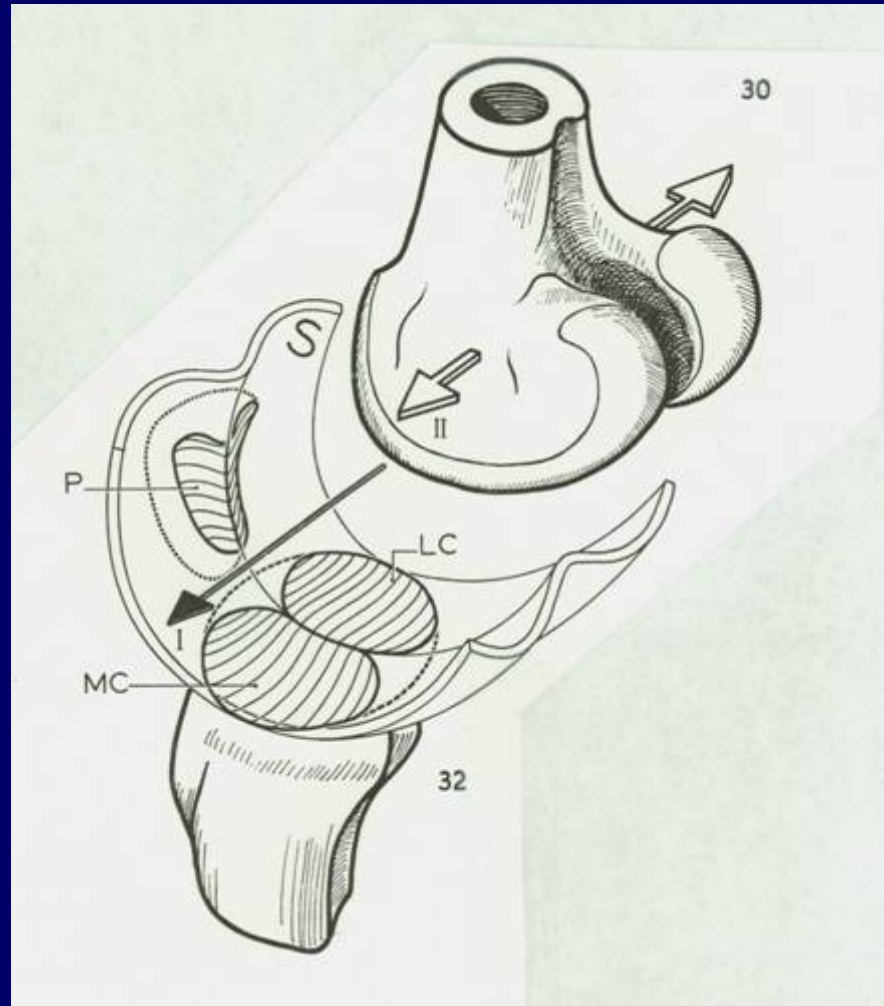


Biomechanical Considerations for Rehabilitation of the Knee

www.fisiokinesiterapia.biz

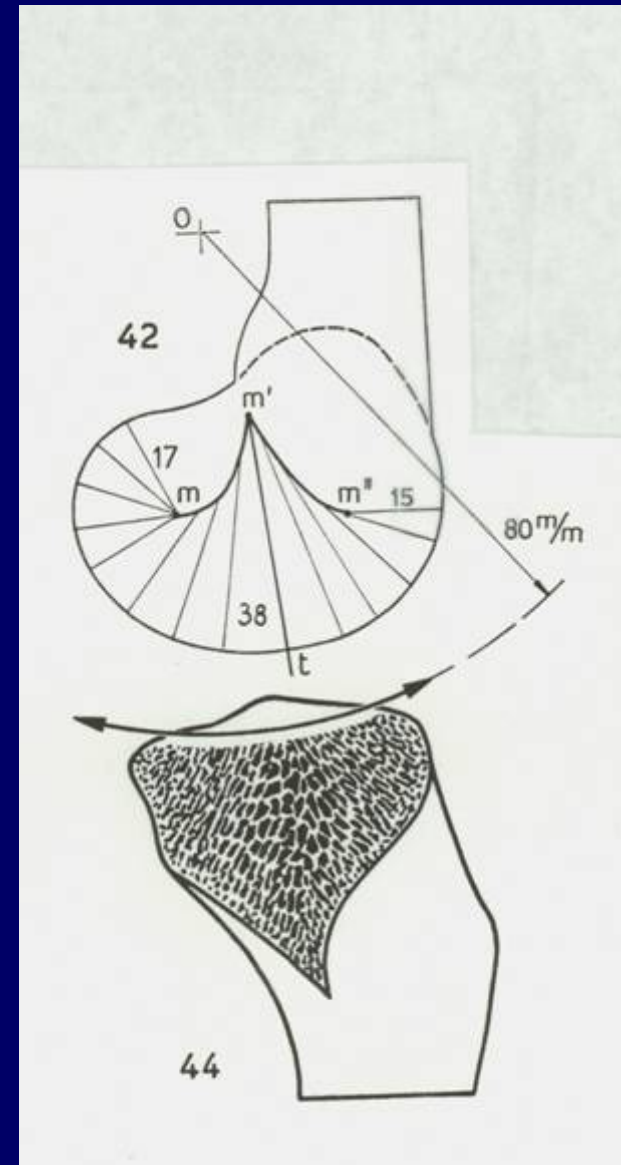
Bony Architecture of the Knee

- Femur
- Tibia
- Patella



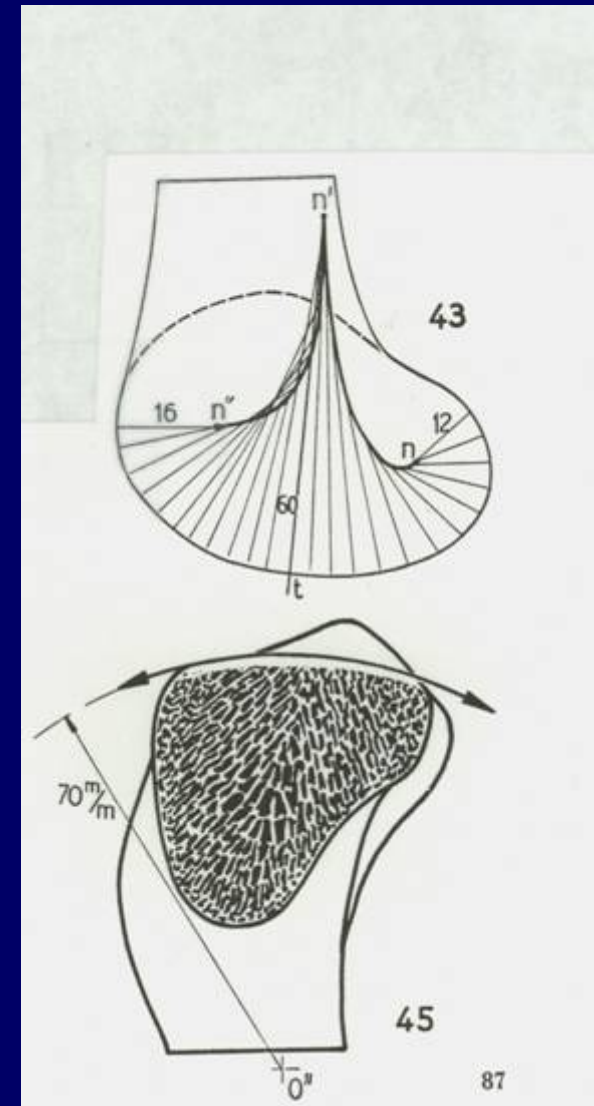
Tibio-Femoral Joint

Medial Compartment

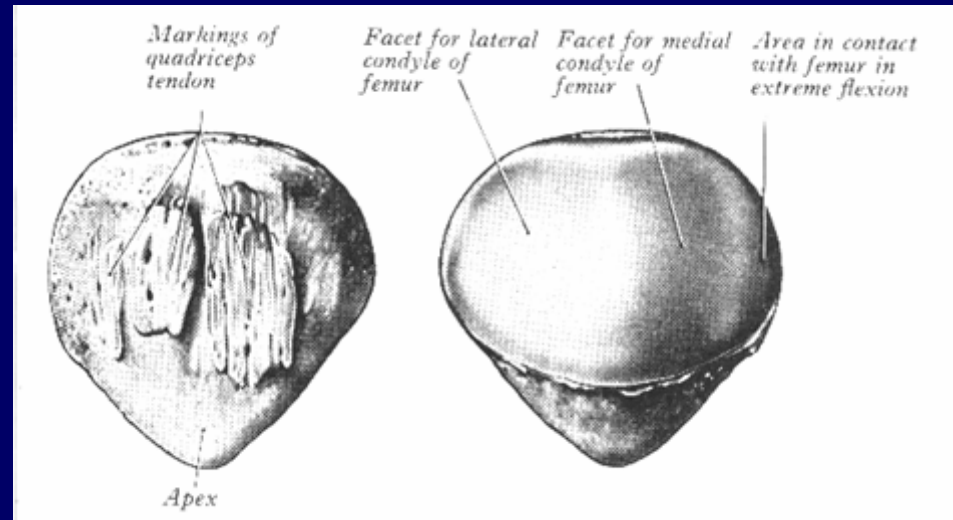
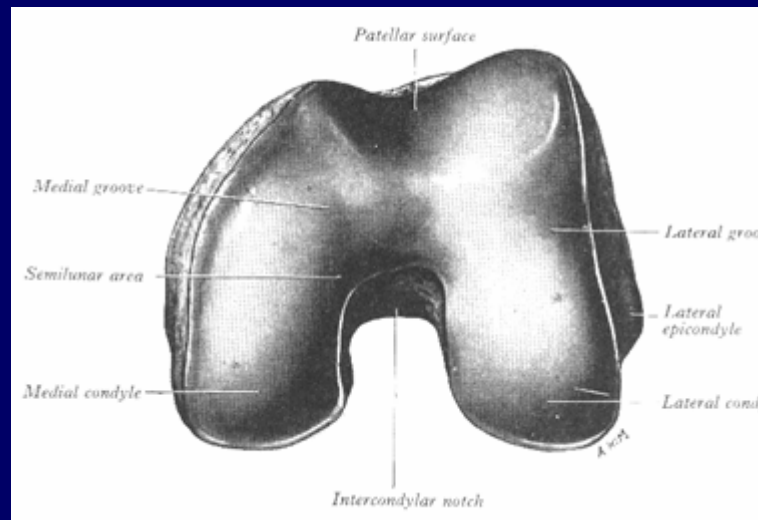


Tibio-Femoral Joint

Lateral Compartment



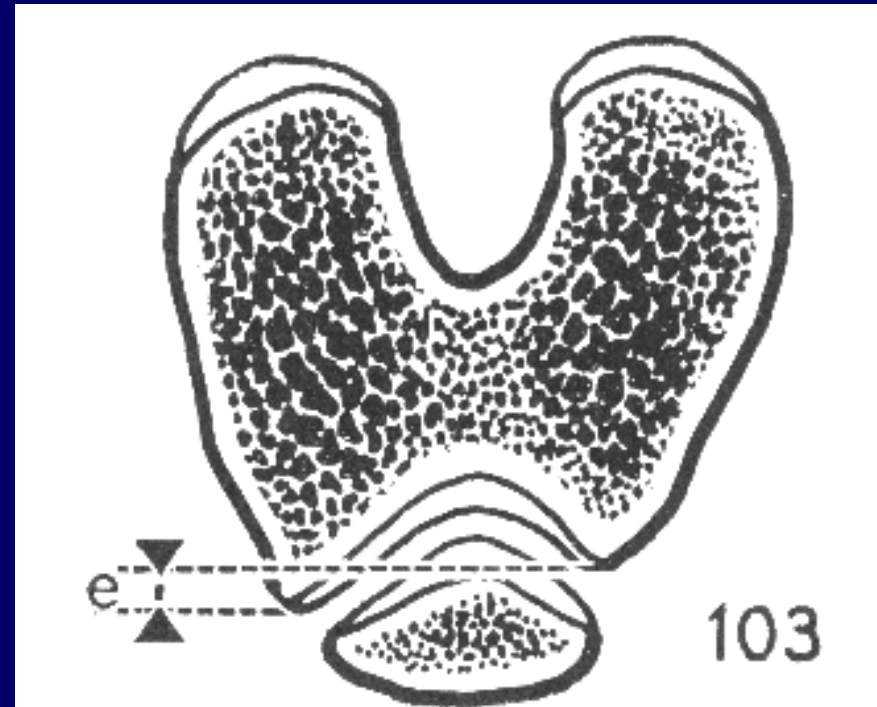
Patello-Femoral Joint



www.fisiokinesiterapia.biz

Restraints to Patellar Motion

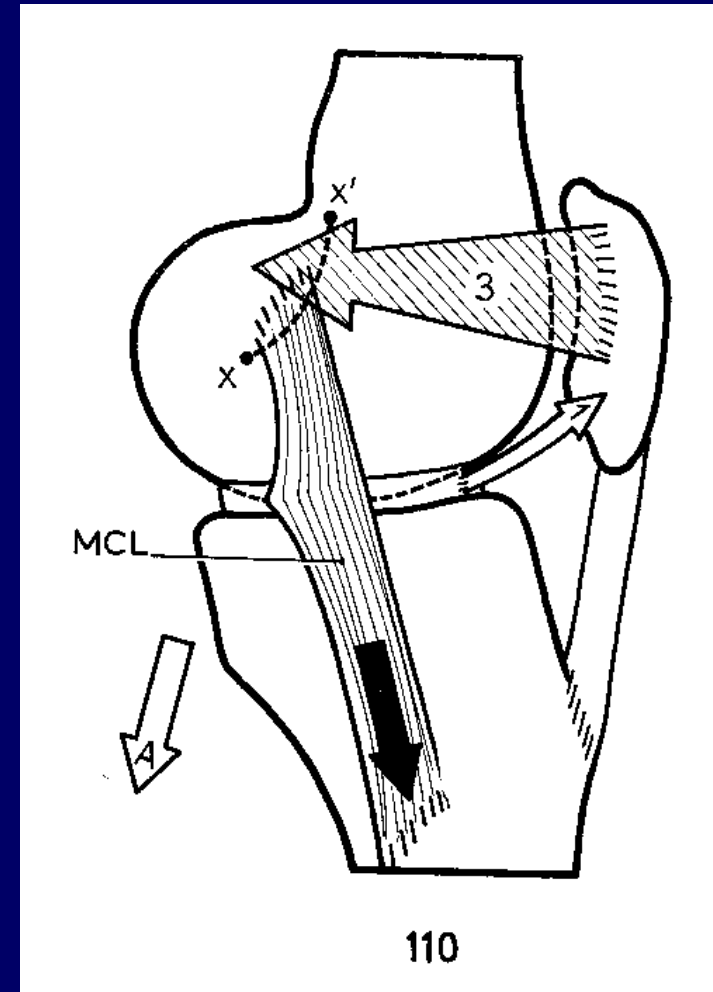
- Bony architecture
- Passive restraints
- Active restraints



Restraints to Patellar Motion

Medial Restraints

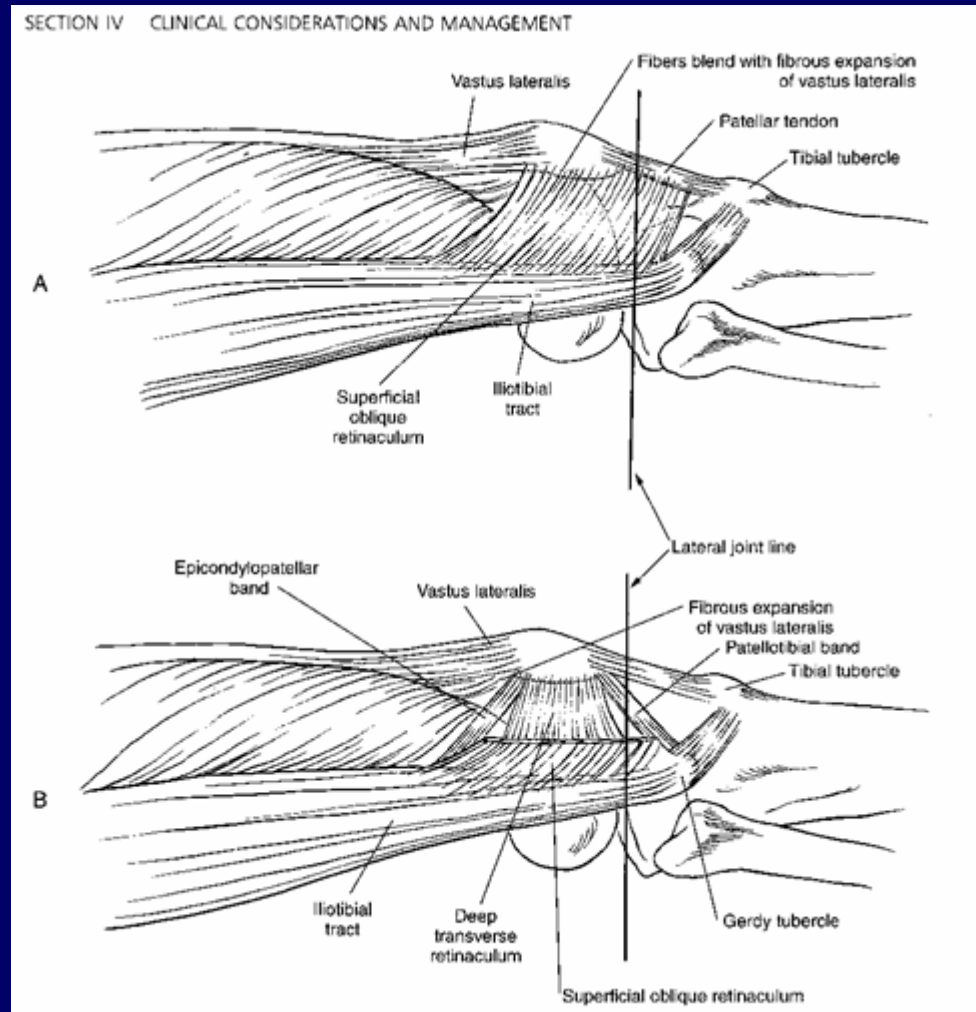
- Medial retinaculum
- Medial P-F ligament
- Medial menisco-patellar ligament



Restraints to Patellar Motion

Lateral Restraints

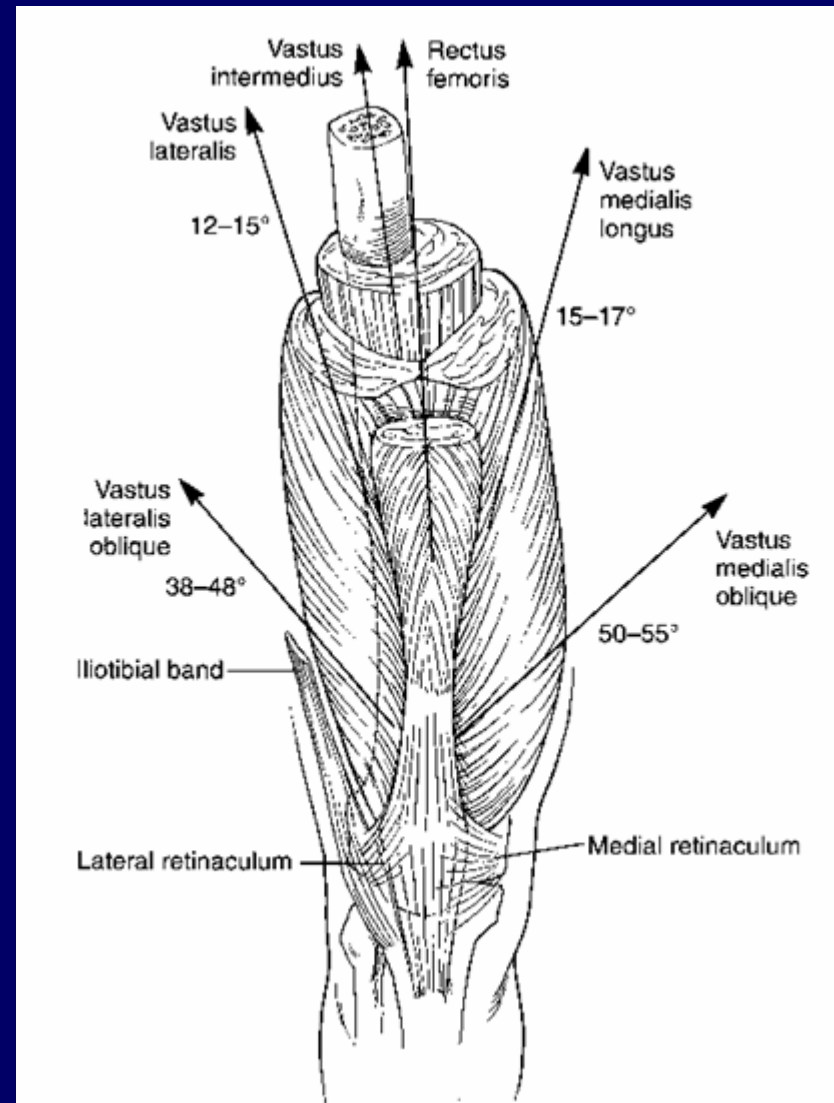
- ITB
- Lateral P-F ligament
- Lateral patello-tibial ligament



Restraints to Patellar Motion

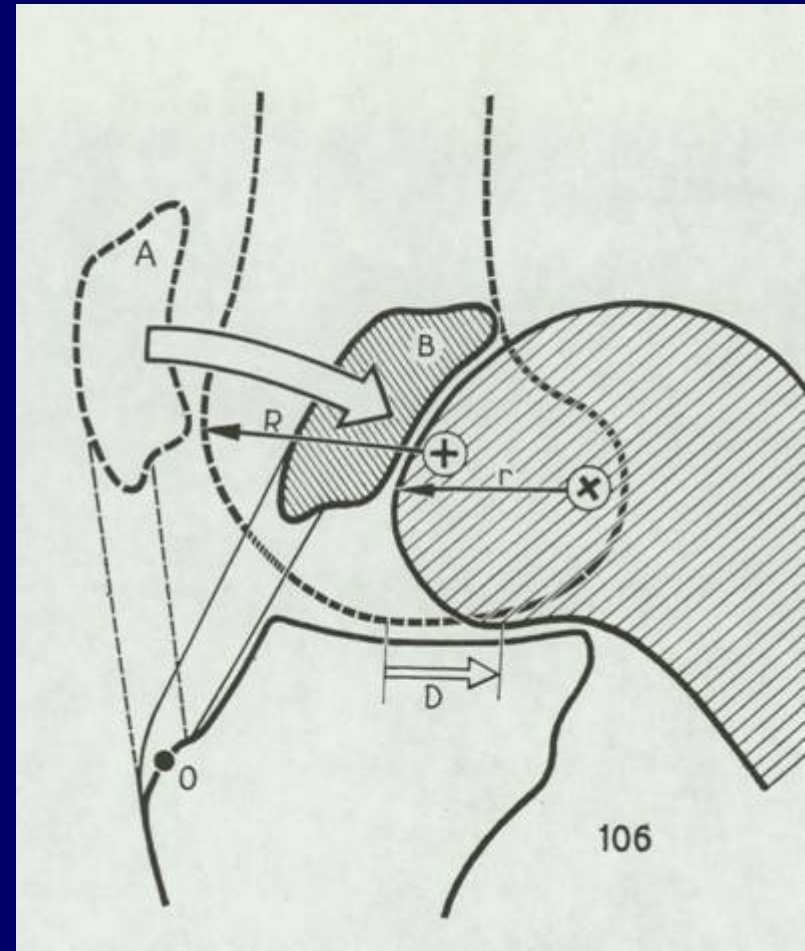
Active Restraints

- Vastus lateralis
- Vastus medialis
- Vastus intermedius
- Rectus femoris

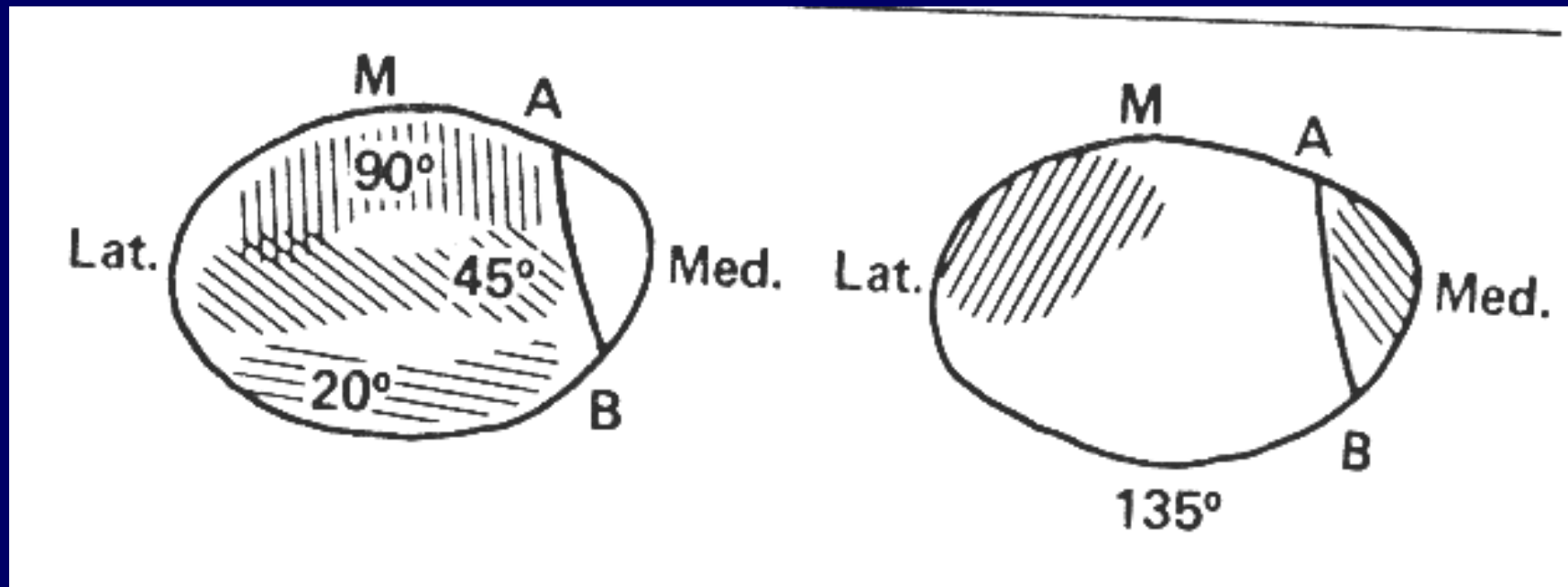


Patellofemoral Motion

- Flexion - patella glides inferiorly
- Extension - patella glides superiorly

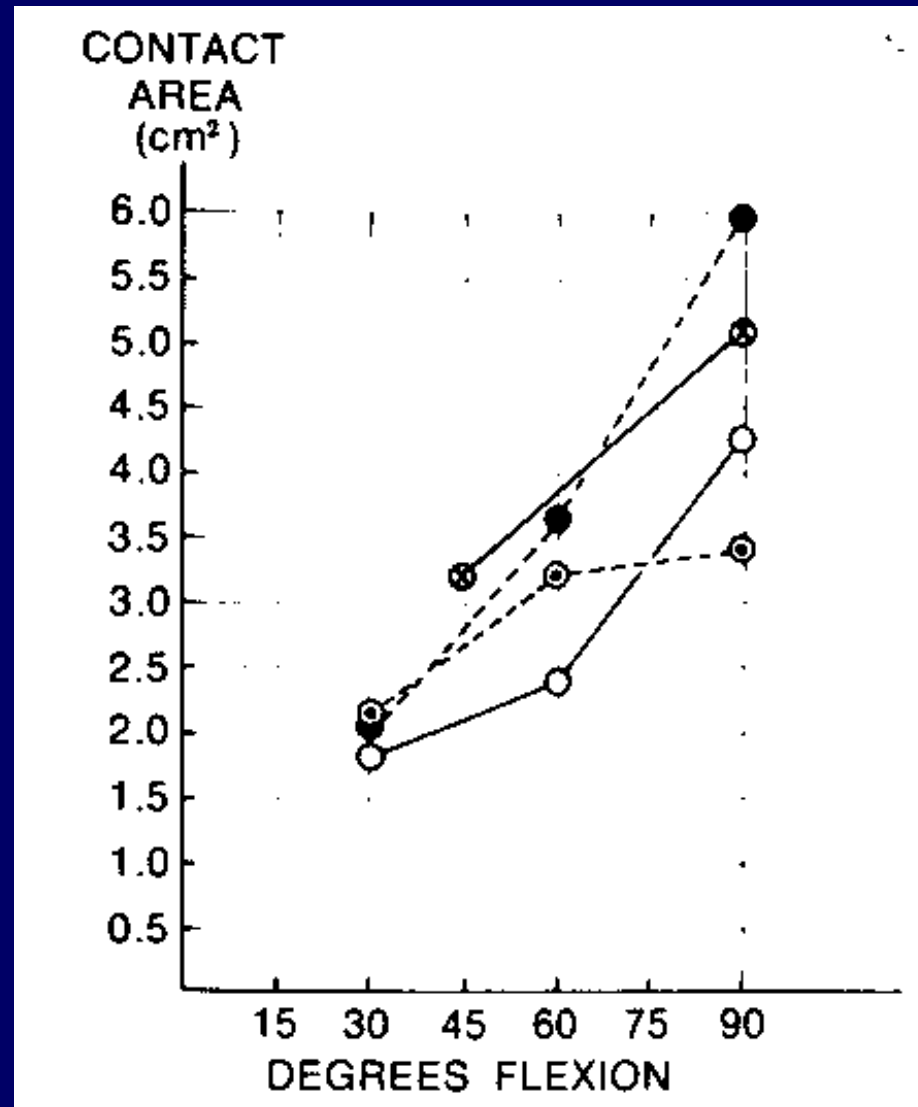


Patello-Femoral Contact



www.fisiokinesiterapia.biz

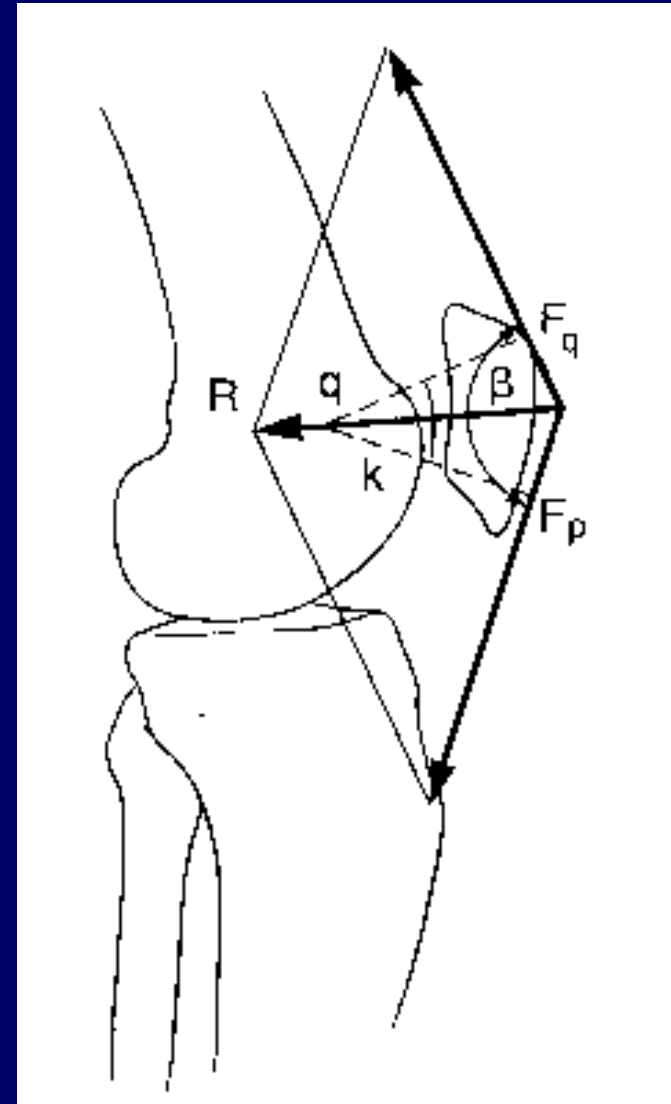
Patello-Femoral Contact Area



Patellofemoral Joint Reaction Force

Function of:

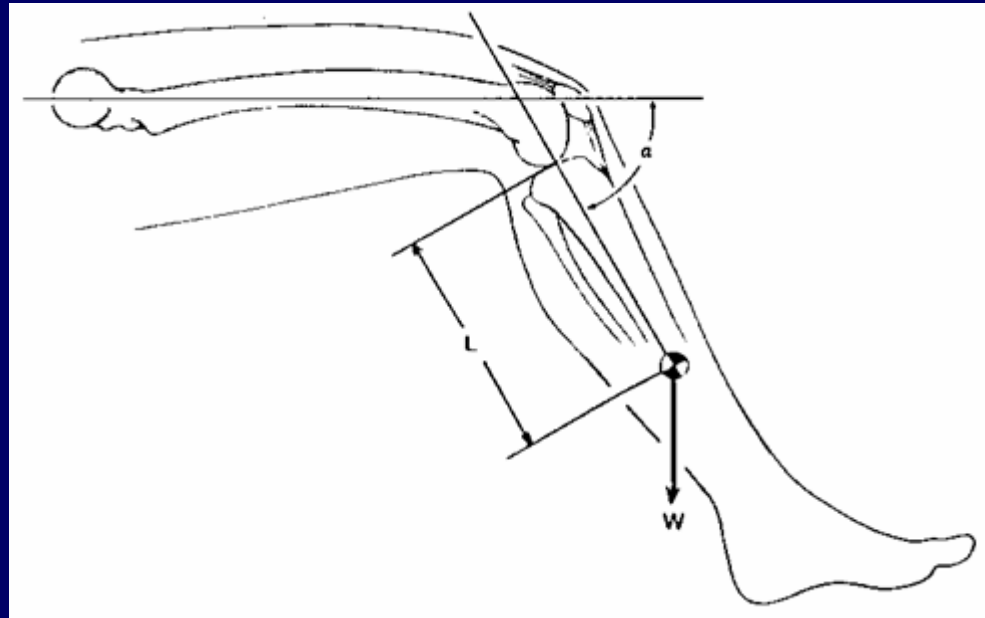
- Angle of knee flexion
- Quadriceps force



Quadriceps Force

Dependent on:

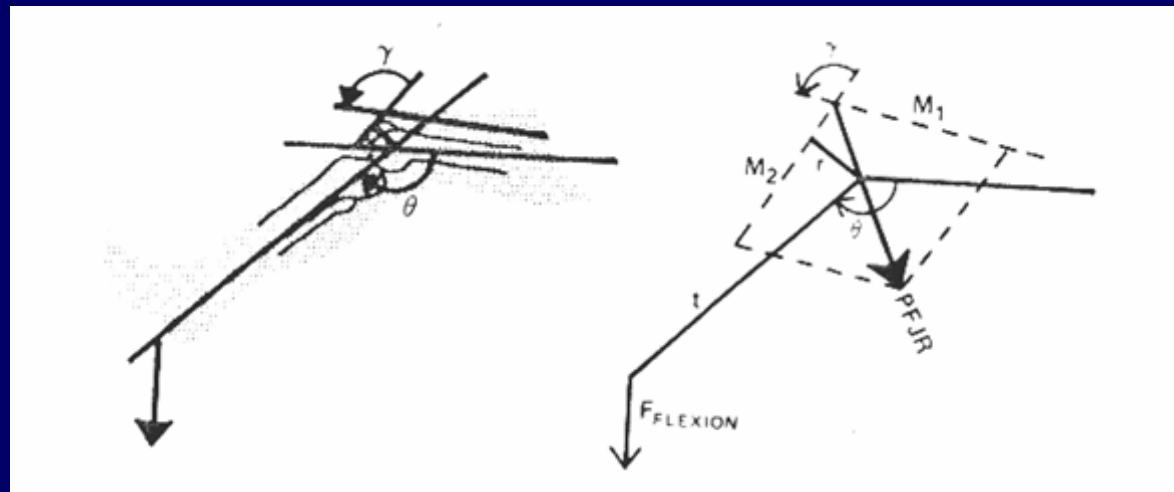
- Flexion moment arm of T-F joint
- Extension moment arm of P-F joint



Open Chain Knee Extension

Increasing Extension

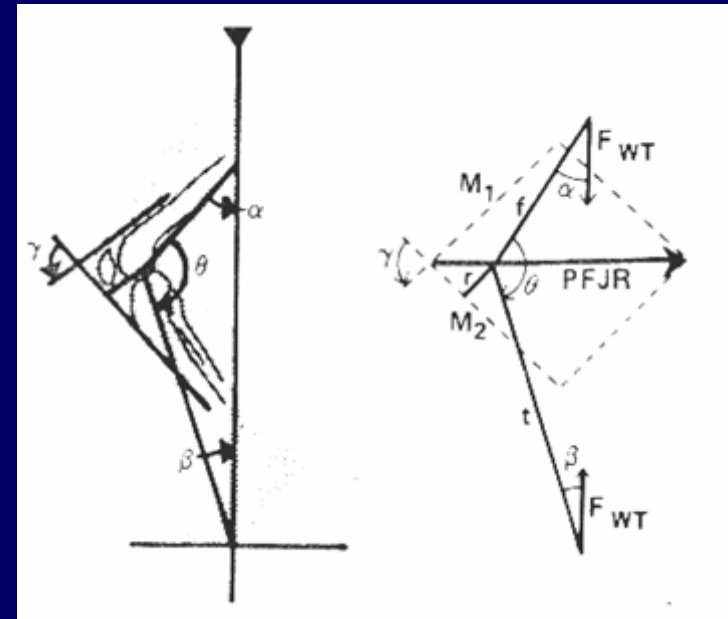
- Increased flexion moment arm
- Increased quadriceps force
- PFJR force peaks at 35°
- Decreased contact area results in increasing contact stress from 90° to 20° of flexion



Closed Chain Knee Extension

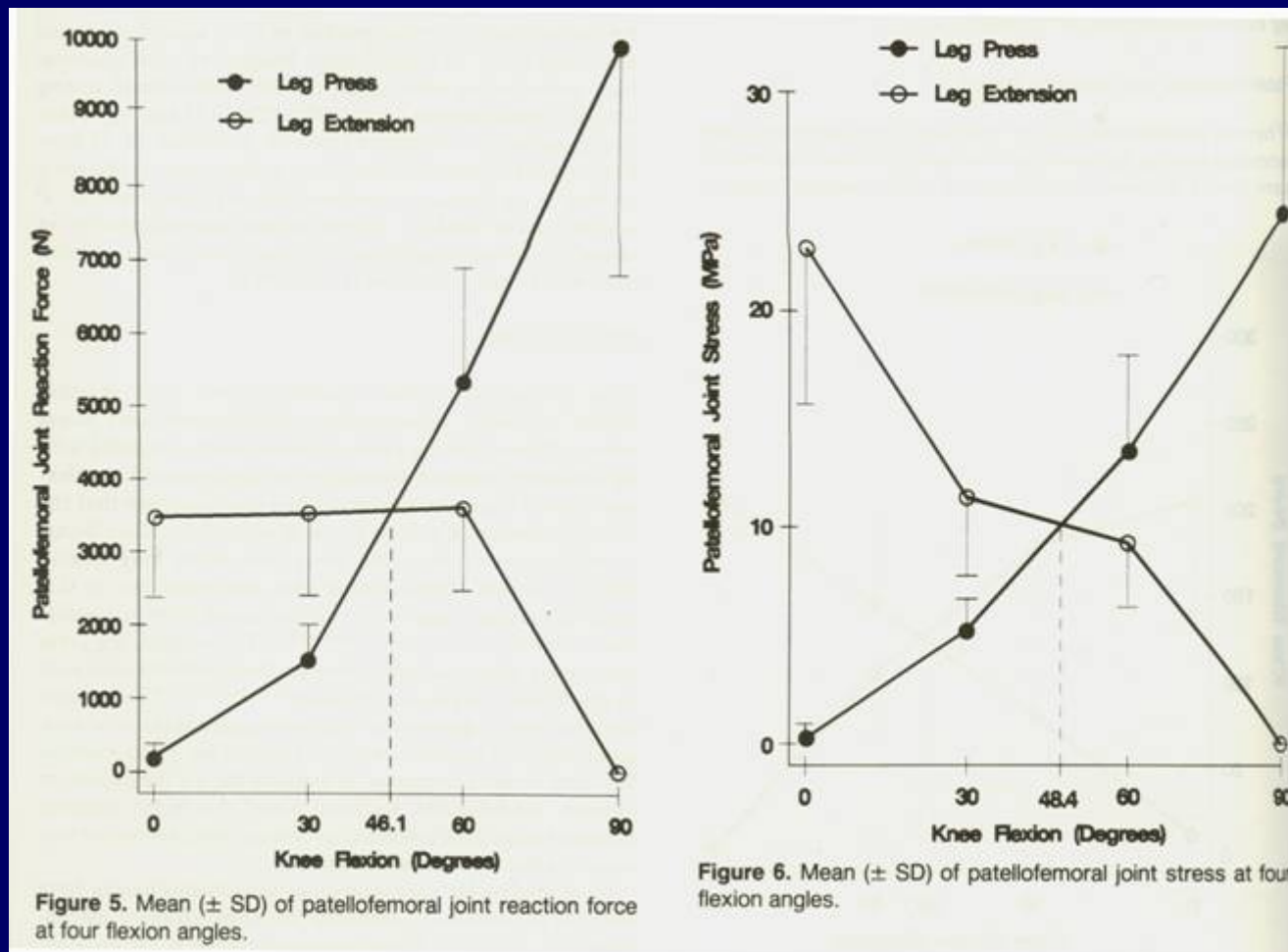
Increasing Flexion

- Increased flexion moment arm
- Increased quadriceps force
- Increased PFJR
- Increased contact area partially off-sets increasing PFJR to minimize increase in contact stress



Open vs. Closed Chain Exercise

- PFJR & contact stress greater with OKC from 0 to 45°
- PFJR & contact stress greater with CKC from 45 to 90°



Patellofemoral Joint Reaction Force

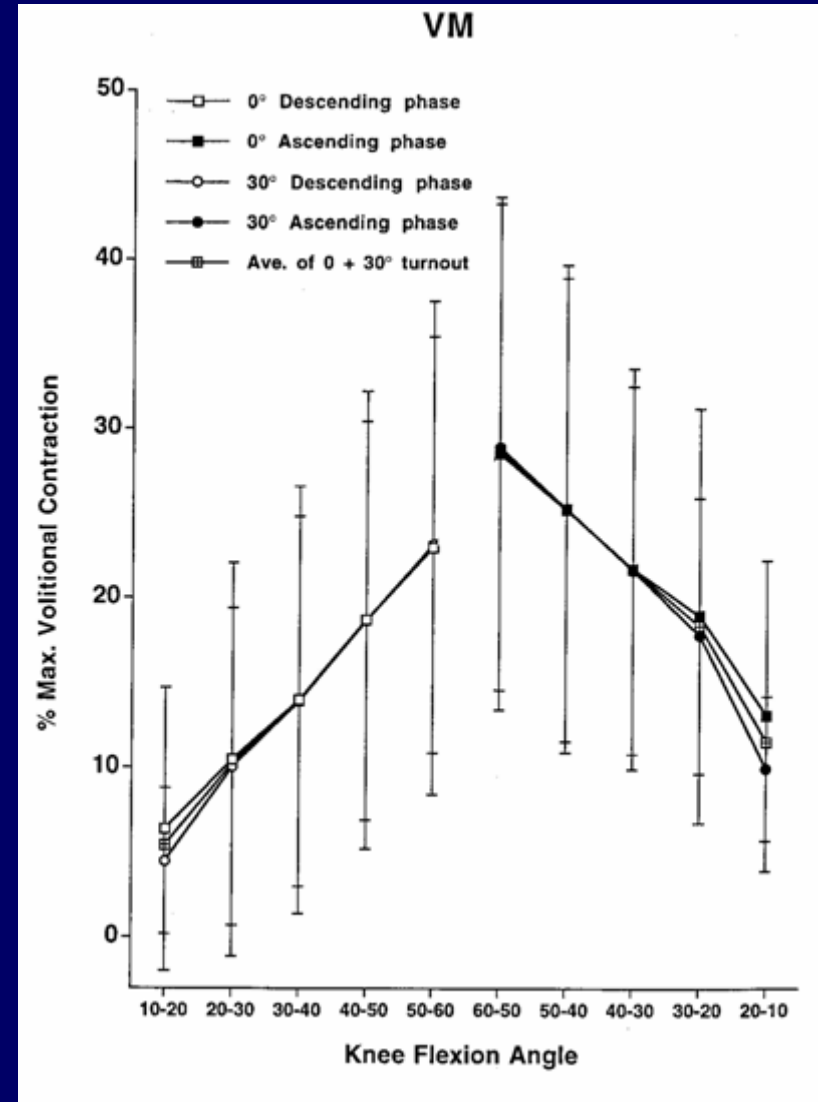
During Functional Activities

- Walking - .5 times body weight
- Stairs - 3 to 4 times body weight
- Squatting - 7 to 8 times body weight

EMG Activity of Quadriceps

Closed Chain:

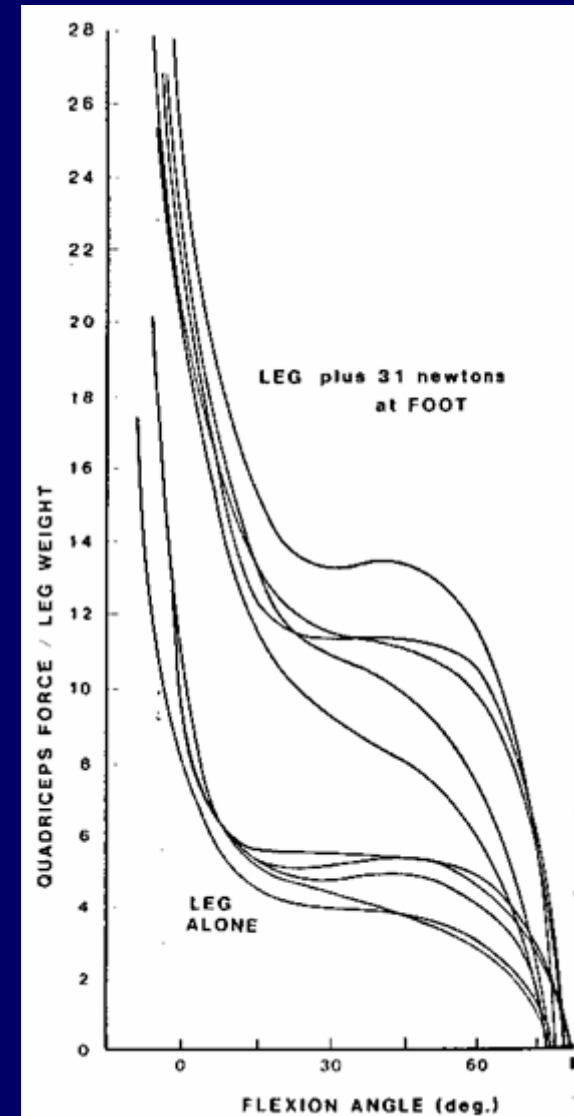
- EMG relatively low & increases with increasing angle of knee flexion



EMG Activity of Quadriceps

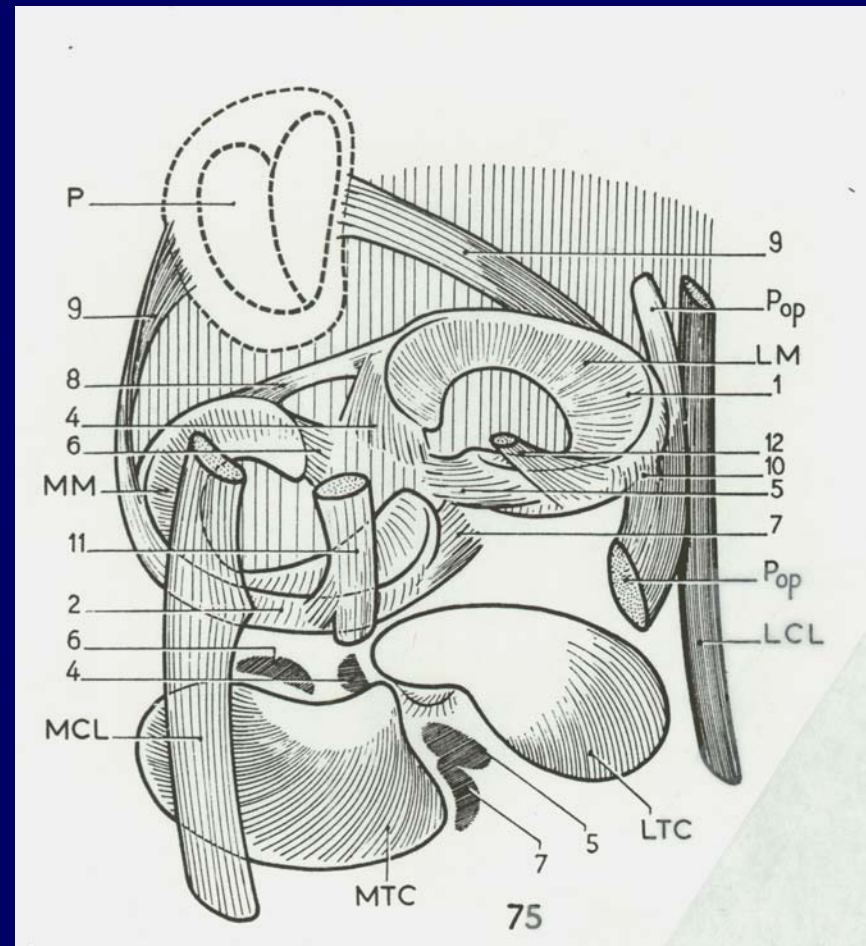
Open Chain:

- EMG activity increases with decreasing angle of knee flexion



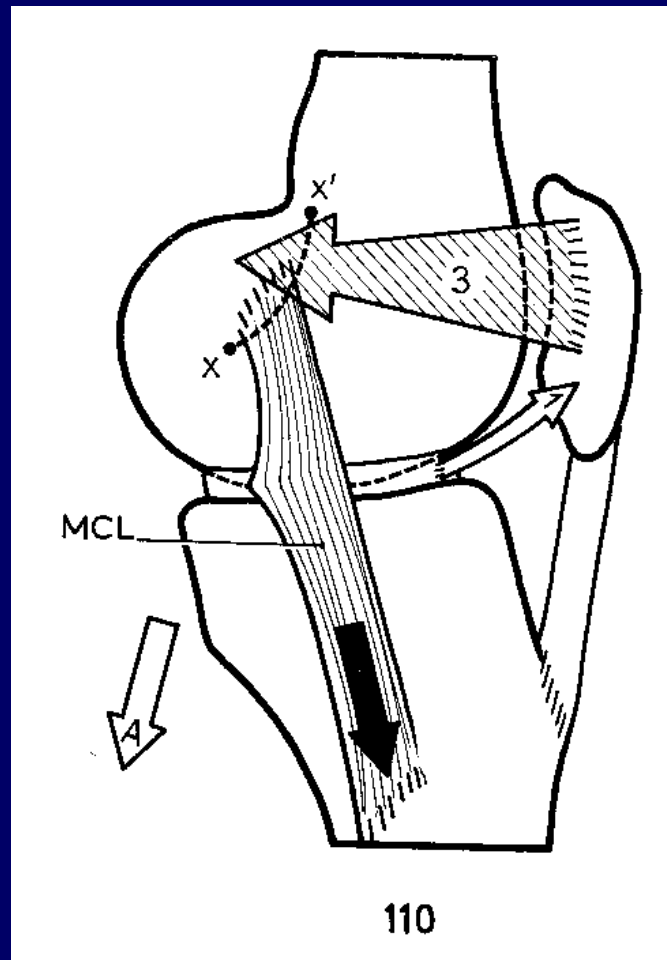
Ligamentous Restraints of Knee

- Collateral ligaments
- Cruciate ligaments
- Capsular ligaments



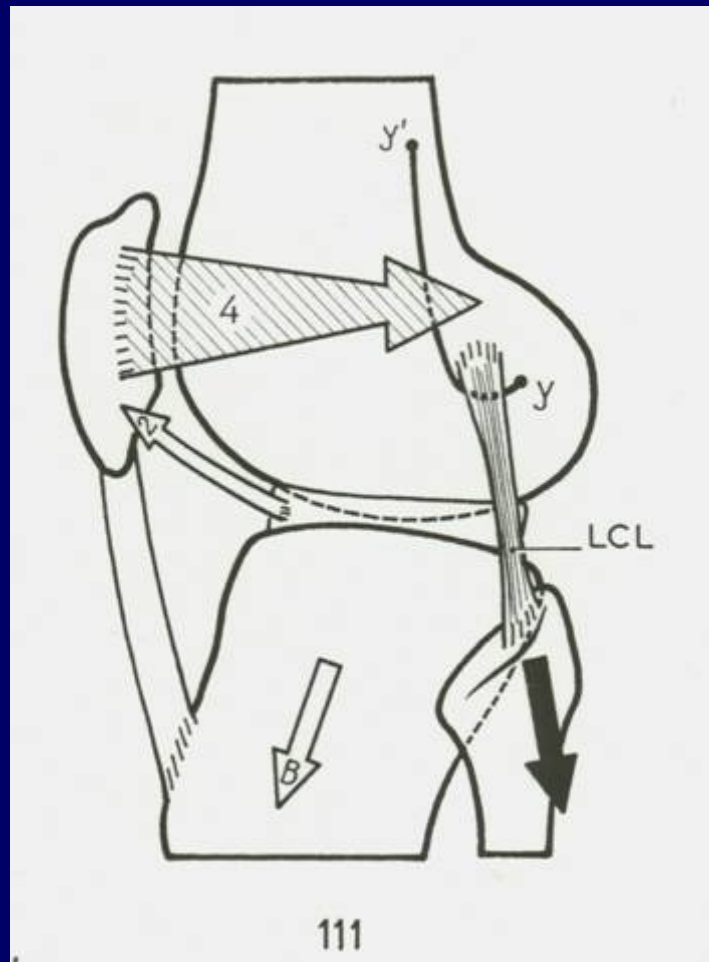
Ligamentous Restraints of Knee

Medial Collateral Ligament

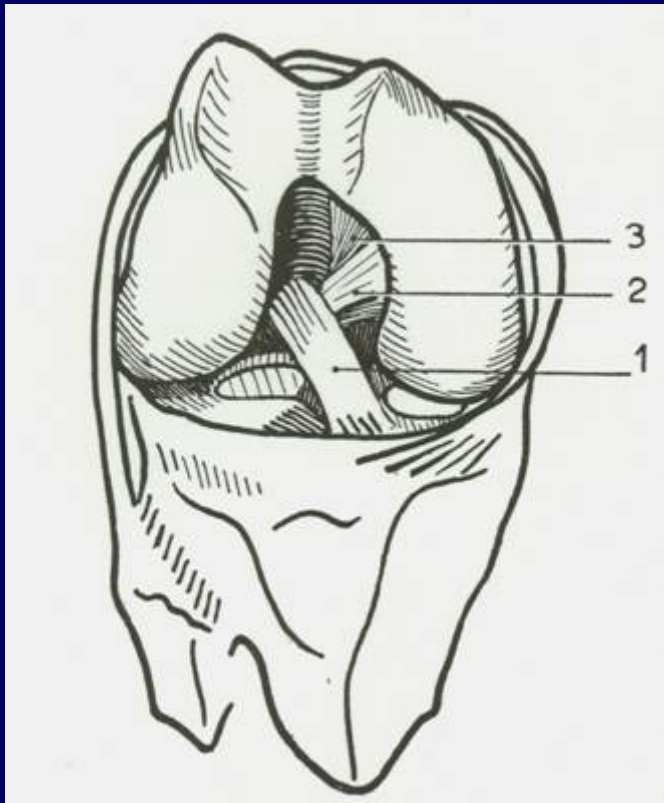


Ligamentous Restraints of Knee

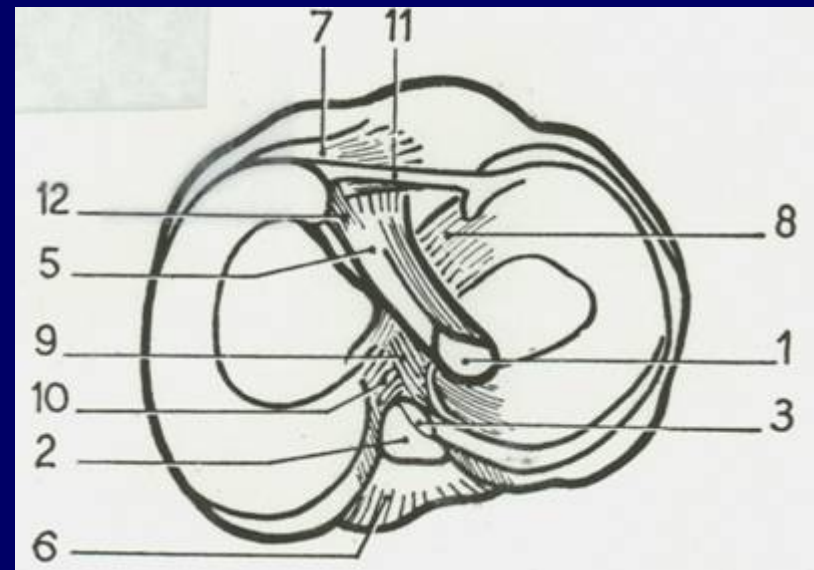
Lateral Collateral Ligament



Ligamentous Restraints of Knee

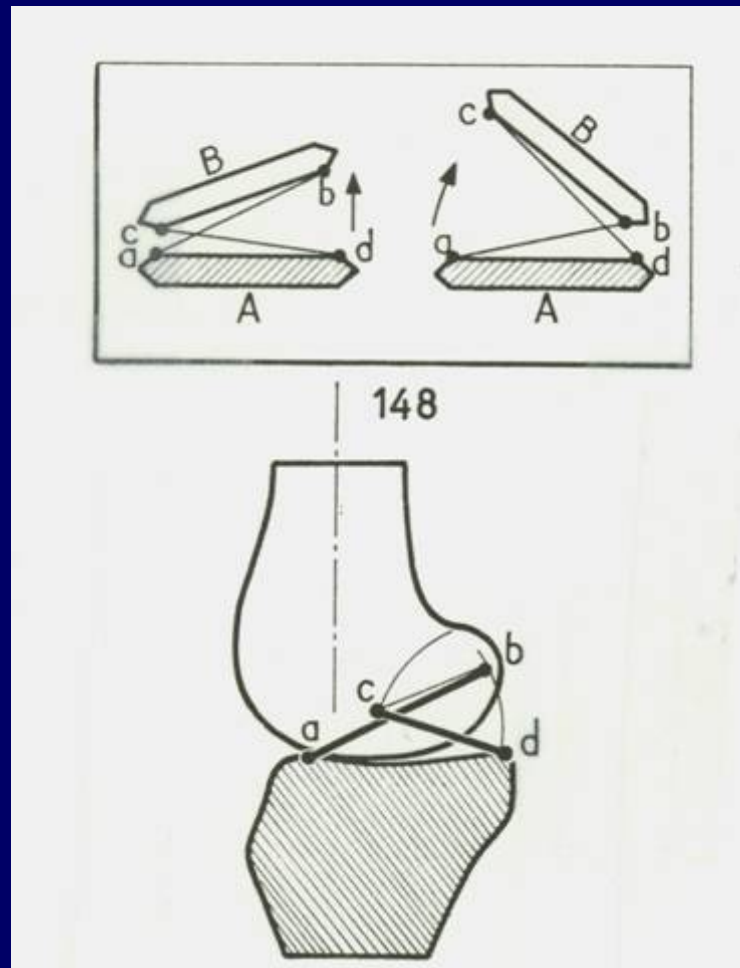


Cruciate Ligaments



Cruciate Ligaments

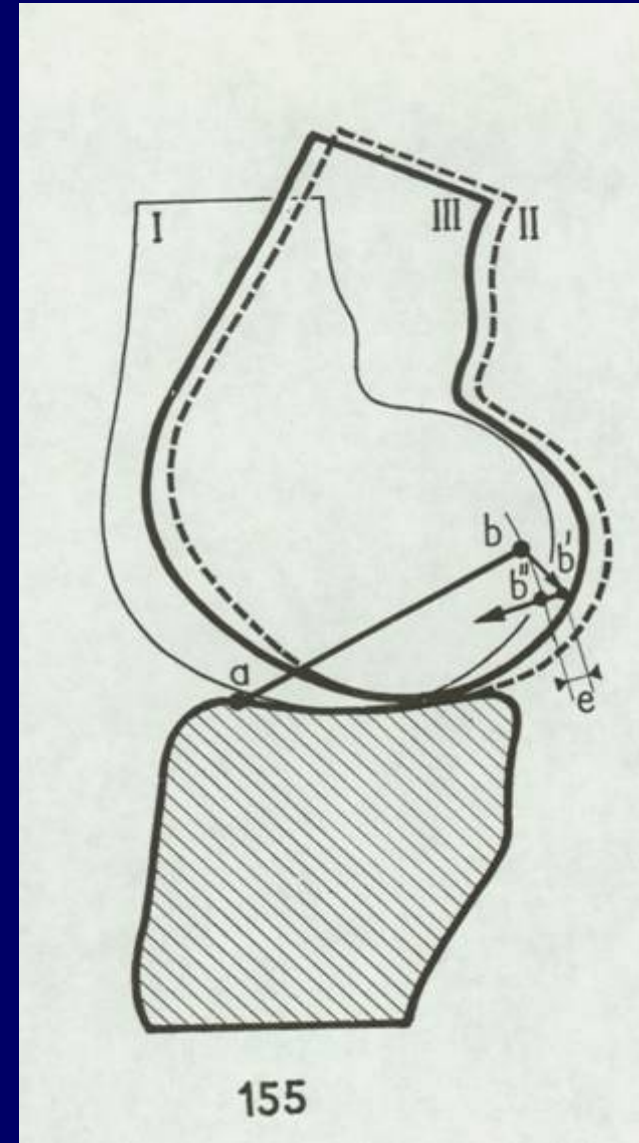
4 - Bar Linkage System



Arthrokinematics of Knee

Flexion

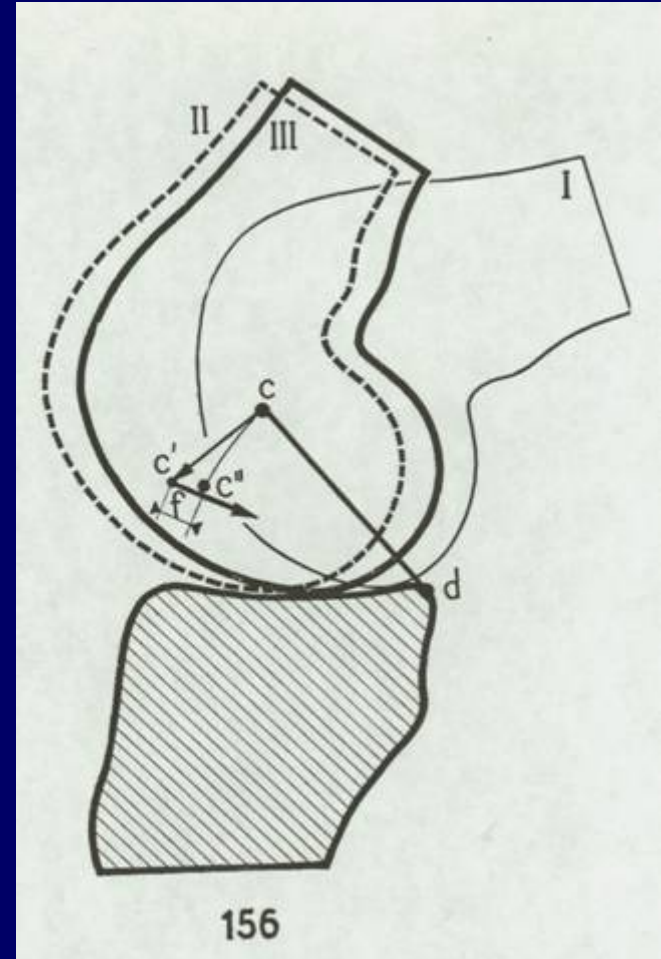
- ACL slides femoral condyles anteriorly as femur rolls posteriorly



Arthrokinematics of Knee

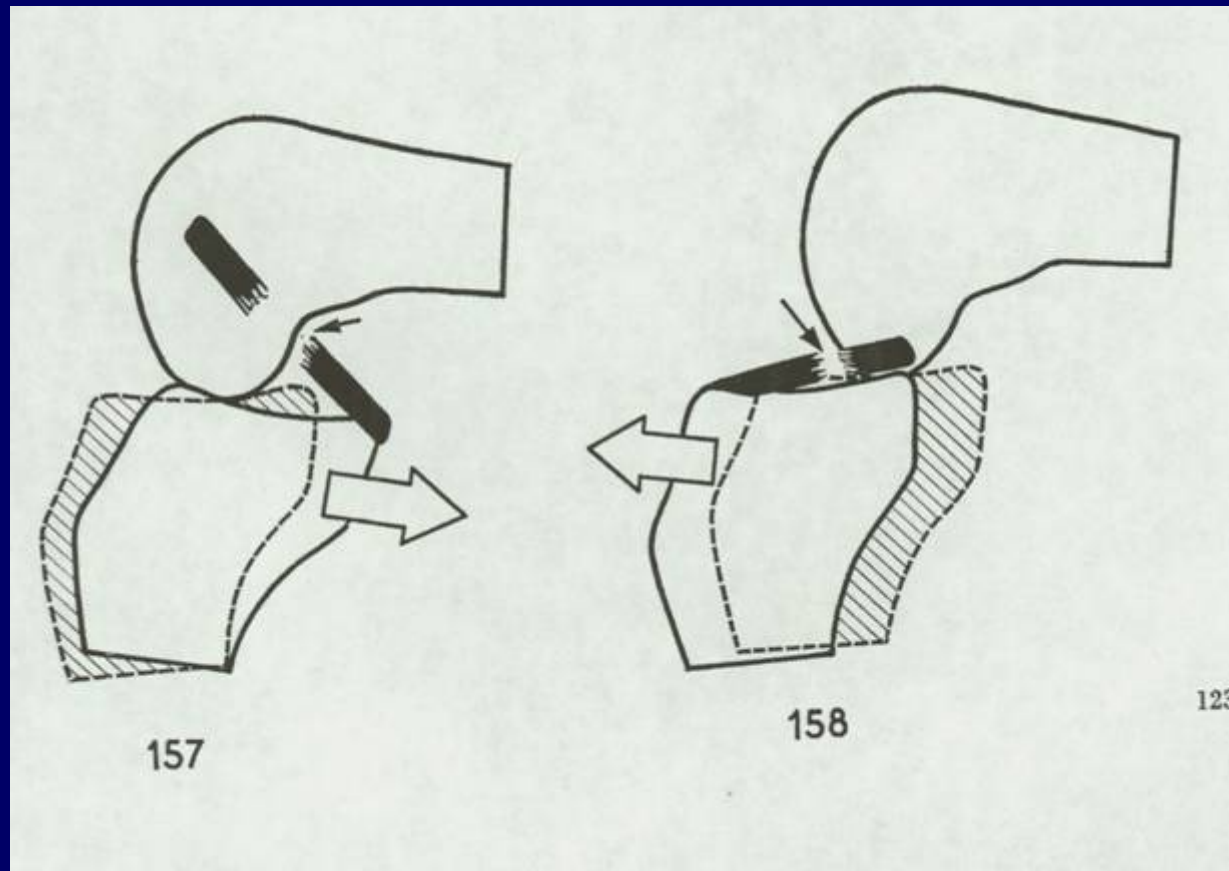
Extension

- PCL pulls femoral condyles posteriorly as femur rolls anteriorly



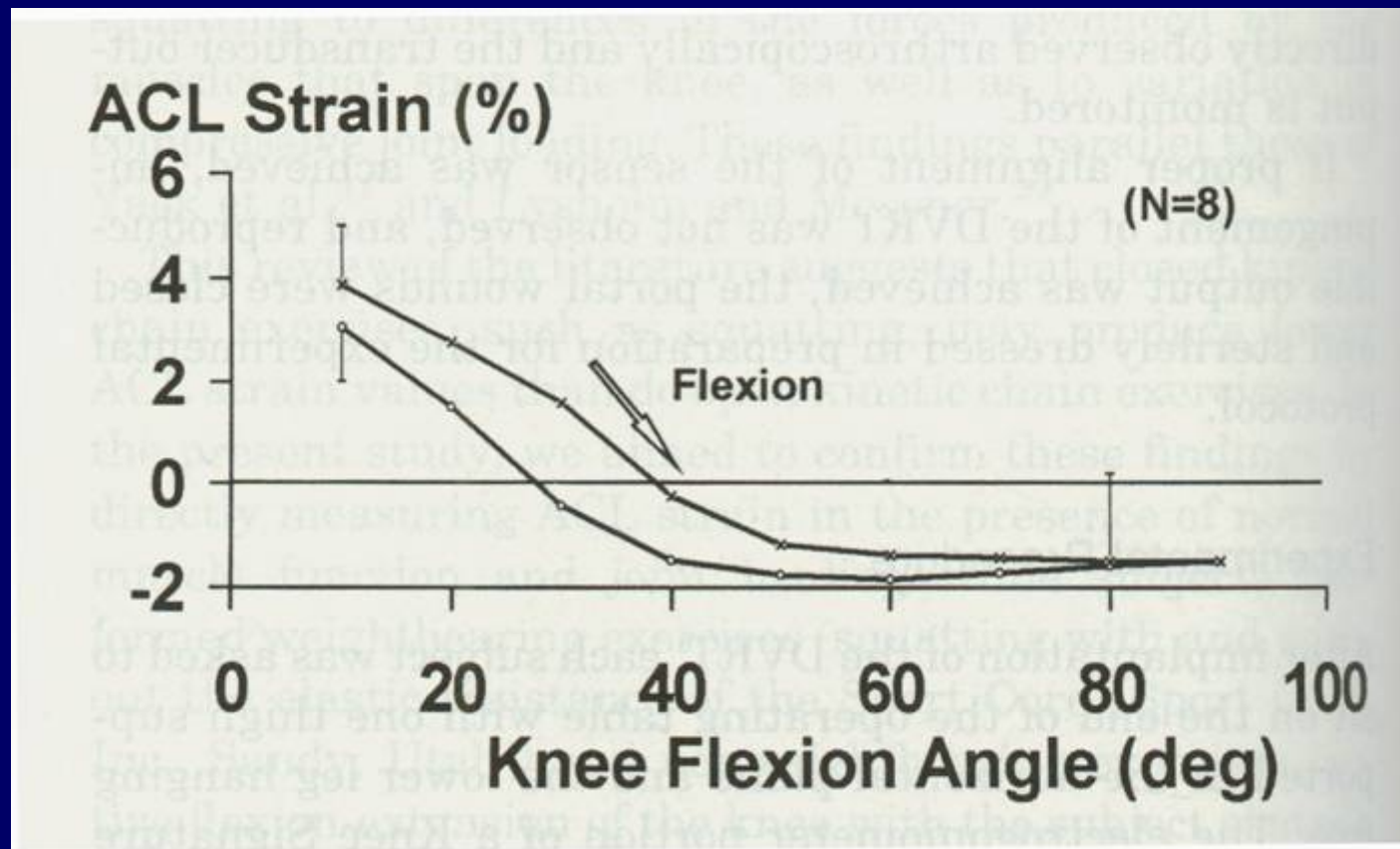
Cruciate Ligament Injury

Results in Abnormal Kinematics



ACL Strain

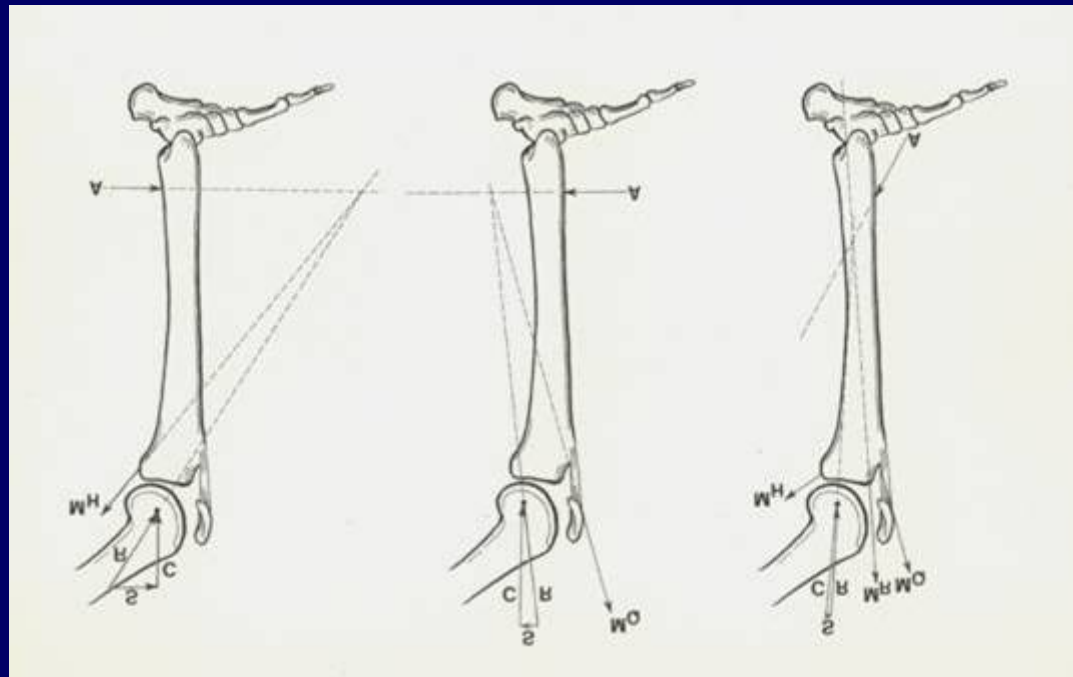
Open Chain Knee Extension



Closed Chain Exercise

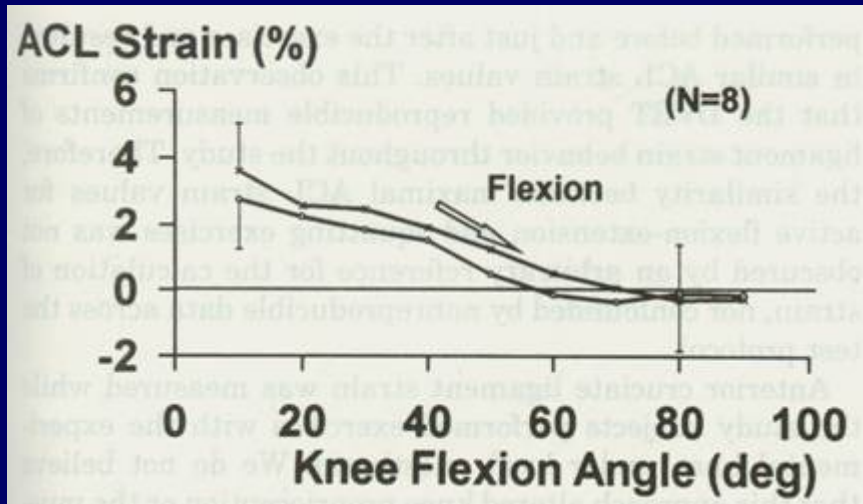
ACL Strain Reduced

- Joint compression
- Hamstring co-contraction
- Angle of force application

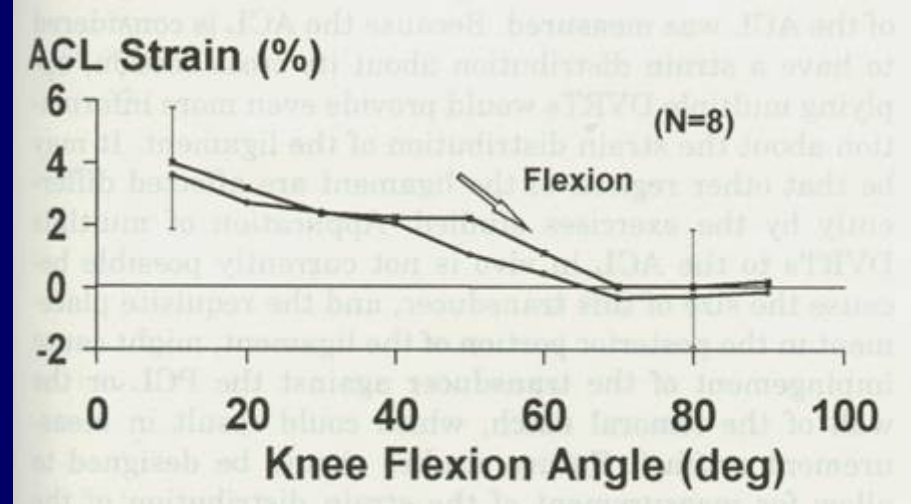


ACL Strain

In-vivo Studies



Active Squat

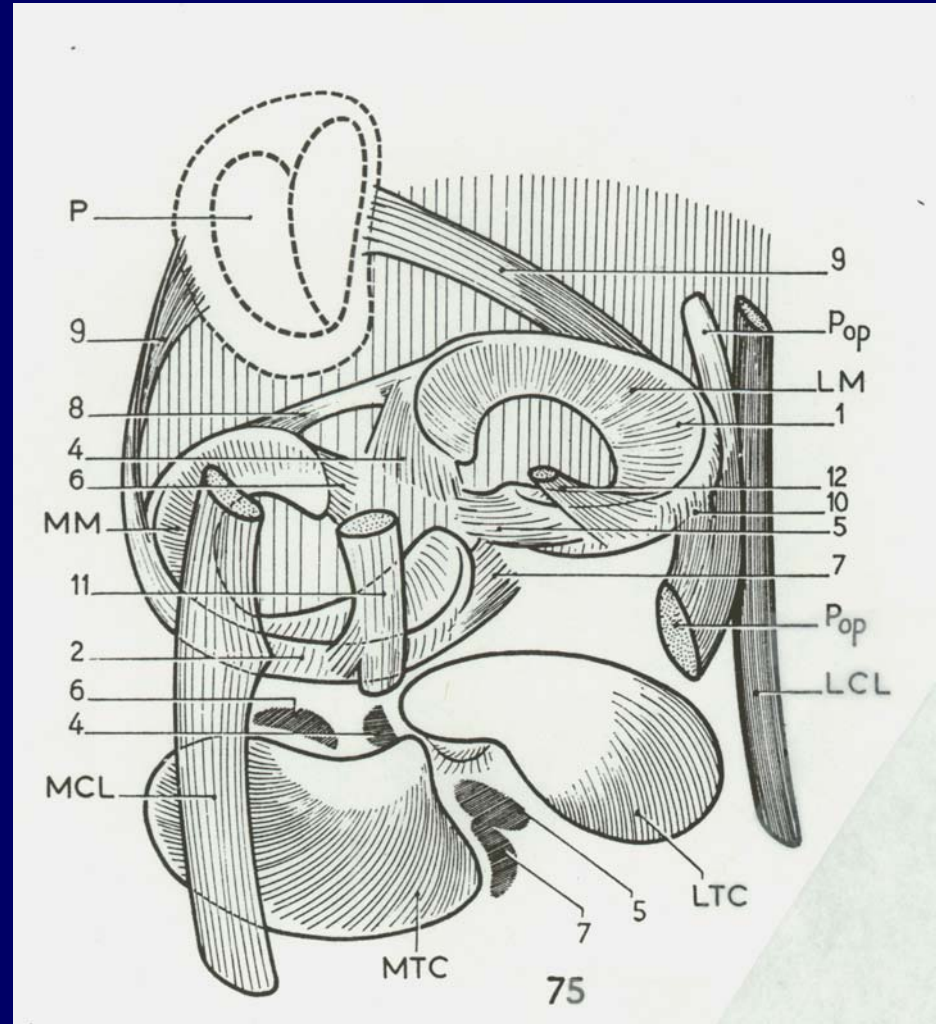


Squat with Sport Cord

Meniscii

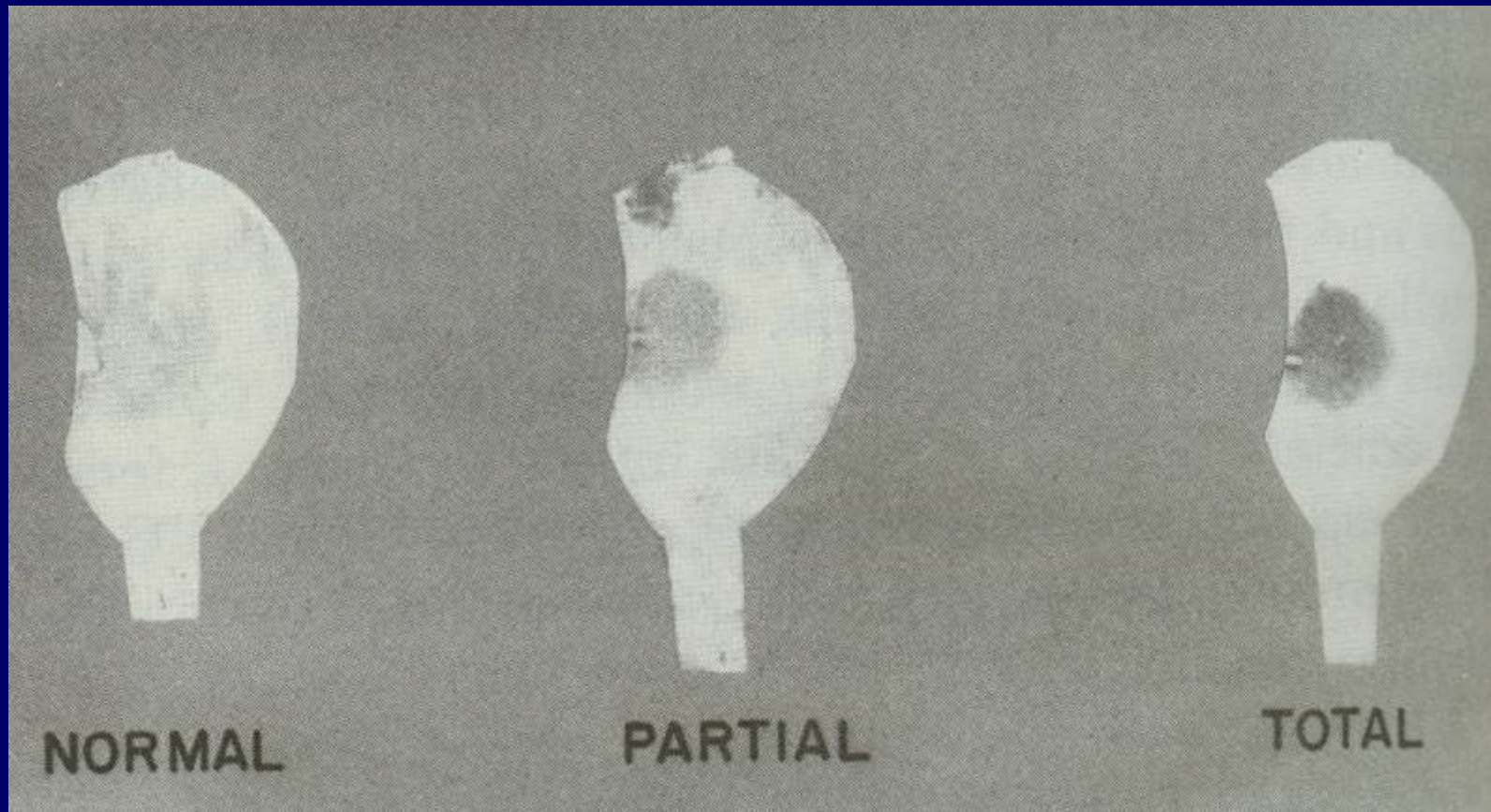
Function

- Absorb shock
- Distribute weightbearing
- Provide stability
- Aid in lubrication



Meniscii

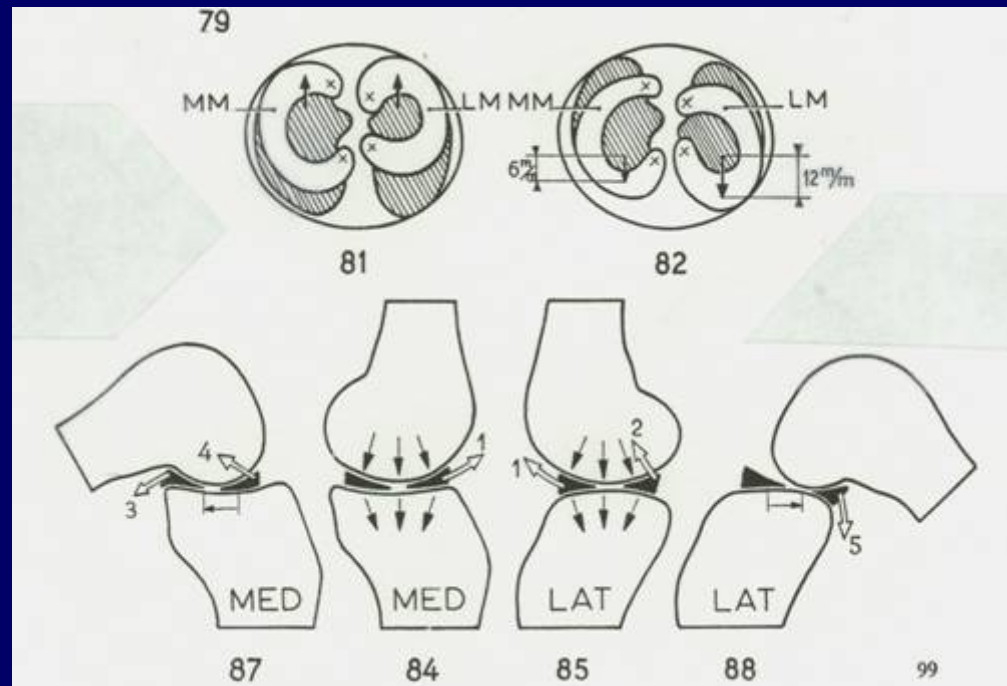
Load Bearing Function



Meniscii

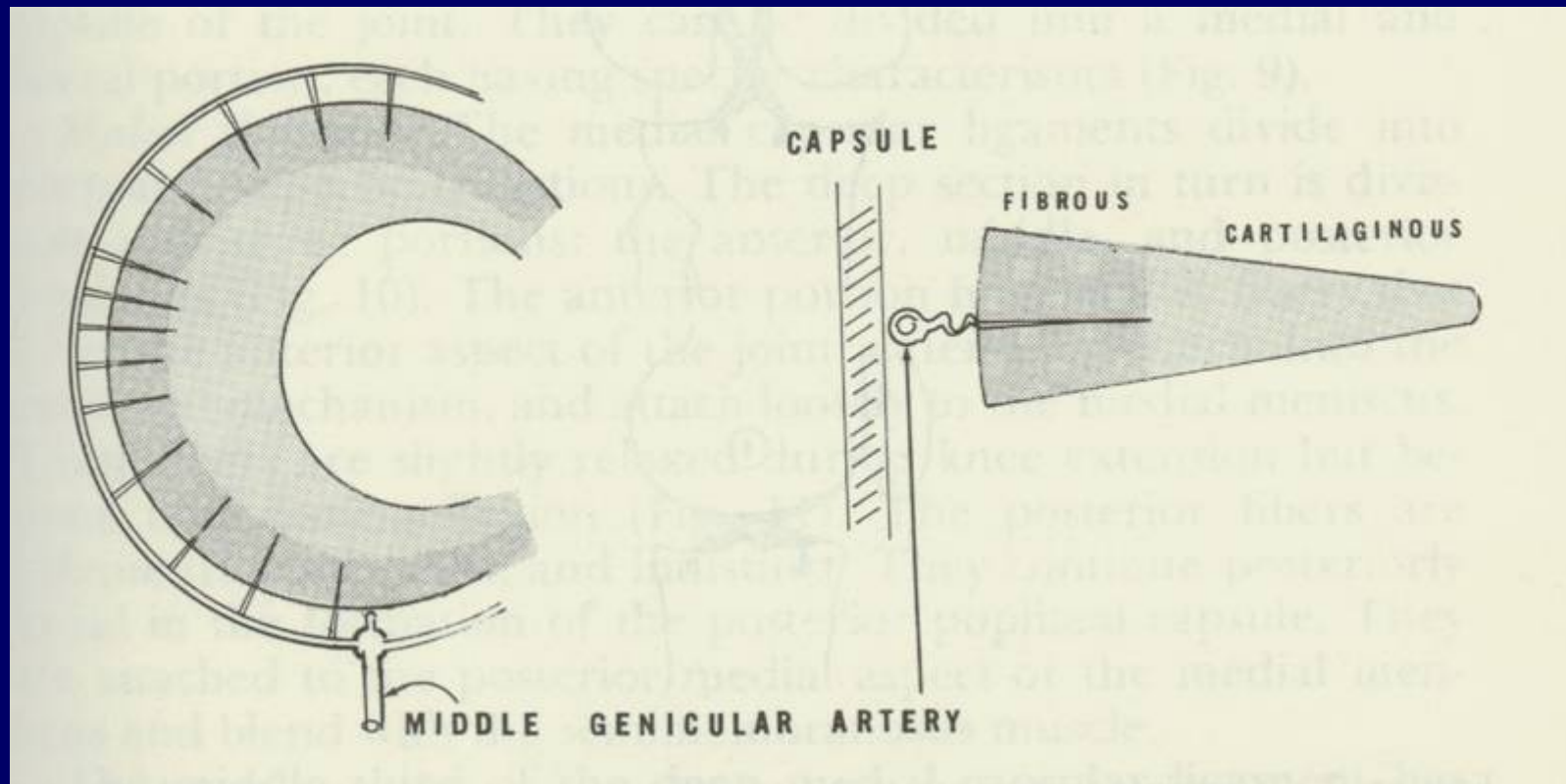
Motion

- Glide anteriorly with extension
- Glide posteriorly with flexion



Mensicii

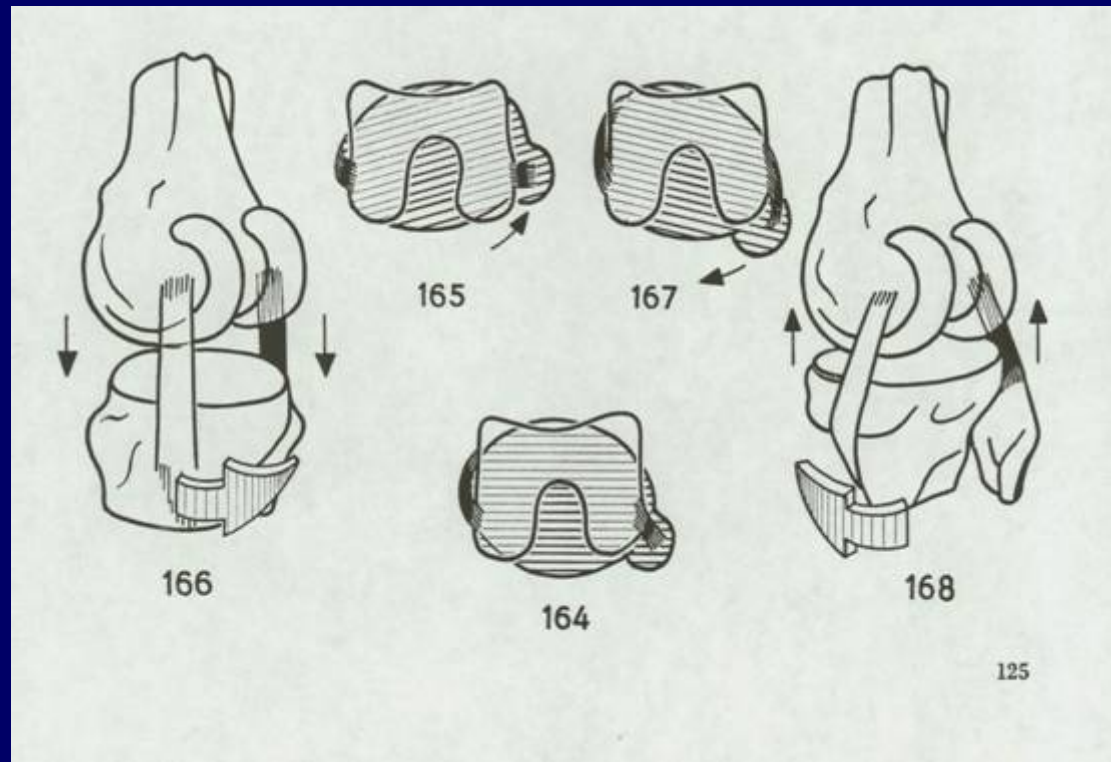
Microvasculature



Restraints to Rotation

External Rotation

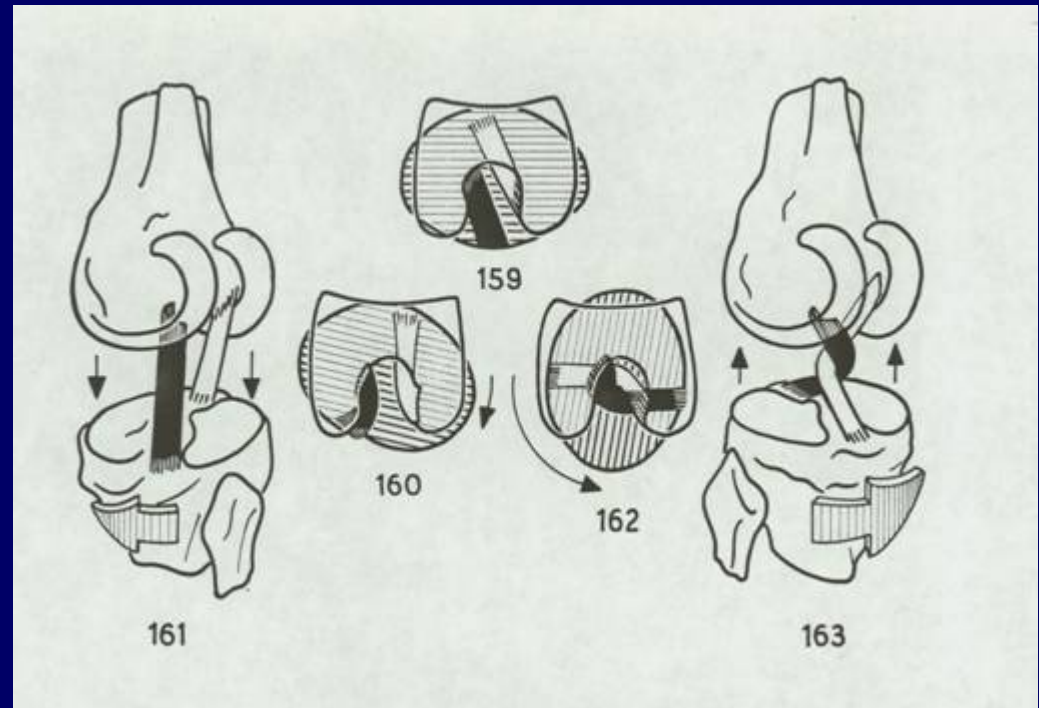
- MCL
- LCL



Restraints to Rotation

Internal Rotation

- ACL
- PCL
- Meniscofemoral ligaments



Dynamic Motion Control

