Lower Leg and Ankle Injuries

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Rehab Summit 2008

Ankle Injuries

- Most common injury in sports
  - 38-45% of all sport-related injuries
  - 86% are sprains
- Mechanism
  - Forceful inversion with plantarflexion
  - Eversion
  - Hyper-plantarflexion

Ankle Anatomy

- Bones
  - Tibia
  - Fibula
- Tibio-Fibular Syndesmosis
- Lateral Ligaments
  - Anterior talo-fibular
  - Calcaneo-fibular
  - Posterior talo-fibular
- Medial Ligament
  - Deltoid Ligament
Ankle Sprains

- Inversion Ankle Sprain
- Eversion Ankle Sprain
- Syndesmosis Injury "High Ankle Sprain"

Ankle Sprains

- Grade I
  - Mild Sprain – Mild tearing of ligament
  - Mild point tenderness
  - Little or no swelling
  - Little or no limitation in motion
  - Tendency to recurrence
  - Little or no disability
  - Quick return to play

Ankle Sprains

- Grade II
  - Moderate Sprain – Partial tearing of ligament
  - Moderate point tenderness
  - Moderate Swelling
  - Decreased ROM
  - Local Bruising
  - Persistent Instability with high recurrence
  - Return to play average 7-10 days
Ankle Sprains

- Grade III
  - Severe Sprain – Complete rupture of ligament
  - Severe pain and disability
  - Severely limited ROM
  - Possible deformity
  - Severe swelling
  - Chronic instability
  - Sometimes season-ending

Inversion Ankle Sprain

- Most common
- Mechanism
  - Inversion or varus tilt
  - Forced plantarflexion
- Symptoms
  - Pain over lateral malleolus
  - Inability to bear weight
- Signs
  - Swelling laterally
  - Bruising laterally or into foot
  - Tenderness over lateral malleolus

Inversion Ankle Sprain

- Treatment
  - Immediately – R.I.C.E.
  - Refer to physician
  - Weight bearing vs. NWB
- Rehabilitation
  - Decrease swelling/pain
  - Increase ROM/Strength
  - Restore proprioception
- Return to play
  - When able to perform all agility needed for specific sport
  - Bracing/Taping
Eversion Ankle Sprain

- Mechanism
  - Eversion or valgus tilt
  - Forced external rotation
- Symptoms
  - Pain on inside of ankle
- Signs
  - Tenderness anterior lower leg and medially
  - Swelling medially

- Relatively rare
- Usually involves syndesmosis injury
- Occasionally involves fibula fracture

Treatment
- Protected mobilization
- Cast immobilization

Rehabilitation
- Decrease swelling/pain
- Increase strength/ROM

Return to play
- When able to perform all agility needed for specific sport

Syndesmosis Injury

- High Ankle Sprain
- Usually associated with fracture
- Mechanism
  - Athlete stops and is pushed back on planted foot

- Signs/Symptoms
  - Tenderness over distal tibiofibular ligaments
  - Tenderness over Deltoid ligament
  - Pain with squeeze at mid-calf
- Treatment – Depends on X-Rays / Laxity Testing
  - Instability
  - No instability
Syndesmosis Injury

- **No Instability**
  - Weight bearing as tolerated
  - Elastic bandage or splint
  - Rehab similar to inversion sprain

- **Instability**
  - Immobilization for 6 weeks
  - Follow-up X-Rays to determine if syndesmosis is healing
  - If not – surgical placement of screw

Evaluation/Assessment

- **Figure of Eight**
  - Esterson 1979
    - Anterior Ankle
    - Inferior to Malleoli
    - Proximal to Base of 5th MT
    - Proximal to Tubercle of the Navicular
  - Tatro-Adams et al
    - Excellent Reliability
  - Petersen et al
    - Highly correlated with water volumetry

Intervention

- **High Voltage Pulsed Current**
  - Burr and colleagues
    - Injury Potential
      - Peaks + at 48 hours, then declines over next several days
  - Voight
    - Literature review
      - Cathodal stimulation for control of histamine release
      - Anodal stimulation for control of hematoma formation
  - Bourguignon and Bourguignon
    - Examined HVPC’s effect on DNA and protein synthesis
      - Maximum activity with cathodal HVPC at 100 pps
  - Taylor et al
    - Examined HVPC’s effect on effusion in hamster cheeks
      - Found less “leakage” in cheeks treated with cathodal HVPC at 50% and 90% Visible Muscle Threshold
Intervention

• High-Voltage Pulsed Current
  – 2 Electrodes
  – Negative polarity
  – 100pps
  – Sub-muscular contraction
  – 20 minutes

Intervention

• Ankle Disk Training
  – McGuine and colleagues
    • Increased postural sway strongly predictive of ankle sprain
  – Wester et al
    • 12-week training program
      • Fewer complaints of re-injury and chronic instability
  – Matsusaka and others
    • Added tactile input
      • Control Group: normal balance at 8 weeks
      • Taped Group: normal balance at 6 weeks

Intervention

• Ankle Disk Training
  – Initiated Day 2 post-injury
  – Progressed as tolerated
    • Bilateral stance
    • Bilateral support with toes
    • Unilateral support
    • Ball height
Intervention

• Perturbation Training
  – Bilateral stance
  – Bilateral support with toes
  – Unilateral stance
  – Unilateral stance on compliant surface

Ankle Bracing

• AirCast
• Positives
  – Provides compression and immobilization
  – Good for immediately post-injury
• Negatives
  – Compression not uniform
  – Bulky – compliance
  – Does not allow normal ankle ROM/movement

Ankle Bracing

• ASO Ankle Brace
• Positives
  – Lace-up/figure-8 straps
  – Good compression
  – Lightweight
  – Fits in all shoes
• Negatives
  – Needs to be replaced annually
Lower Leg Anatomy

- **Bones**
  - Tibia
  - Fibula
- **Muscles**
  - Tib. Anterior/Posterior
  - Toe Extensors
  - Gastrocnemius/Soleus
  - Toe Flexors
- **Tendons**
- **Ligaments/Pseudo-ligaments**

Lower Leg Injuries

- **Contusions**
  - Compartment Syndromes
- **Achilles Tendon Injuries**
  - Tendonitis
  - Rupture
- **Medial Tibial Stress Syndrome**
- **Fractures**
  - Stress Fractures
  - Traumatic Fractures
- **Nerve Injuries**

Contusions

- Highly exposed to direct trauma
- Most often over the anterior leg (shin)
- Abrasions and Lacerations
- Must rule-out bone injury

- Treat with R.I.C.E.
- Complications:
  - Compartment Syndrome
  - Peroneal Nerve Damage

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Compartment Syndrome

- Caused by swelling within one of the 4 compartments
- Usually due to trauma
- Most commonly anterior compartment
- Increases pressure on vascular structures and nerves

Compartment Syndrome

- Symptoms
  - History of trauma
  - Throbbing/aching pain
  - Red, distended skin
  - Increased tissue temp.
  - Foot Drop
  - Pain with passive motion

- Treatment
  - R.I.C.E.
  - Immediate referral to physician
  - May require surgery to release pressure

Exertional Compartment Syndrome

- Symptoms similar to Compartment Syndrome, but exercises induced
- Symptoms usually bilateral
- Relief of pain after exercises is stopped

- Treatment
  - R.I.C.E.
  - Referral to physician
  - Surgery is likely
Achilles Tendon Injuries

- Lower leg is site of origin for muscles responsible for foot and ankle power
- Athletic participation requires explosive and repetitive motions
- Strains may occur anywhere along the muscle or tendon
- Usually the result of violent contraction, overstretches, or continued overuse

Achilles Tendon Injuries

- Acute injury to muscle/tendon
- Most common site is the calf
- Tendency to become chronic
- Treatment:
  - R.I.C.E.
  - Slow/Gradual return to activity

Achilles Tendonitis

- Common among distance runners
- Thickening of surrounding tissues
- Tenderness on palpation
- Stiffness/Pain with activity
Achilles Tendonitis

• Symptoms
  – Generalized pain/stiffness around tendon
  – Uphill running is worse
  – Swelling
  – Decreased ankle ROM
  – Tendon may feel warm
  – Crepitus

Achilles Tendonitis

• Treatment
  – R.I.C.E
  – Cho-Pat Strap
  – Proper shoes
  – Orthotics
  – Physical Therapy
  – Stretching
  – Strengthening

Achilles Tendon Stretching

Gastroc Stretch (knee straight)

Soleus Stretch (knee flexed)
Achilles Tendon Rupture

- Atraumatic injury
- Relatively rare
- Typically in men age 30-40
- Causes
  - Decreased tissue blood supply
  - Anatomic limb alignment
  - Excessive or uncoordinated muscle contraction
  - More likely after period of inactivity

Surgical Treatment
- Must wear cast/brace for 6-8 weeks
- Toe-touch weight bearing
- Return to activity 4-6 months after surgery

Non-Surgical Treatment
- Higher risk of re-rupture within first 6 months
- Cast/Bracing for 12 weeks or more
- Return to activity 6 months or longer

Medial Tibial Stress Syndrome

- “Shin Splints”
- Most often occur early in training program
- Inflammation of tendon and fascia
- Disagreement over exact cause
Medial Tibial Stress Syndrome

- Pain anywhere along the leg
- Usually limited to muscular areas anteriorly
- Causes
  - Muscle inflexibility
  - Fallen arch
  - Pronated foot
  - Ill-fitting footwear
  - Training techniques
  - Playing surfaces

Medial Tibial Stress Syndrome

- Treatment
  - No one best treatment
  - R.I.C.E.
  - Correction of possible causes
  - Strengthening
  - Stretching
  - Taping
  - Slow return to activity
- Prevention
  - Gradual progression of training program
  - Properly fitted shoes
  - Identify over-pronation
  - Strengthening and flexibility program
    - Ankle ROM
    - Ankle strengthening
      - Weight bearing
      - Non-weight bearing

Shin Splints - Taping

- Arch Support
  - Helps raise arch
  - Corrects over-pronation
Shin Splints - Taping

- Tibial Taping
  - Eases symptoms
  - Provides extra support to inflamed fascia

Fractures

- Tibia and fibula both susceptible to fracture
- Fibula injured more often
  - Direct blow to outside of leg
  - Stress fractures
- Tibia fractures easily identified
  - Direct blow
  - Twisting force
  - Stress fractures

Stress Fractures

- Develop due to abnormal or unusual repetitive stress applied to the bone
- Difficult to differentiate shin splints vs. stress fracture
- More common in people with high arches
- Also more common with over-pronation
- Symptoms
  - Point tenderness
  - Swelling
  - Gradual onset
Stress Fractures

Bones Involved with Stress Fractures

- Tibia
- Fibula
- Metatarsals
- Femur
- Pelvis

**Stress Fractures**

- **Causes**
  - Change in shoes
  - Change in running surface
  - Change in distance
  - Changes in exercise program
  - Surgery on other side

- **Treatment**
  - Rest
  - Splinting vs. casting
  - Non-weight bearing vs. weight bearing
  - Gradual return to activity at 4-6 weeks

**Traumatic Fractures**

- To ER immediately
  - Severe local pain
  - Inability to bear weight
  - Deformity

- Apply ice and splint extremity in current position

- **DO NOT** try to straighten deformed leg
Nerve Injuries

• Causes
  – Nerve entrapment
  – Chronic stretch due to multiple ankle sprains
  – Nerve compression

• Symptoms
  – Pain
  – Foot drop
  – Numbness

• Treatment
  – Remove tight clothing/tape
  – Active/Passive Stretching
  – Refer to Physician
  – Resume activity as tolerated when cleared

Outcome Measures

• Hop Tests
  – Single Hop for Distance
  – Triple Hop for Distance
  – 6 meter Timed Hop

  • Performed Bilaterally
    – 3 practice reps
    – 5 measured/timed trials

Outcome Measures

• Star Excursion Battery
  – Measures balance and neuromuscular control
  – Hertel et al, Kinzey et al
  • Good reliability
Outcome Measures

- Star Excursion Battery
  - Performed bilaterally
  - 3 practice trials
  - 5 measured trials