# CHAPTER 7 THE KNEE

- I. Introduction:
  - A. After first aid of a knee injury, always refer to Dr.
  - B. Serious knee injuries can be prevented by strengthening the *quadriceps and hamstring* muscle groups.
- II. ANATOMY:
  - A. Bones
- 1. LARGEST and one of the WEAKEST joints in the body due to unstable bone structure.
  - a. Femur sits precariously on top of tibia
  - b. These 2 bones slide back and forth on each other.
  - c. There is a small amount of normal rotation by the femur on the tibia.
- 2. The distal end of the femur has 2 slightly CONVEX surfaces called *CONDYLS*, which articulate with slightly CONCAVE surfaces of the tibia.
- 3. Two other bones of the knee joint are FIBULA and PATELLA (knee cap).
- B. Ligaments (4).
  - 1. medial collateral (mcl)
  - 2. lateral collateral (lcl)
  - 3. anterior cruciate
  - 4. posterior cruciate
  - 1. MCL
    - a. broad and flat
    - b. helps secure the femur to the tibia
    - c. connects to the cartilage of the knee, the MEDIAL MENISCUS
  - 2. LCL
    - a. not as strong as the MCL.
    - b. Is cord-like
    - c. Doesn't attach to the lateral meniscus.
  - 3. Collateral ligaments assist in reducing valgus and varus (side to side movement) in the knee joint.
  - 4. Two cruciate ligaments: anterior and posterior, form an "X" in the center of the joint; cruciate comes from Latin word meaning cross.
    - a. They restrict anterior and posterior movement of the femur on the tibia.

# C. MUSCLES:

- 1. 12 muscles support the knee:
  - a. vastus medialis
  - b. vastus lateralis
  - c. vastus intermedius
  - d. rectus femoris
  - e. sartorius
  - f. gracilis
  - g. semitendinosis
  - h. semimembranosus
  - i. biceps femoris
  - j. popliteus
  - k. gastrocnemius
  - 1. plantaris
- 2. Most support comes from the large muscle groups of the thigh and the lower leg.

a. **QUADRICEPS-** on the anterior portion of the thigh.

- b. Comprised of:
  - 1. rectus femoris
  - 2. vastus medialis
  - 3. vastus lateralis
  - 4. vastus intermedius
- c. Extends (or straightens) the lower leg.
- d. Join together to form the *patellar tendon*.
  - 1. The tendon encases the patella and inserts on the front of the tibia, on the *tibial tubercle*.

e. The vastus medialis muscle is VITAL in patellar tracking.

- f. HAMSTRINGS- on posterior aspect of thigh
  - 1. Includes the:
    - a. semitendinosus
    - b. semimembranosus
    - c. biceps femoris (2)
  - 2. Flexes (or bends) the knee.
  - 3. Helps control rotary movements of the
- tibia
- 4. Called the NATURAL KNEE BRACE
- 5. Originates on the pelvis and femur.

6. Divides to attach below the knee on the tibia and fibula.

- a. Other muscles that provide support and control knee movement are:
  - 1. sartorius
  - 2. gracilis
  - 3. popliteus
  - 4. gastrocnemius
  - 5. plantaris
  - 6. tensor fascia latae/IT band

#### D. CARTILAGE

1. The knee contains 2 tough, fibrous cartilages called *menisci.* 

a.Lateral meniscus

b. Medial meniscus

2. They rest on top of the tibia in its 2 shallow, concave indentations.

3. They form a cushioned base for the medial and lateral *condyles* of the femur.

4. They also serve as shock absorbers, add to joint stability, and help smooth the gliding and rotating movements of the femur and tibia.

# E. OTHER STRUCTURES

1. BURSAE

a. Closed, fluid-filled sacs that cushion against friction over a prominent bone

b. 13 in the knee

2. SYNOVIAL MEMBRANE

- a. A large, closed sac that lines the inside of the knee joint.
- b. Helps to lubricate the tendons, ligaments, and bones.
- c. Fat pads are specialized soft tissue structure for weight bearing and absorbing impact.

#### **III. EVALUATION FORMAT**

A. Purpose:

- 1. To determine if there is a serious injury.
- 2. The 4 steps to evaluation process:
  - a. HISTORY ask questions

b. OBSERVATION- look for bleeding, deformity, swelling, discoloration, scars.

c. PALPATION- Try to pinpoint site of most severe pain.

d. SPECIAL TEST- assesses disability to ligament, muscle, tendon, etc.

- B. Conditions that indicate a Physician referral is indicated:
  - a. Gross deformity
  - b .Significant pain
  - c. Increased swelling
  - d Circulatory or neurological impairment
  - e. Joint instability
  - f.Dislocated patella

g. Abnormal sensations (clicking, popping, grating, or weakness)

- h. Locked knee or excessively limited motion
- i. Any doubt regarding the severity or nature of the injury.

#### **IV.COMMON INJURIES**

A. Knee injuries call for immediate referral to a physician. Without advanced medical training, an evaluation is not possible.

B. It is possible for a knee to be severely injured and to exhibit little swelling or pain.

C. Most common knee injuries are:

#### 1. Contusions:

a. caused by direct blow or falling on the knee

b. can damage muscles and/or the bursae that protect the bones.

c. To reduce the occurrence of contusion, kneepads should be worn.

# 2. Ligament sprains:

a. caused by a blow from any direction

b. injury is compounded when athlete's foot is planted.

c. Common football injury; player is hit on the lateral side of the leg causing the medial ligament to stretch or tear; called <u>shearing</u>.

# 3. Torsion Injuries:

a. occur when feet are fixed and the body is twistedb. Sports that require cleated shoes pose a greater risk of injury. The longer the cleat, the greater the risk of torsion.c. Sometimes torsion damages the ligaments, but most often it damages the *menisci*.

d. Less severe injuries to the knee caused by:

- 1. muscle weakness or imbalance
- 2. overuse or repetition
- 3. poor running mechanics
- 4. improper fitted shoes
- 5. conditions related to the growth process

# 4. Sprains

a. <u>mild</u>: one or more supporting ligaments and surrounding tissue are stretched. Minor discomfort, pt. tenderness, limited or not swelling, no abnormal movement in the joint.

b. <u>moderate</u>: Portion of one or more ligaments is torn; Pain, swelling, pt. tenderness, loss of function for several minutes of longer, slight abnormal movement in the joint, may not be able to walk normally, will favor injured leg.

c. <u>severe</u>: One or more ligaments completely torn, joint instability, either extreme pain or no pain if nerve damage, loss of function, pt. tenderness, rapid swelling; fracture is possible.

d. Treatment is PRICES and referral to Dr.

#### 5. Patellar tendonitis

a. Patellar tendon originates from the quadriceps muscles to the patella (knee cap)

b. Quads. are responsible for lower leg extension (i.e.) jumping

c. Excessive stress on this tendon can cause inflammation above and below the patella

d. Symptoms- pain after exercise, maybe some swelling

e. Treatment- cold to reduce pain and inflammation. Dr. may prescribe rest

f. Prevention- strong, flexible hamstrings and quads.

#### 6. Chondremalacia Patellae

a. Painful degeneration that results in the irritation and softening of the cartilage of the posterior aspect of the patella

b. Causes pain when you run, jump, kneel, and climb stairs.

c. Caused by:

1.muscular weakness or imbalance causing unusual patellar tracking as it moves in the femoral groove.

2.athlete's body structure

d. Treatment:

1. strengthen quads. through straight-leg raises and limited R.O.M. resistance exercise.

2. cold application before and after activity

- 3. muscle setting (isometric) strengthening exercises
- 4. use of knee pads to protect the area

# 7. Female athlete's Knee

a. Patellar problems are more prevalent for women than men because of their wider pelvic girdle.

b. Female's wider pelvis creates a sharper angle where femur attaches to the pelvis.

c. This angle changes the line of pull of the quads., which may cause the patella to be pulled <u>laterally</u> upon muscle contraction.

d. Angle change can also cause Chondromalacia Patellae, patellar dislocations or subluxation.

e. Treatment – Strengthen the *medial* portion of the quads. (Vastus Medialis) which will usually prevent any lateral sliding of the patella.

f. Performing complete R.O.M. exercises with resistance can strengthen the vastus medialis muscle.

g. If chronic pain persists, refer athlete to Dr.

h. Cryotherapy and modification of activity or rest are also recommended.

#### 8. Osgood-Schlatter's

a. common to adolescents.

b. causes could be partial separation of the tibial tubercle from the tendon or an inflammation of the tibial tubercle.

c. Characterized by swelling below one or

both knees

d. involves the growth center of the tibial tubercle to which the patellar tendon attaches.

e. Can lead to chronic knee irritation and pain

f. Inflammation is aggravated by activity and relieved by rest.

g. tenderness at patellar tendon's insertion point.

h. Athlete will complain of severe pain on jumping, running, or kneeling and after athletic activity.

i. After a long time, a bony prominence can be felt.

j. Symptoms disappear after adolescence but the bony prominence remains.

k. Treatment ranges from restriction or modification of sports activity to immobilization in a cast.

# 9. Muscular Strains

a. A common injury.

b. Causes:

- 1. lack of strength
- 2. repetitive overuse
- 3. improper technique
- 4. inadequate warm-up

c. characterized by pain primarily in the soft tissue

d. Basic treatment is PRICES.

e. Hamstrings are more likely to be <u>strained</u> because they are usually under-emphasized in strength and flexibility.

f. Quadriceps are more likely to be <u>contused</u> because most sports are played face to face making them more accessible than the hamstrings. V. Rehabilitation

A. Student trainer's response to knee injuries is basic first aid; PRICES followed by referral to a Dr.

B. The best method of knee injury prevention is through muscle strength, power, endurance, and balance.

C. Through strength training, the muscles in the injured leg should equal the strength of the uninjured leg.

D. The BEST way to build strength is through resistance exercise or weight training.

E. Strength is lost of the muscle is not exercised regularly.

F. Athletes should perform strengthening exercises in-season as well as during the off-season.

G. Before returning to competition, the following rehab. guidelines must be met:

1. Full R.O.M.

2. Strength, power, and endurance are proportional to the athlete's size and sport.

3. No pain during running, jumping, or cutting.

H. The trainer should consult with the sports medicine team to establish an individual rehab program tailored for the individual athlete and the specific injury.

I. Rehab protocol is the following:

1. ROM

2. resistive exercises

3. functional activities (walking, squatting, stair climbing)

4. sports specific activities (jumping, figure 8's, jumping rope)

VI. Preventive and Supportive Techniques

A. Taping:

1. Is time consuming

2. Can be expensive

3. All injured body parts should be taped initially.

4. The purpose of taping is to keep the joint from moving so the ligaments won't be stretched further.