

1.) **TERMINOLOGY**

- * *Terrible Triad (O'Donahue's)* – ACL, Medial collateral ligament and meniscus
- * *Macrotrauma* – one crushing blow or incident
- * *Microtrauma* – repetitive, cumulative insults repeated hundreds or 1000's of times (obesity, running, repetitive motion injuries)
- * *The Closed Kinetic Chain* –
- * *How pronation affects the knee* –
- * *Lateral tracking problems* –
- * *Apprehension Sign* – an ortho test for patellar dislocation
- * *Genu valgus* – knock-kneed
- * *Genu varus* – bowlegged
- * *Genu recurvatum* – hyperextension of the knee
- * *Screw Home mechanism* – a function of external rotation of the tibia when the knee is brought into extension. This occurs when the foot is about to have Heel strike with ground. The foot and knee externally rotate and are in locked position.

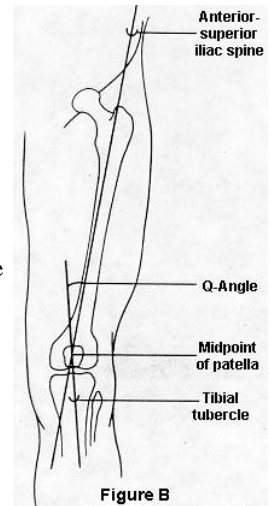
2.) **ABC'S OF THE KNEE:**

a) *Alignment of knee*

- Knee is hinge joint but has 3 secondary motions which are:
 - flexion/extension
 - abduction/adduction
 - internal/external rotation
- Three translations also occur and they are:
 - compression/distraction
 - medial/lateral translation (femur moves med-lat on tibial plateau)
 - Anterior/posterior translation

b) *The Q Angle:*

- Angle formed by the intersection of a line drawn through the tibial tuberosity to the midline of the patella and from the ASIS to the midline of the patella
- In males it averages 10-15° and in females it averages 15-20°
- Females more prone to lateral tracking problems
- Excessive Q angle can be caused by:
 - At the hip – wider pelvis
 - At the knee – genu valgus
 - At the foot – flat feet, pathologically pronated



c) *Bony structure of knee:*

- * Two largest levers in the body come together at the knee (tibia and femur)
- * Made up of 4 bones – femur, tibia, fibula, and patella (largest sesmoid bone in the body)
- * Largest joint in body

3.) **CARTILAGE AND LIGAMENTS:**

- Many injuries are due to cartilage (menisci) or supporting ligaments of knee
- May be due to macro/micro trauma
- Medial meniscus
 - * bears 80% of ground contact weight
 - * 4 meniscal functions include:
 - knee stabilization
 - shock absorption
 - lubrication
 - mobile buffering
 - load bearing
 - * pivot point for internal and external rotation of normal gait (note wear and tear)
 - * anchored to capsule predisposing greater tearing
- Lateral collateral ligament –
- Medial collateral ligament –
- Anterior cruciate ligament (ACL) –
- Posterior cruciate ligament (PCL) – strongest ligament in the knee
- Vastus Medialis Obliques (VMO) – most important m. in the knee, first to show weakness with dysfunction, only m. on medial knee



4.) **COMMON KNEE INJURIES:**

- C** – causes or mechanism of injury
- P** – pathognomonic sign or characteristic feature of injury
- T** – treatments

a) *Meniscal Tears:*

- C** – twisting action of knee, foot planted, knee flexed
- P** – “knee locks”, knee unstable, +McMurray's sign
- T** – depends on extent of injury, arthroscopic surgery

b) *Ligament Sprain/tears:*

- C** – force, slip, fall or tackle (ex: overweight, stumbling down stairs)

P – + varus/valgus sign

T – strengthen quad, nutritional support (glucosamine sulfate, Vit C)

c) *Osgoode-Schlatter's Disease:*

C – traction injury, avulsion of tibial apophysis, adolescent male 10-15 years old, due to rapid growth

P – pain at tibial tubercle & Pt. can't kneel down or flex knee

T – epsom salts, flexion program, rest and chiropractic

d) *Ilio-tibial Band Friction Syndrome:*

C – IT sliding over the greater trochanter

P – pain running & walking upstairs

T – stretching of IT band

e) *Pes Anseri Bursitis:*

- pes anseri made up of sartorius, gracilis, semi-tendinosus

C – overstrain hamstrings

P – pain on medial knee

T – ice, rest

f) *Osteoarthritis (DJD):*

C – macro/micro trauma and cortisone may contribute to it

P – morning stiffness, decreased joint space on radiograph & joint sclerosing

T – chiropractic (↑ ROM & circulation), limit wt. bearing, glucosamine sulfate, hydrate, peanut oil on joint

g) *ACL Injury:*

C – quick deceleration with turning/landing off balance, aggravated by ↑ Q angle (div. I female basketball players)

P – pops, snaps, hemarthrosis (blood in joint), effusion, knee gives out, & + AP DRAW Sign

T – surgical referral

h) *Chondromalacia Patella:*

C – degeneration of the articular cartilage on posterior patellar surface due to increased forces or abnormal tracking problems

P – “pain in the knee”, “garbage can diagnosis”

T – knee sleeve, strengthen quads after pain eases

i) *Lateral Tracking Problem:*

C – weak vastus medialis, increased Q angle, pathological pronation, increased valgus at knee

P – pain along lateral patellar border, frank dislocation, + patellar scrape test, + apprehension test

T – strengthen quads (last 15° of knee extension) , pelvic adjustments & ↑ proprioception

5.) **CLINICAL PEARLS:**

Women in NCAA division I basketball are 8 times more likely to sustain ACL injuries than men, occurs in 10% of women

The body attempts to correct chronic chondromalacia patella by tightening the medial and lateral hamstrings

The loss of 10-15 pounds by a patient can decrease knee symptoms

Vastus medialis strengthening leads to 90% success rate in treating patello-femoral problems

WEEK 2: HIPPRONEL

1.) **TERMINOLOGY:**

* *acronym* – word formed from the initial letters of a name, or by combining initial letters or parts of a series of words

* *acrostic* – a poem or series of lines in which certain letters, usually the first in each line, form a name, motto, or message when read in sequence

* *ecchymosis* – a purplish patch caused by extravasation of blood into the skin

* *stereognosis* – ability to recognize objects in the hand with eyes closed

* *graphesthesia* – ability to recognize symbols that are traced out on the skin without seeing them

* *two point discrimination* – ability to determine two pointed objects touching skin on one area

* *painful arc* – occurs during active motion; a portion of ROM has pain occurrence. May be due to tendonitis or bursitis

* *clinical judgment* – exercise of the clinician's experience and knowledge in diagnosing & treating patients

* *orthopedic test* – test involving the locomotor structures of the body

2.) **HIPPRONEL**

a) *Chief Complaint:*

- this patient's problem stated in patient's words

- be prepared to LISTEN

- frequency and duration should also be addressed

b) *History:* (pertinent details regarding the chief complaint)

- location:

- Point – right to the spot, usually indicative of torn muscle tissue (ex: plantar fasciitis)

- Trace – usually a nerve problem

- Circle – more vague muscular type pain (ex: trigger point)

- mechanism of injury:

- What caused the problem?
- Repetitive Motion Injury (RMI)
- Unknown causes to the patient- insidious onset, often seasonal changes patients don't think about
- Macro trauma such as car accident
- Obesity (60% Americans are obese) - microtrauma
- Microtrauma such as jogging, assembly line worker, etc.
- nature of pain:
 - hot/cold ($\uparrow\downarrow$ blood flow) - throbbing (vascular)
 - intermittent (varies t/out day) - constant (chronic pain)
 - burning (lactic acid pain) - stiffness (osteoarthritis)
 - dull/ache (musculoskeletal, most common)
- onset of pain
 - When did the problem start? (for MVA get exact date/time for court case)
- palliative/provocative:
 - What makes the condition better... what makes it worse?
 - postural (standing, sitting, antalgic lean)
 - TX received (hot/cold $\downarrow\uparrow$ symptoms)
 - time of day (morning stiffness, night pain could be cancer)
 - movements (ROM; muscles, bursa)
 - medication (do not adjust if on coumadin)
- quality of pain:
 - numbness & tingling & sharp pain (nerve) - dull (muscle/tendon)
 - electric like (root of nerve) - burning (metabolic imbalance, lactic acid)
- region/radiation of pain:
 - trace pattern of pain (i.e. dermatome)
- severity of pain may use the following scales:
 - Owesstry – large question exam, points are totaled
 - 1-4 & 1-10 point scale for pain
 - visual analog scale that is 100 mm long
- time:
 - wake up – osteoarthritis
 - bedtime – cancer, physiology slows
 - sleep – trigger points
 - before activity - during activity - after activity

c) *Inspection:*

DASED

- discoloration - abrasions - scars - edema - deformities

MALT

- malpositions - anomalies - landmarks - tenderness

d) *Palpation:*

- use any or all of the following methods at your disposal:
 - static - motion (POMP, gait) - surface (surface creases) - deep (abdominal insp)
 - ballotment (press into abdomen & spring out – appendicitis test)

e) *Percussion:* (sound air > fluid > solid mass)

- the following sounds may be heard:
 - tympanic (gastric air bubble) - resonance (healthy lungs)
 - dull (liver) - flat (muscle)

f) *Range of Motion (ROM):*

- observe bilateral symmetry for equal motion
- carry out Active ROM first and if painful indicates muscular or tendon problem
- carry out Passive Rom and if painful indicates joint or ligament problem
- painful arcs are areas of impingement

* endfeels defined:

- | | |
|----------------------|---------------------------------|
| bone to bone | → elbow extension |
| spasm | → hypertonic muscle |
| capsular | → shoulder in external rotation |
| springy block | → internal joint derangement |
| tissue approximation | → arm flexion |
| empty feel | → joint ligamentous laxity |

g) *Orthopedic Tests:*

- these tests are provocative in nature and stress bones, joints, ligaments, cartilage and tendons in an area of focus

- orthopedic testing underscores the importance of knowing the anatomy in a particular area
- * Fabare-Patrick
 - Fabare means – flexion, abduction, external rotation
- * Straight Leg Raise (SLR) could indicate the following:
 - tight hamstring will give pain in back of leg
 - disc herniations will give pain in low back and toes
- * Differential Tests – most useful orthopedic tests, test more than one things at once

h) Neurological Testing: (MSR's – muscle reflex sensory)

- variety of tests to determine neurological integrity
- * muscle tests (Wexler scale 0-5)
 - 5 full ROM against gravity and resistance
 - 4 full ROM against gravity with some resistance
 - 3 full ROM against gravity
 - 2 full ROM with gravity eliminated
 - 1 evidence of slight contractility
 - 0 no evidence of contractility
- * reflexes (DTR – deep tendon reflexes)
 - +0 no response
 - +1 sluggish
 - +2 normal
 - +3 hyperactive
 - +4 hyperactive, intermittent or transient clonus
- other reflexes are:
 - cranial nerve reflexes
 - primitive – Moro Startle, Palmar/plantar grasp
 - Superficial – spinal levels T7-L2
 - Babinski – pyramidal tract lesion
- * sensory tests are done to assess dermatomes affected and include the following:
 - superficial touch/pain, temperature/pressure, vibration, position sense
 - cortical sensory function
 - Stereognosis – ability to identify an object by touch or manipulation. Lack indicates parietal lobe lesion
 - Two point discrimination – ability to distinguish between two points
 - Tongue/finger tip – least distance 1-7 mm
 - Back/upper arms/thighs – greatest 40-75 mm
 - Graphesthesia – draw letter/number on body part

i) Exams:

- anatomically may include x-rays (moment in time), computerized tomography (CT scan) & MRI (soft tissue)
- physiologic may include somatosensory evoked potentials (SSEP, peripheral nerve exam), nerve conduction velocity/electromyography (NCV/EMG) and thermography

j) Labs:

- complete blood cell count (CBC), blood chemistry, urine analysis, prostate specific antigen (PSA)

3.) CLINICAL PEARLS

Smoking one pack of cigarettes a day produces the equivalent stress on the heart as being 80 pounds overweight
 Medical diagnosis is said to be accurate 65% of the time

WEEK 3 THE HIP

1.) TERMINOLOGY:

- * coxa vara – distal femur toward midline, knock-kneed
- * coxa valga – distal femur away from midline, bow-legged
- * the closed kinetic chain – review picture
- * femoral anteversion causes foot to Toe In
- * femoral retroversion causes foot to Toe out

2.) HIP FACTS:

- hip is necessary for gait, weight bearing and general activities
- must withstand the forces of weight bearing (3-22x body weight)
 - stress of standing on hip is 1/3 of body weight
 - stress of standing on one leg is 2.5x body weight
 - walking produces a stress of 2.5-4x body weight
 - running produces a stress of 4-7x body weight
 - sprinting and jumping produces stresses of 10-22x body weight

- use of a cone reduces stress on the hip of to 40%
- must withstand the forces of muscular contraction
 - in sprinting the quad moves 0mph-100mph-0mph 2.25x per second
- one of the largest joints in the body
 - hip is more prone to bone/joint damage, shoulder is more prone to soft tissue injury
- disorders of the hip are more age-related than any other joint
 - infant – congenital (hip dysplasia)
 - adolescent – growth plate injury (slipped capital femoral epiphysis)
 - young adult – trauma

Functional Anatomy:

- acetabulum is formed from the ischium, pubic and ilium bones
- the head of the femur is 2/3 of a sphere
- the rim of the acetabulum is protected by fibrocartilage (labrum)
 - protects the acetabulum from forceful movements
 - deepens acetabulum making dislocation more difficult
 - stretch of the glut medius may be painful in geriatric patients with DJD of hip joint – superior and lateral pain
- hyaline cartilage and fatty tissue surround the acetabulum (female triad)

Trabecular Patterns (little beams):

- tension trabeculae are medial to lateral
 - run from femoral head to the trochanteric line (NB These lines are reabsorbed with aging, corticosteroid use, smoking & diet and may lead to femoral neck fractures)
- compression trabeculae are inferior to superior
 - run from lesser trochanter to femoral head
 - more inferior

NB The epiphyseal plates are at right angles to the tension trabeculae predisposing them to ground reaction forces and epiphyseal plate fractures (Salter Harris Fractures) or a slipped capital femoral epiphysis

3.) HIP ANGLES:*a) Range of Motion:*

- Flexion 120° • Extension 30°
- Abduction 45° • Adduction 45°
- Internal rotation 40° • External rotation 45°

b) Angles of Inclination:

- angle formed between femoral neck and shaft of femur
- normal range is 90-125°
- > 125° coxa valga (↑ leg length, axial loading femoral head, foot pronation, ↓ abduction force of muscles)
- < 125° coxa vara (↓ leg length, ↑ shear forces on femoral head – Salter Harris fracture)

c) Angulation of Femoral Head (Version)

- normal angulation is 12-25°
- an anterior or posterior position of the neck of the femur with respect to the long axis of the shaft of the femur (or increased internal or external rotation of femoral shaft with relation to the femoral neck)
- anteversion > 25°
 - will see toe in, valgus at knee, foot pronation
- retroversion < 12°
 - will see toe out, foot supination

d) Open Pack Position of the Hip:

- 30° flexion, 30° Abduction, 5° external rotation

e) Closed Pack Position of the Hip:

- full extension, Abduction & internal rotation

4.) LIGAMENTS:

* There are 4 supporting ligaments of the Hip

- *joint capsule* – cylindrical from acetabulum to femoral neck (4 types fibers: longitudinal, oblique, circular, arcuate)
- *iliofemoral ligament (Y)* – strongest ligament in the body, limits extension, found anterior and superior
- *ischiofemoral ligament* – limits excessive medial rotation, abduction and some extension. (adjusted with internal rotation)
- *pubofemoral ligament* – limits excessive abduction, lateral rotation & some extension (tested with sign of 4)

NB Mennel felt that ext. was the first/most common motion lost at the hip (note ligaments) and leads to flexion contracture or vice versa
Role of the psoas

Body weakness at the thoraco-lumbar junction

* Two functional ligaments:

- *ligamentum teres* – assists in joint lubrication
- *transverse* – converts acetabular notch into foramen for femoral head anatomy

5.) **BURSA:**

* there are 3 bursa:

- *iliopectineal* – painful with flexion, adduction, & excessive extension
- *trochanteric* – below glut medius/maximus tendon or tight ilio-tibial band, painful running and walking upstairs
- *ischiogluteal* – between ischial tuberosity and hamstrings, painful with sitting

6.) **MUSCLES:**Flexors

Iliopsoas
Rectus femoris
Glut minimus/medius
TFL
Pectineus
Adductor brevis/longus/magnus
Gracilis
Sartorius

Adductors

Glut max
Obturator externus
Quadratus femoris
Gracilis
Biceps femoris – long head
Semitendinosus
Semimembranosus

Extensors

Glut max – maximal power at 90° hip flexion
Hamstrings (semimembranosus, semitendinosus, biceps femoris – 2 joint muscle)
Adductor magnus (ischial portion)

Abductors

Glut medius
Glut minimus
Piriformis
Sartorius
TFL

External rotators

Glut max
Quad femoris

Internal rotators

Glut medius, minimus
(sprinters exhaust glut max as primary stabilizer and ER's take over)

Strongest movements of the hip: extension, external rotation, adduction

7.) **CLINICAL CONDITIONS:**a) *DJD:*

C – micro trauma, overuse, metabolic

P – deep aching pain, gait abnormalities – ER, minimal flexion and abduction, glut stretch leads to pain in the joint due to compression superior and lateral

T – long axis traction, glucosamine sulfate, goal of maintenance

b) *Snapping Hip Syndrome:*

• IT band snaps back & forth

C – inflamed trochanteric bursa due to glut max/med pressure

P – pain at greater trochanter with movement

T – stretch IT band, neurolympahtic point mid IT band

c) *Piriformis Syndrome:*

C – excessive sitting, sleeping position, sacral subluxation, female problem

P – pain with palpation (sciatic type)

T – trigger point therapy, stretch hip (flex, adduct, IR), diversified adjustment of sacrum, sleep with body pillow

d) *Quadriceps Angle:*

C – genetic > 15° leads to lateral tracking at knee, long-term problems (ACL?)

P – visual inspection & measurement

T – ↑ proprioception, strengthen quads, adjust pelvis

e) *Acetabulum Protrusio:*

C – female triad (osteoporosis, ammenorrhea, anorexia), metabolic

P – hip pain, x-ray findings

T – maintenance, nutritional counseling, lifestyle changes, long-term hip replacement

f) *Avascular Necrosis of Femur:*

C – death of a portion of the bone due to severance of lateral and medial circumflex arteries

P – pain with walking leading to knee pain

T – referral

g) *Dislocation:*

C – trauma, leg planter, hip dislocated posterior and superior (shoulder anterior and inferior)

P – flexed, IR, position, said to be most painful dislocation/fracture

T – referral

h) *Osteoporosis*

- C – aging, diet, drugs, exercise
- P – radiographic, pencil thin cortices
- T – calcium citrate, glucosamine sulfate, weight bearing exercises, water exercises

i) *Meralgia Paresthetica*:

- C – mechanical compression of lateral femoral cutaneous n. by inguinal lig. due to beer belly, excessive sitting, tight clothing
- P – lateral thigh pain
- T – pelvic adjustment, lose weight

j) *maigne's syndrome*: • occurs at thoracolumbar jct. with radiating pain in & around hips (tall people)

8.) **CLINICAL PEARLS**

10-20% of people who suffer hip fractures die within one year

Sciatic pain should increase with internal rotation and decrease with external rotation

Pneumonics for the hip muscle innervation: abduction – “5 on the side”, extension – “S1 on the bun”, adduction – “2,3,4 obturator close the door”, flexion – “1,2,3 lift the knee”

WEEK 4 BIOMECHANICS AND LISTING SYSTEMS

1.) **MECHANICS:**

- the study of forces and their effects

2.) **BIOMECHANICS:**

- application of mechanical laws to living structures
- bones form levers; joints form hinges; muscles and ligaments react to gravity/external forces
- concept evolved out of Industrial Revolution, mechanistic view of the world, “(wo)man as machine”

3.) **MOTION:**

- continuous changes in the position of an object
- in human joints there is the potential for 6 planes of motion
 - 3 rotation
 - 3 translation
- planes
 - Rotation (tilt) – around an axis (a line or point), theta x,y,z, use “right hand rule”, fingers point to a positive
 - Translation – (glide or slide) – straight path or linear motion along an axis
 - Curvilinear – most common joint movement, combination of rotation and translation, the body follows a circular path or rotates around a point or line

4.) **KINEMATICS:**

- the study of the visual appearance of motion
- movement of the center of mass, flight paths, velocities, accelerations

5.) **KINETICS:**

- study of force
- includes ground reaction forces, magnitude and direction
 - a. anatomical neutral
 - b. compression
 - c. distraction (tension)
 - d. shearing
 - e. lateral bending on one side, distracting on the opposite
 - f. torque or counter rotation
- Power – mass x angular velocity (measured in degrees/second)
 - motor vehicle crashes – 100,000 degrees/second – c. 1400 mph
 - muscle power is determined by cross sectional area, length/tension ratio, degree of fatigue, fiber type
- Contractions:
 - *Concentric contraction* is shortening of muscle creating acceleration (power generation)
 - *Eccentric contraction* is lengthening of muscle creating deceleration (power absorption)
 - *Isometric contraction* is no change in length, creating a stabilizing action, strengthens and stabilizes ligaments

6.) **ELASTIC ENERGY:**

- stretch reflex – enhances force production by 20% (rubber band example)
- elastic tissues include: muscles, tendons and other connective tissue, Golgi tendon organs; ratio of stretch of muscle to tendon is 20:1
- torque – a winding-unwinding (counter rotation possibly activated by the stretch reflex), seen with angular acceleration
- NCAA division I female basketball players

7.) **LEVER SYSTEMS:**

- three types, involve fulcrum (a joint), effort (muscle), resistance (weight)
- 1st class (see-saw): trapezius on skull
- 2nd class lever (wheel barrow): gastroc contraction
- 3rd class lever: brachialis on radius, least efficient

8.) **DYNAMIC STABILIZATION:**

- allows for fluid and balanced movements such as gait
- role and function of the gluteus medius in gait

9.) **ENDFEEL & JOINT PLAY:**

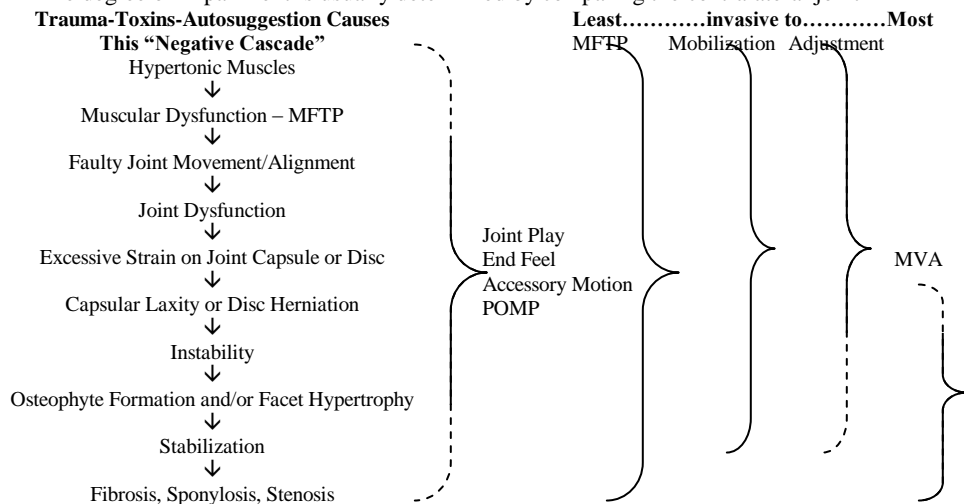
- There are two types of accessory motion joint challenges: joint play and end feel
- *Joint play* is the gapping or ability of joint to separate or gap open
- *Endfeel* is small elastic springiness at end of passive ROM (at the elastic barrier and into the paraphysiological space)
- *Accessory motion* includes endfeel and joint play
- *Total joint movement* equals voluntary ROM +/- end feel/joint play
- Voluntary movement depends on joint play/end feel
- BUT end feel/joint play cannot be produced or isolated by the action of voluntary movement. You cannot induce long axis distraction, for example, by will.
- Loss of end feel/joint play produces pain whenever that specific direction of end feel/joint play is tested. Manipulation restores the joint and the pain resolves.
- **Only an examiner can demonstrate the presence or absence of joint play or end feel**
- **Joint play/end feel can only be restored by a dynamic thrust given in the correct direction**

10.) **JOINT FUNCTION:**

- Normal muscle function is dependant on normal joint movement
- When a joint is not free to move the muscles that move the joint become dysfunctional
- Muscles cannot be restored to normal if the joints they move are not free to move
- Impaired muscle function started a “negative cascade: that perpetuates and can cause joint degeneration

11.) **JOINT DYSFUNCTION:**

- Defined by Mennel as the loss of joint play or end feel
- Can only be determined by clinical examination or sometimes x-rays or videofluroscopy
- Cannot be detected by static x-rays or lab tests
- If pain is elicited during performance of joint play or end feel that movement is impaired
- The degree of impairment is usually determined by comparing the contralateral joint



12.) **SPECIFIC APPLICATIONS TO THE LOWER EXTREMITY**

Hip – transverse stability is secured by simultaneous contraction of hip abductors and hip adductors

- position of symmetry
 - adductor dominance leads to lateral tilt
- What does this do to the knee? The foot? Genu valgus, hyperpronation, coxa varus

Knee – patello-femoral joint

- flexion – chondromalacia patella
- extension
- hyperextension – genu recurvatum
- hyperextension – lateral tracking of patella

Mortise joint (tibio-fibular with dome of talus)

Dorsiflexion/plantar flexion in one plane?

Notice where the angle is measured from

Subtalar joint (calcaneous and talus) a multiaxial joint

- anatomical neutral

- b. pitches forward
- c. turns on itself
- d. rolls tilting to one side
- e. pitch, roll and turn together

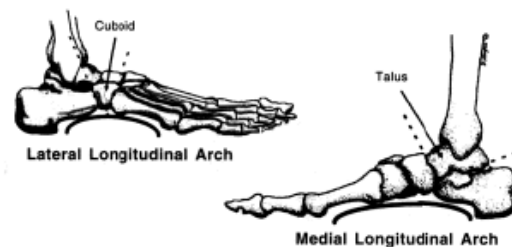
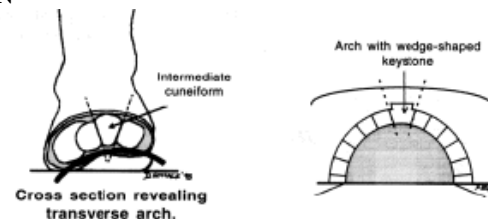
13.) CLINICAL PEARLS

- “I do not believe that osteoarthritis per se causes pain in joints. It is my belief that the commonest cause of pain in an osteoarthritis joint is joint dysfunction.” Mennel
- The prevalence of DJD in the body – Finger DIP > 1st MTP > Knee > Finger PIP > 1st MCP > Lumbosacral joint > Cervical Spine
- Strains become a chronic problem because they heal with inelastic scar tissue
- In gout pannus formation will cover the articular cartilage, depriving the cartilage of its nutrition and trapping the chronic inflammatory cells, like macrophages within the joint. The macrophages produce enzymes which breakdown the articular cartilage and erode bone, thereby destroying the joint.

WEEK 5 PRONATION & SUPINATION

1.) FOOT ARCHES:

- there are 3 recognized foot arches that we will deal with
- Medial Longitudinal Arch
 - 4 Keystone is the Talus (specifically the head)
 - 4 Supported by the Anterior and Posterior tibials, calcaneus, talus, navicular, 1st/2nd cuneiform & 1st/2nd metatarsals
- Lateral Longitudinal Arch
 - 4 Keystone is the Cuboid
 - 4 Supported by the calcaneus, cuboid & 4th/5th metatarsals
- Transverse Arch
 - 4 Keystone is the intermediate cuneiform
 - 4 Supported by the cuboid, 1st/2nd/3rd cuneiform & navicular



2.) MULTIAXIAL FOOT MOVEMENT:

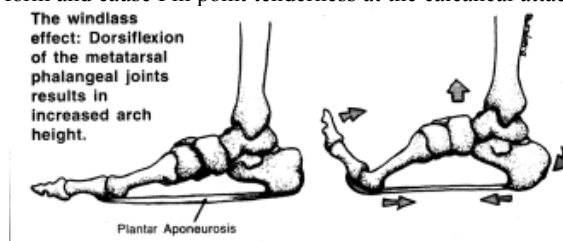
- Subtalar joint is saddle type of joint
- Head of Talus/navicular joint is like a ball and socket. • rotation here leads to PRONATION
- Pronation is composed of :
 - dorsiflexion
 - eversion
 - ABDuction
- Supination is composed of :
 - plantar flexion
 - inversion
 - ADDuction

3.) FOOT FACTS:

- ⊗ 85% of injuries are ankle sprains and 80% of these are plantar flexion inversion

4.) WINDLASS EFFECT:

- Dorsiflexion on “TOE OFF” and this tightens up the Plantar aponeurosis causing the Medial Longitudinal Arch to move Superior.
- If subluxated then “Heel Spurs” form and cause Pin point tenderness at the calcaneal attachment point.



5.) FOOT CONDITIONS RELATED TO PATHOLOGICAL PRONATION:

- a) *Pes Plannus* is plastic deformation of plantar calcaneal ligament due to drop of the talus
- b) *Plantar Fasciitis* is pinpoint pain at medial side of calcaneus and hurts more in the morning when getting out of bed because you stretch your aponeurosis.
- c) *Tarsal Tunnel Syndrome* is due to pathological pronation of the foot and the compression of the posterior tibial nerve as it passes under the Flexor retinaculum. Person may have heart condition or ankle edema.
- d) *Claw Toes* is when the extensors of large toe are compromised and big toe curls up like a claw.
- e) *Shin Splints* occur due to Posterior Tibial Tendon, Anterior Tendon or Soleus problems and possibly Fracture of Malleolus
- f) *Double crush* occurs when there is proximal lesion of the nerve (say tibial in popliteal fossa) and then symptoms are felt distally in the foot.

6.) ROLE OF THE FOOT:

- a) *Mobile Adaptor*: this occurs when foot is in midstance position (pronation)
- b) *Rigid Lever*: this occurs when the foot is in heel strike or toe off (supination)