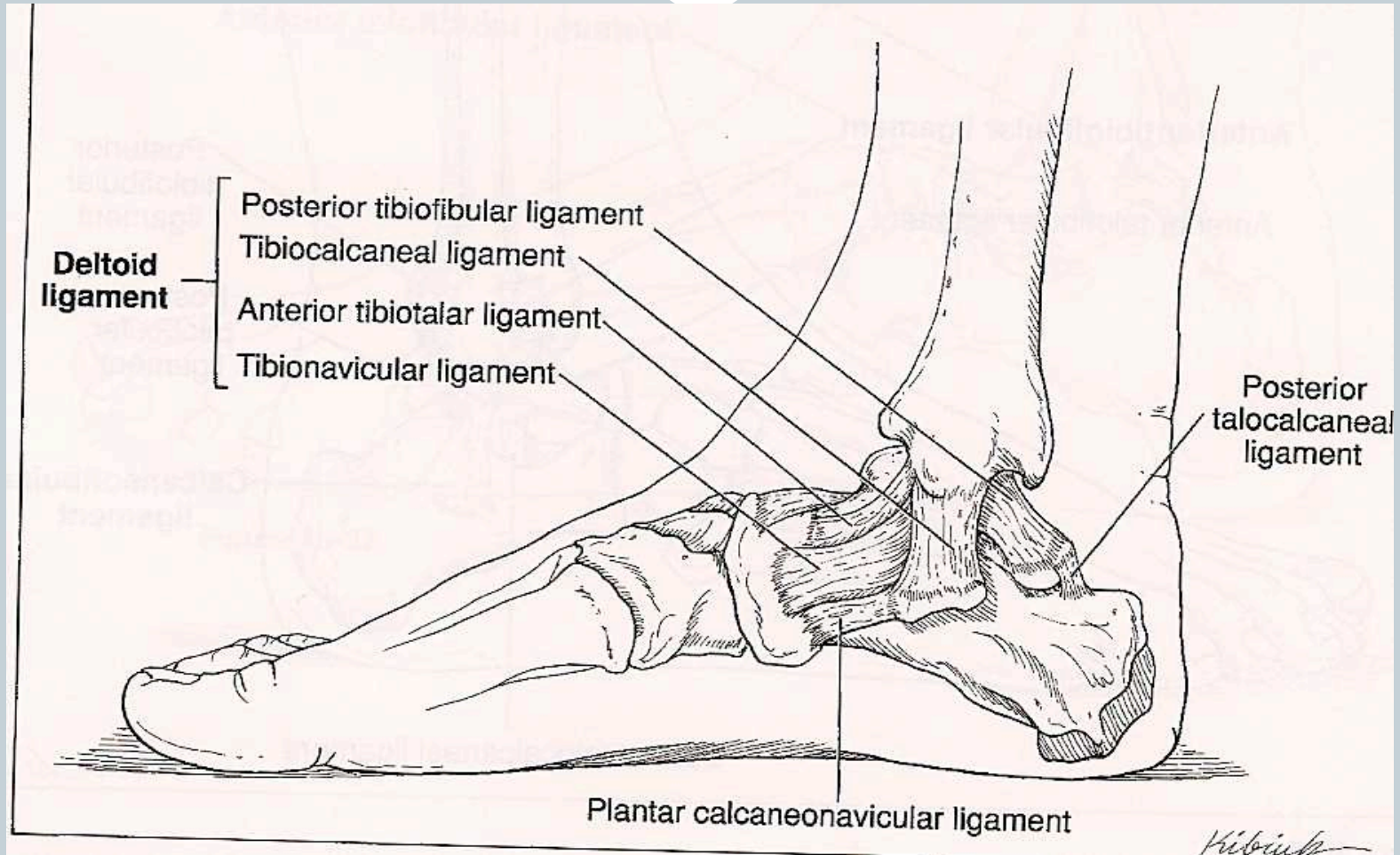
- **Procedure:** Patient supine. Passively evert foot.
- **Rationale:** Gapping secondary to trauma. Suspect tear of deltoid ligament.

# Medial Stability





# Medial Stability

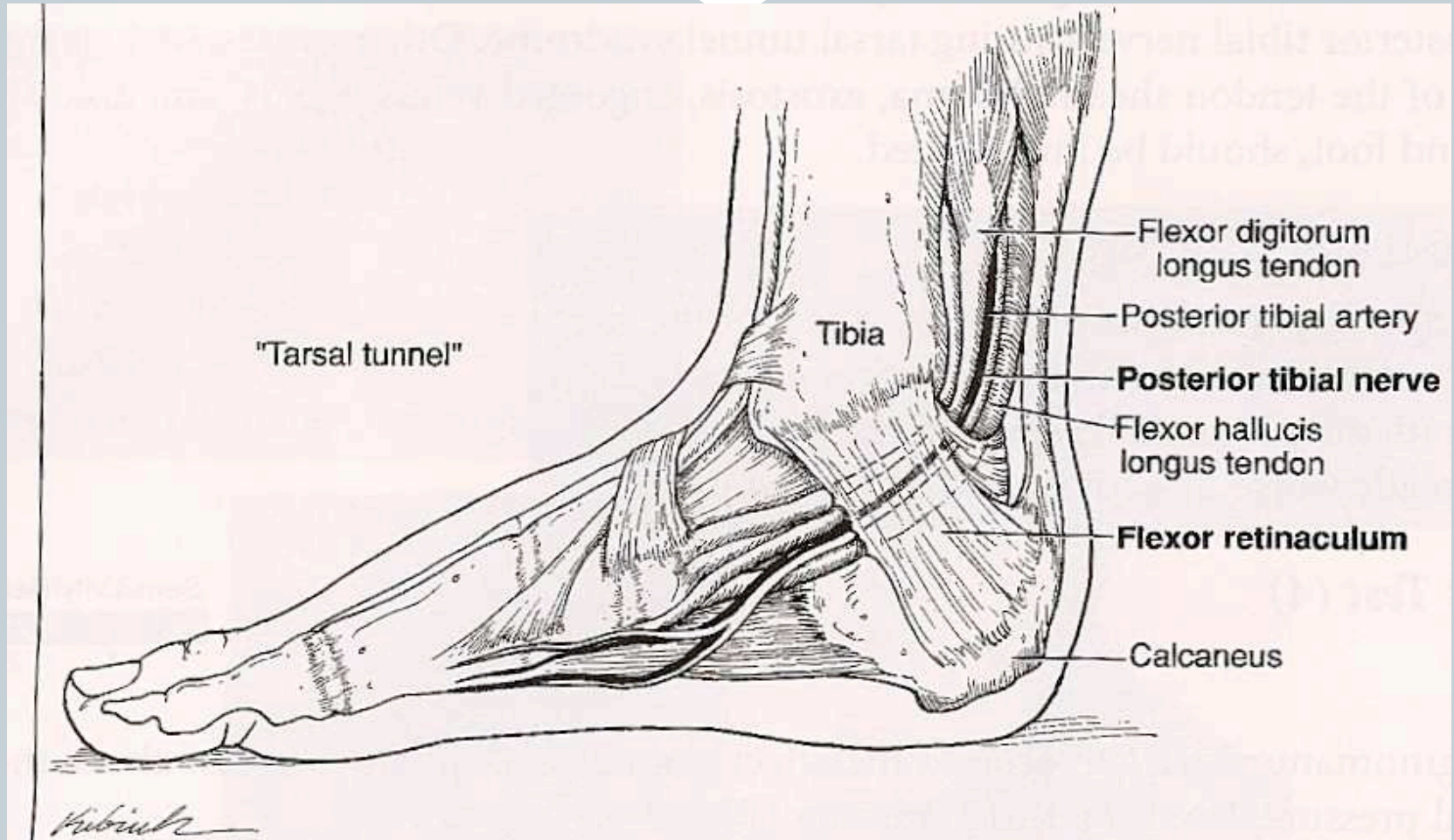


# Syndesmosis



**The squeeze test** A provocative test for syndesmotic injury. The examiner compresses the tibia and fibula above the ankle. Pain in the region of the distal syndesmosis (area of pain indicated by the tip of the arrow) confirms distal syndesmotic injury. Courtesy of Karen Naughton, MD.

# Tarsal Tunnel



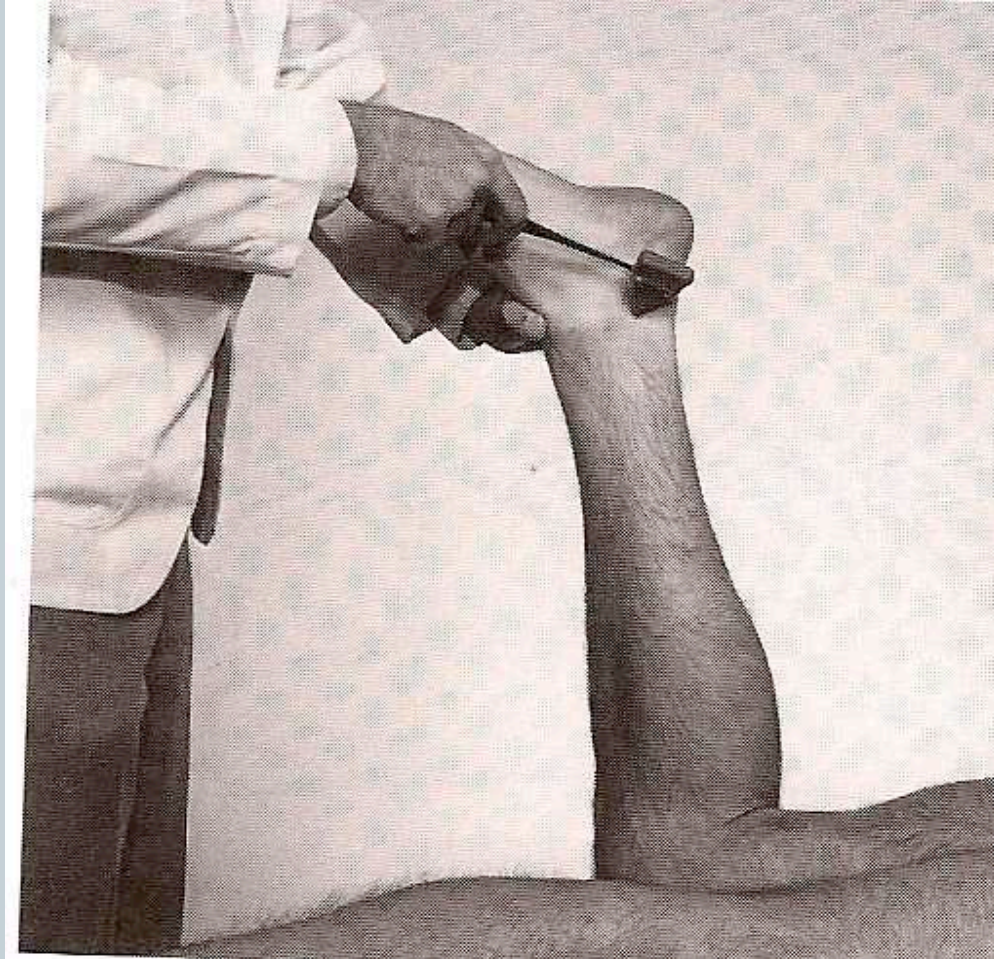
# Tinel's Foot Sign



- **Procedure:** Tap over the posterior tibial nerve with a neurological reflex hammer.
- **Rationale:** Paresthesias radiating to the foot indicate irritation of the posterior tibial nerve that may be caused by constriction at the tarsal tunnel.



# Tinel's Foot Sign



# Thompson's Test



- **Procedure:** Patient prone. Flex knee. Squeeze the calf muscles against the tibia and fibula.
- **Rationale:** The the gastrocnemius and soleus are squeezed, they mechanically contract. They are attached to the Achilles tendon, which plantar-flexes the foot. If the tendon is ruptured, contraction of the gastrocnemius and soleus muscles will NOT plantar-flex the foot.

# Thompson Test

