Chapter 19: The Ankle and Lower Leg
Guided Notes

Functional Anatomy:

- Ankle is a stable ________________ joint
- Medial and lateral displacement is prevented by the ________________
- Ligament arrangement limits ________________ and eversion at the subtalar joint
- Square shape of talus adds to stability of the ankle
- Most stable during ________________, least stable in plantar flexion
- Degrees of motion for the ankle range from 10 degrees of dorsiflexion to 50 degrees of plantar flexion
- Normal gait requires ________ degrees of dorsiflexion and 20 degrees of plantar flexion with the knee fully extended
- Normal ankle function is dependent on action of the rear foot and subtalar joint
- Critical link in ________________

Preventing Injury in the Lower Leg and Ankle:

- Achilles Tendon Stretching
  - A tight heel cord may limit ________________ and may predispose individual to ankle injury
  - Should routinely stretch before and after practice
  - Stretching should be performed with knee extended and flexed ________ degrees
- Strength Training
  - ________________ and ________________ joint stability is critical in preventing injury
  - While maintaining normal ROM, muscles and tendons surrounding joint must be kept strong
- Neuromuscular Control Training
  - Can be enhanced by training in controlled activities
  - Uneven surfaces, BAPS boards, rocker boards, or ________________ can also be utilized to challenge athlete
- ________________
  - Can be an important factor in reducing injury
  - ________________ should not be used in activities they were not made for
- Preventive Taping and Orthoses
  - Tape can provide some ________________ protection
  - ________________ applied tape can disrupt normal biomechanical function and cause injury
  - Lace-up braces have even been found to be ________________ to taping relative to prevention
Assessing the Lower Leg and Ankle:

- **History**
  - Past history
  - Mechanism of injury
  - When does it hurt?
  - Type of, quality of, duration of pain?
  - Sounds or feelings?
  - How long were you disabled?
  - Swelling?
  - Previous treatments?

- **Observations**
  - Postural deviations?
  - Genu valgum or varum?
  - Is there difficulty with walking?
  - Deformities, asymmetries or swelling?
  - Color and texture of skin, heat, redness?
  - Patient in obvious pain?
  - Is range of motion normal?

- **Palpations (Soft Tissue and Bony)**
  - Fibular head and shaft
  - Lateral malleolus
  - Tibial plateau
  - Tibial shaft
  - Medial malleolus
  - Dome of talus
  - Calcaneus
  - Sustentaculum tali
  - Peroneus longus
  - Peroneus brevis
  - Peroneus tertius
  - Flexor digitorum longus
  - Flexor hallucis
  - Posterior tibialis
  - Anterior tibialis
  - Extensor hallucis longus
  - Extensor digitorum longus
  - Gastrocnemius
  - Soleus
  - Achilles tendon
  - Anterior/posterior talofibular ligament
  - Calcaneofibular ligament
  - Deltoid ligament
  - Anterior tibiofibular ligament
  - Posterior tibiofibular ligament

- **Special Test - Lower Leg**
  - Percussion and compression tests for ______________________
  - ________________________________

  - Used to determine damage to anterior __________________________ ligament primarily and other lateral ligament secondarily
• A positive test occurs when foot slides forward and/or makes a clunking sound as it reaches the end point

• Used primarily to determine extent of damage to the __________________ ligament and may be used to evaluate distal ankle syndesmosis, anterior/posterior tibiofibular ligaments and the interosseus membrane
• With lower leg stabilized, foot is rotated _____________________ to stress the deltoid

• Functional Tests
  – While weight bearing the following should be performed
    • ____________________________ (plantar flexion)
    • ____________________________ (dorsiflexion)
    • Walk on lateral borders of feet (inversion)
    • Walk on medial borders of feet (eversion)

• Passive, active and resistive movements should be manually applied to determine joint integrity and muscle function
• If the patient has difficulty with bearing weight these tests should not be utilized

• Special Injuries:
  – Ankle Injuries: Sprains
    • ____________________________ in the physically active caused by sudden inversion or eversion moments
  – Inversion Sprains
    • Most common and result in injury to the ____________________________
    • ____________________________ ligament is injured with inversion, plantar flexion and internal rotation
    • Occasionally the force is great enough for an ____________________________ fracture to occur w/ the lateral malleolus
    • Severity of ligament sprains is classified according to ________________
    • With inversion sprains the foot is forcefully inverted or occurs when the foot comes into contact w/ uneven surfaces

• Grade 1 Ligament Sprain
  – Etiology
    • Occurs with ________________________________________________
    • Causes stretching of the anterior talofibular ligament
  – Signs and Symptoms
    • Mild pain and disability; weight bearing is minimally impaired; ____________________________ over ligaments and no laxity
  – Management
    • RICE for 1-2 days; limited weight bearing initially and then aggressive rehab
    • Tape may provide some additional support
    • Return to activity in ________________ days

• Grade 2 Ligament Sprain
  – Etiology
    • Moderate inversion force causing great deal of ____________________________ with many days of lost time
– Signs and Symptoms
  • Feel or hear ___________________________; moderate pain w/ difficulty bearing weight; tenderness and edema
  • Positive talar tilt and ______________________________________________
– Management
  • RICE for at least first 72 hours; ____________ exam to rule out fx; crutches 5-10 days, progressing to weight bearing
  • Management (continued)
    • Will require protective immobilization but begin __________________________ early to aid in maintenance of motion and proprioception
    • Taping will provide support during early stages of walking and running
    • Long term disability will include chronic instability with injury recurrence potentially leading to joint degeneration
    • Must continue to engage in rehab to prevent against __________________________

• Grade 3 Ligament Sprain
  – Etiology
    • Relatively __________________________ but is extremely disabling
    • Caused by significant force (inversion) resulting in spontaneous subluxation and reduction
    • Causes damage to the __________________________________________ and calcaneofibular ligaments as well as the capsule
  – Signs and Symptoms
    • Severe pain, swelling, hemarthrosis, discoloration
    • __________________________________
    • Positive talar tilt and anterior drawer
  – Management
    • RICE, X-ray (physician may apply dorsiflexion splint for ____________ weeks)
    • Crutches are provided after cast removal
    • Isometrics in cast; ROM, PRE and balance exercise once out
    • __________________________ may be warranted to stabilize ankle due to increased laxity and instability

• Eversion Ankle Sprains
  -(Represent ____________% of all ankle sprains)
  – Etiology
    • Bony protection and ligament strength decreases likelihood of injury
    • Eversion force results in damage to __________________________ and possibly fx of the fibula
    • Deltoid can also be impinged and contused with inversion sprains
  – Etiology (continued)
    • Due to severity of injury, it may take longer to heal
    • Foot that is pronated, hypermobile or has a depressed __________________________ is more predisposed to eversion sprains
  – Signs and Symptoms
    • Pain may be severe; ___________________________; and pain with abduction and adduction but not direct pressure on bottom of foot
  – Management
    • RICE; X-ray to rule out fx; no weight bearing initially; posterior splint tape; NSAID’s
    • Follows the same course of treatment as __________________________

• Grade 2 or higher will present with considerable instability and may cause weakness in medial longitudinal arch resulting in excessive pronation or fallen arch
• Etiology
  • Injury to the distal tibiofemoral joint (anterior/posterior ligament)
  • Torn with increased external rotation or dorsiflexion
  • Injured in conjunction with medial and lateral ligaments
• Signs and Symptoms
  • Severe pain, loss of function; passive external rotation and dorsiflexion cause pain
  • Pain is usually anterolaterally located
• Management
  • Difficult to treat and may require months of treatment
  • Same course of treatment as other sprains, however, and total rehab may be longer

• Ankle Fractures/Dislocations
  • Etiology
    • Number of mechanisms
      • Avulsion, bi-malleolar fractures
  • Signs and Symptoms
    • Swelling and pain may be extreme with possible
  • Management
    • RICE to control hemorrhaging and swelling
    • Once swelling is reduced, a or brace may be applied, with immobilization lasting 6-8 weeks

• Acute Achilles Strain
  • Etiology
    • Common in sports and often occurs with sprains or excessive
  • Signs and Symptoms
    • Pain may be mild to severe
    • Most severe injury is partial/complete avulsion or of the Achilles
  • Management
    • and RICE should be applied
    • After hemorrhaging has subsided an should continue to be applied
    • Conservative treatment should be used as Achilles problems generally become chronic
    • A should be used and stretching and strengthening should begin soon

• Achilles Tendinosis
  • Etiology
    • Achilles tendinitis is an inflammatory condition involving tendon, sheath
      • Referred to as
      • Causes fibrosis and scarring that can restrict tendon motion in sheath
      • May lead to tendinosis
    • Achilles tendinosis typically does not present with, area has lost normal appearance, with cell disorganization/scarring and degeneration
    • Tendon is overloaded due to extensive
    • Presents with gradual onset and worsens with continued use
    • Decreased exacerbates condition
- **Signs and Symptoms**
  - Generalized pain and ________________________, localized proximal to calcaneal insertion
  - ___________ and painful with palpation, also presents with thickening
  - May limit strength
  - May progress to morning stiffness
  - ___________ with active plantar flexion and passive dorsiflexion
  - Chronic inflammation may lead to thickening
- **Management**
  - Resistant to quick resolution due to slow healing nature of tendon
  - Must reduce stress on tendon, address structural faults (orthotics, mechanics, flexibility)
  - Use ______________________________ modalities and medications
  - ______________________________ massage may be helpful in breaking down adhesions
  - Strengthening must progress slowly in order to not aggravate the tendon
- **Achilles Tendon Rupture**
  - **Etiology**
    - Occurs w/ sudden ___________ and go; forceful plantar flexion w/ knee moving into full extension
    - Commonly seen in athletes > ___________ years old
      - Can be observed at any age
    - Generally has history of chronic inflammation
  - **Signs and Symptoms**
    - Sudden ___________ (kick in the leg) w/ immediate pain which rapidly subsides
    - Point ________________________, swelling, discoloration; decreased ROM
    - Obvious indentation and positive Thompson test
    - Occurs 2-6 cm proximal the calcaneal insertion
  - **Management**
    - Usual management involves _________________ repair for serious injuries (return of 75-80% of function)
    - Non-operative treatment consists of _____________, NSAID’s, analgesics, and a non-weight bearing cast for 6 weeks, followed up by a walking cast for 2 weeks (75-90% return to normal function)
    - Rehabilitation lasts about ________ months and consists of ROM, PRE and wearing a 2cm heel lift in both shoes
- **Peroneal Tendon Subluxation/Dislocation**
  - **Etiology**
    - Occurs in sports with dynamic forces being applied to the _____________
    - May also be caused by dramatic blow to posterior lateral malleolus, or moderate/severe inversion ankle sprain resulting in tearing of peroneal retinaculum
    - In some cases ____________ may rupture
  - **Signs and Symptoms**
    - Complain of _________________________ in and out of groove with activity
    - Eversion against manual resistance replicates subluxation
    - Recurrent pain, snapping and instability
    - Present with ecchymosis, edema, tenderness, and _________________ over the tendon
  - **Management**
    - Conservative approach should be used first, including compression with felt
• Reinforce compression pad with rigid plastic or plaster until acute signs have subsided
• RICE, NSAID's and analgesics
• Conservative treatment time 5-6 weeks followed by gradual rehab program
  • ___________________________ if conservative plan fails

• Anterior Tibialis Tendinitis
  – Etiology
    • Commonly occurs after ___________________ down hill running
  – Signs and Symptoms
    • Point tenderness over ____________________________
  – Management
    • Rest or at least decrease running time and distance, avoid hills
    • In more serious cases, ___________ & stretch before and after running to reduce symptoms
    • Daily strengthening should be conducted
    • Oral _______________________________ medication may be required

• Shin Contusion
  – Etiology
    • ___________________________ to lower leg (impacting periosteum anteriorly)
  – Signs and Symptoms
    • Intense pain, rapidly forming ______________________ w/ jelly like consistency
  – Management
    • RICE, ______________________ and analgesics as needed
    • Maintaining compression for hematoma (which may need to aspirated)
      • Fit with ______________________ pad and orthoplast shell for protection
    • If not managed appropriately may develop into osteomyelitis (deterioration of bone)

• Muscle Contusions
  – Etiology
    • _______________________________, particularly in the region of the gastrocnemius
  – Signs and Symptoms
    • ___________________________ may develop, pain, weakness and partial loss of limb function
    • Palpation will reveal hard, rigid, inflexible area due to internal hemorrhaging and muscle guarding
  – Management
    • Stretch to prevent spasm; apply cold compression and ice
    • If superficial therapy and massage do not return patient to normal in 2-3 days, ultrasound would be indicated
    • Wrap or ____________ will help to stabilize the area

• Leg Cramps and Spasms
  – Sudden, violent, involuntary contraction, either ________________ (intermittent) or tonic (sustained) in nature
  – Etiology
    • Difficult to determine; fatigue, loss of fluids, electrolyte imbalance, inadequate reciprocal muscle coordination
  – Signs and Symptoms
    • ___________________________ with pain and contraction of calf muscle
  – Management
    • Try to help patient relax to relieve ________________
    • Firm grasp of cramping muscle with gentle stretching will relieve acute spasm
    • ________________ will also aid in reducing spasm
    • If recurrent may be fatigue or water/__________________________ imbalance
• Gastrocnemius Strain
  – Etiology
    • Susceptible to strain near musculotendinous attachment
    • Caused by quick start or stop, ________________
  – Signs and Symptoms
    • Depending on grade, variable amount of swelling, pain, muscle disability
    • May feel like being “______________________________”
    • Edema, point tenderness and functional loss of strength
  – Management
    • RICE, NSAID’s and ________________ as needed
    • Grade 1 should apply gentle stretch after cooling
    • ________________ as tolerated; use heel wedge to reduce calf stretching while walking
    • Gradual rehab program should be instituted

• Acute Leg Fractures
  – Etiology
    • Fibula has highest incidence of fracture, occurring primarily in the middle third
    • ________________ fractures occur predominantly in the lower third
    • Result of direct ________________ or indirect trauma
  – Signs and Symptoms
    • Pain, swelling, soft tissue insult
    • Leg will appear hard and swollen (Volkman’s contracture)
  – Management
    • X-ray, reduction, casting up to 6 weeks depending on the extent of injury

• Medial Tibial Stress Syndrome (______________________________)
  – Etiology
    • Pain in ________________ portion of shin
    • Catch all for stress fractures, muscle strains, chronic anterior compartment syndrome
    • Accounts for 10-15% of all running injuries, 60% of leg pain in athletes
    • Caused by repetitive ________________
    • Weak muscles, improper footwear, training errors, varus foot, tight heel cord, hypermobile or pronated feet and even forefoot supination can contribute to MTSS
    • May also involve, stress fractures or exertional compartment syndrome
  – Signs and Symptoms
    • Four grades of pain
      • Pain before and after activity and not affecting performance
      • Pain before, during and after activity, affecting performance
      • Pain so severe, performance is impossible
  – Management
    • Physician referral for X-rays and ________________
    • Activity ________________
    • Correction of abnormal biomechanics
    • Ice massage to reduce pain and inflammation
• Flexibility program for gastroc-soleus complex
• __________________________ and or orthotics

• Compartment Syndrome
  – Etiology
    • Acute compartment syndrome
      – Occurs secondary to direct trauma
  – Acute exertional compartment syndrome
    – Evolves with minimal to __________________________ activity
  – Chronic compartment syndrome
    – Symptoms arise consistently at certain point during activity
  – Signs and Symptoms
    • Complain of deep aching __________________ & tightness due to pressure and swelling
    • Reduced __________________ and sensation of foot occurs
    • Intracompartmental measures further define severity
    • Must be recognized and treated early
  – Management
    • If severe acute or chronic case, may present as __________________ emergency that requires surgery to reduce pressure or release fascia
    • RICE, NSAID’s and __________________________ as needed
    • Under acute and exertional cases pressures will be monitored and surgical needs will be dependent on findings
      – Following surgical release patient may not return to activity for 2-4 months
    • In chronic conditions management is initially conservative
    • __________________________ may be necessary if conservative measures fail

• Stress Fracture of Tibia or Fibula
  – Etiology
    • Common __________________________ condition, particularly in those with structural and biomechanical insufficiencies
    • Runners tends to develop in lower third of lower leg (dancers middle third)
    • Often occur in unconditioned, non-experienced individuals
    • Often training errors are involved
    • Component of __________________________
  – Signs and Symptoms
    • Pain more __________________ after exercise than before
    • Point tenderness; difficult to discern bone and soft tissue pain
    • __________________________ results (stress fracture vs. periostitis)
  – Management
    • Discontinue stress inducing activity _________ days
    • Use crutches for walking
    • Weight bearing may return when pain subsides
    • Cycling before running
    • After pain free for _______ weeks patient can gradually return to running
    • Biomechanics must be addressed
Rehabilitation Techniques

– General Body Conditioning
  • Must be maintained with _____________________ bearing activities

– Weight Bearing
  • Non-weight bearing vs. partial weight bearing
  • Protection and faster healing
  • Partial weight bearing helps to limit muscle ____________________, proprioceptive loss, circulatory stasis and tendinitis
  • Protected motion facilitates collagen alignment and stronger healing

– Joint Mobilizations
  • Movement of an injured joint can be ______________________ with manual mobilization techniques

– Flexibility
  • During early stages ______________________ and ____________________ should be limited
  • ______________________ and ____________________ should be encouraged
  • With decreased discomfort inversion and eversion exercises should be initiated

– Strengthening
  • ______________________ (4 directions) early during rehab phase
  • With increased healing, aggressive nature of strengthening should increase (isotonic exercises
  • Pain should serve as the guideline for progression
  • _____________ exercises allows for concentric and eccentric exercises
  • PNF allows for isolation of specific motions

– Taping and Bracing
  • Ideal to have patient return w/out taping and ______________________
  • Common practice to use tape and brace initially to enhance stabilization
  • Must be sure it does not interfere with overall motor performance
  • Utilize braces and taping to provide support to __________________________
  • May help athlete detect movement in the ankle and reduce injury

– Functional Progressions
  • Severe injuries require more ______________________
  • Introduction of weight bearing activities (partial vs. full) is critical to ______________________
  • Progression must occur based on pain and level of function
  • Running can begin when ambulation is pain free (transition from pool → even surface → changes of speed and direction)

– Return to Activity
  • Must have complete range of motion and at least _____________% of pre-injury strength before return to sport
  • If full practice is tolerated w/out insult, patient can return to competition
  • Return to activity must involve gradual progression of functional activities, slowly increasing stress on injured structure
  • Specific _____________ dictate specific drills