Learning Objectives

Following completion of the program, the participant will be able to:

1. describe the anatomy, classification systems, and diagnostic exam techniques relevant to lateral ankle instability
2. list treatment alternatives to minimize acute swelling
3. apply proprioceptive exercises and explain their influence
4. prescribe an intervention program for both non-operative and post-operative conditions
5. prescribe a rehabilitation program appropriate to the type of fracture

talk a little about post-operative management
Pathological Impairment of Consequence
Increased Talar Anterior/IR Translation

inversion mechanism
for “lateral” ankle sprain

rotational mechanism
for “high” ankle sprain

Lateral Inversion Ankle Sprains

- **Grade I** (Mild)
  - ATP
  - Minimal functional disability
  - Usually slight swelling
  - Mild pain and tenderness
  - Unable to FWB
  - Negative drawer/tilt

- **Grade II** (Moderate)
  - ATP - CF
  - Moderate functional disability
  - Usually slight to marked swelling
  - Moderate pain and tenderness
  - Usually slight to marked pain and tenderness
  - Usually slight abnormal gait
  - Ecchymosis
  - Usually slight to marked soft end feels

- **Grade III** (Severe)
  - ATP - CF - PTF
  - Unable to FWB
  - Large and diffuse swelling
  - Marked pain and tenderness
  - Marked + drawer and/or tilt

Tilt and Drawer Tests

- **ATF Disruption**
  - Translation of > 10mm or 3mm difference between sides
  - 2-4 mm is normal

- **ATF/CF disruption**
  - 20-30° tilt or > 10° greater than uninjured side
R/O Deep Vein Thrombosis

Homan’s Sign

- No diagnostic value
- Unreliable
- Poor specificity and suspect sensitivity

New Gold Standard based on venography studies

Clinical Decision Rule
Wells, et al, 1997

9 medical history and physical exam findings that categorize a patient as low, moderate, or high risk

What’s the first thing to address?
Management of Edema – Control Swelling

What’s the best way to reduce swelling?

<table>
<thead>
<tr>
<th>Protection</th>
<th>Ice</th>
<th>Ice</th>
<th>Compression</th>
<th>Elevation</th>
</tr>
</thead>
</table>

Evidence

- Ice superior to heat or contrast but all increased edema when in dependent post
  » Cote, et al, 1988; Expert Panel Consensus (Level C)
Evidence

- Ice superior to heat or contrast but all increased edema when in dependent posture
  - Cote, et al, 1988; Expert Panel Consensus (Level C)
- Elevation and Compression
  - If the limb is to be maintained in elevation, do not apply compression simultaneously
    - Empirical Evidence Level I
  - Elevation when non weight-bearing
  - Compression when weight-bearing

Dependent Posture

- Edema reduction as a result of elevation or intermittent compression lasts less than 5 minutes after a return to a gravity-dependent position

Additional techniques to minimize swelling

- Ice – Compression (cryocuff)
- Horseshoe or Donut Compression Channeling
- Maintenance of Closed Pack Position
- HVGS in Elevated Position
Additional techniques to minimize swelling

- Ice – Compression (cryocuff)
- Horseshoe or Donut Compression Channeling
- Maintenance of Closed Pack Position
- HVGS in Elevated Position
- AROM/Isometrics

Lateral Ankle Sprains
additional acute phase considerations

- Weight Bearing to tolerance in posterior splint
- Neutral orthotic and open basket weave support
- BAPS and Isometrics
- Fibular MWM
- Gluteal strengthening

what muscle group should be emphasized in rehab?

Lateral ankle sprains
- frontal plane stabilization & control
- peroneals and gluteus medius

Peroneals

- Triplanar manual resistance to 1st ray plantar flexion with STJ eversion and ankle plantarfexion
- Is eccentric invertor strength equally important to re establish?

gluteal strengthening?

- Hip abductor weakness present in those with chronic ankle sprains
- Altered hip muscle recruitment patterns following an sprained ankle
  Beckman, SM. Arch Phys Med Rehab 1995
- Local sensory and muscle function affected by severe ankle sprain
  Bullock-Saxton JE. Phys Ther 1994
Weakness in Gluteus Maximus
- Promoted by tight hip flexors that create reciprocal inhibition and limited extension range
- Promoted by decreased ankle dorsiflexion range in midstance of gait

What criteria do you use?
- Strength
- Mobility
- Pain
- Swelling
- Time
- MD Orders
- etc

When patient has a normal, non-antalgic heel-toe gait pattern and weight bearing forces do not disrupt healing process

Weight-bearing immobilization combined with early exercise provided a safe and effective intervention

Contrast Therapy
- Friction massage at site of lesion
- CKC functional rehab in frontal plane
  - Gastroc-soleus stretching
  - Stork stands
  - Contra kicks
  - BAPS/Tilt boards
- Begin proprioceptive training

Maintain/Restore dorsiflexion ROM
- Posterior talair mobs
  - Addition of TJC mobilization necessitated fewer treatments to achieve pain-free df ROM and improved stride speed
- Achilles stretching
What is proprioception?

The ability of articular mechanoreceptors to determine where the joint’s segments are in space is called PROPRIOCEPTION.

Why is proprioception training important?

to overcome articular deafferation through:
- restoration of joint mechanoreceptor’s dynamic stability function
- reaction to unpredictable external forces/stresses
- enhancement of sensorimotor outflow

Proprioceptive Balance Exercise Parameters

- Support: Brace/Tape – Shoes – Orthotics – Barefoot – “Short Foot”
- Stance Position: Bilateral (wide vs. narrow) – Unilateral – Staggered
- Knee Position: locked – unlocked
- Dynamic Movement: LE Squats – Kicks (frontal vs. sagittal) – lunges – reaches (LE or UE)
- Vision: eyes open vs. eyes closed
- Vestibular Input: head position/cerebellar movement
- Arm Position: arms abducted – hands cross chest – hands on waist – arms overhead
- Incline: uphill (df) – downhill (pf) – everted – inverted
- Overload: A/P or varus/valgus moments with tubing or cable column overload – manual perturbation

is balance a predictor of ankle sprains?

Higher postural sway corresponded to a 7 fold increase in ankle sprain injury rate

Evidence for proprioceptive exercise

Effective at reducing residual symptoms and recurrent injury


Lateral Ankle Sprains
functional phase rehabilitation

- Cryotherapy prn
- Ankle bracing – taping
- Plyometrics
- Advanced proprioceptive activities
- ADL/Sport specific training
Lateral Ankle Sprains
does balance training help?

- Balance Training relative risk reduction = 54%
  - Recurrent sprain within 8 months = 54% without balance training
  - Recurrent sprain within 8 months = 25% with balance training
  Wester, et al, JOSPT, 1996

- Supervised rehab relative risk reduction = 79%
  - Recurrent sprain within one year = 29% without rehab
  - Recurrent sprain within one year = 6% with rehab

Example of an Advanced Proprioceptive Exercise

Possible Variables
- Resistance
- Speed
- UE Involvement
- Surface Stability
- Surface Inclination
- Visual Input
- Brace/Shoe Support

Employ the S.A.I.D. Principle

SAID Principle
- Tissues remodel according to stimulus imposed on them
- Rehab activities should be chosen based on the desired outcome
- What is the best way to get better at swimming?

How long will it take till I can get back?

Statistically significant relationship between ambulation status and patient self-assessment of function (SF36) as predictor of time it will take to return to activity


disability prediction for acute ankle sprains

\[ Y = -0.942 \text{ Activity} - 0.14 \text{ VAS} + 22.2 \]

(Accuracy ± 3 days)

- Activity – 1 point each for ability to walk 40 meters, run 40 meters, 24 meter Fig 8 run, single leg hop for distance, triple crossover hop, and hop ↑↓ flight of stairs
- VAS – visual analog scale of “how do you rate your athletic ability today?”
- Taken at 3 days post-injury

disability prediction for acute ankle sprains

\[ Y = 0.04 \text{ Swelling} - 0.251 \text{ ROM Loss} + 6.57 \]

(\text{Accuracy ± 4 days})

- Swelling – mL volumetric displacement difference
- ROM Loss – difference in total TCJ sagittal plane motion
- Taken at 3 days post-injury


Swelling alone is not an accurate predictor of function


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**Brace or Tape?**

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**Standardized Effect of ROM Restriction**


Influence of Ankle Support on Joint ROM Before and After Exercise: A Meta-Analysis

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**Number Needed to Treat**

**Bracing vs. Taping**

- Number needed to treat (brace vs. tape) to prevent one ankle sprain
  - Need to tape 26 ankles to prevent one ankle sprain in a group of intramural basketball players with history of sprain and 143 to prevent a sprain in the same healthy group
  - Need to brace (aircast stirrup) 5-18 ankles to prevent one ankle sprain in a group of intramural basketball and competitive soccer players with history of sprain and 39-57 to prevent a sprain in the same healthy group

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I didn’t say don’t tape ...

- Taping application may increase proprioceptive input and allow the peroneal muscles to react more rapidly to inhibit extreme inversion

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How long should I continue with external support?

“Tape it up real tight, Floyd ... and the other ankle, too.”
Recovery and Recurrence Prevention

- I recommend at least six months following full recovery
- Along with a continuation of strengthening, agility, and balancing activities

What type of shoes?

- No convincing evidence in the literature to suggest one type of shoe (high, mid, or low) over another

How will I know they're ready to return to activity?

- Excursion tests
- Balance and reach tests
- Hop and jump tests
- ADL specific tests

% contribution to jump performance

<table>
<thead>
<tr>
<th></th>
<th>Vertical Jump</th>
<th>Standing Long Jump</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hip</td>
<td>40%</td>
<td>45%</td>
</tr>
<tr>
<td>Knee</td>
<td>25%</td>
<td>5%</td>
</tr>
<tr>
<td>Ankle</td>
<td>35%</td>
<td>50%</td>
</tr>
</tbody>
</table>

functional hopping testing

- Frontal plane (side-to-side) and transverse plane (figure 8) hopping more reliable predictors of function than sagittal jumps

finally, a little about surgery and post-op management
surgical intervention evidence

**Reconstruction vs. Repair**

- Great overview of surgical consideration and literature review of outcomes


**Anatomic Repair (modified Brostrom):**

- reproduces ATF/CF orientation
- controlled anterior displacement, internal rotation, and talar tilt without compromising STJ ROM


- least amount of anterior talar displacement and talar tilt angle at all forces
- greater mechanical restraint than non-anatomic (peroneal rerouting) reconstructive procedures.


**anatomic repair post-op rehab**

- Immobilization for ~ six weeks in neutral dorsiflexion and slight eversion
- 0-3 weeks NWB; 3-6 weeks PWB in walking boot; Stirrup splint support for 6-12 weeks with ADLs
- Sagittal plane A/AAROM at 6 wks
- Frontal plane A/AROM at 8 wks
- PREs at 8 weeks
- Functional rehab commences when no detectable limp
- Return to activity takes 4-6 months

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**Lateral ankle sprains**

**key points for rehabilitation**

- Edema management
- Normalization of gait ASAP
- Maintenance of closed pack position
- Damaged ligaments must heal as “flexible” restraint

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**Lateral ankle sprains**

**key points for rehabilitation**

- Structural Abnormalities
  - Compensated forefoot valgus
  - Uncompensated rearfoot varus
  - > 10° tibial varum without adequate calcaneal eversion ROM
- Proprioceptive Deafferentation
- Poor frontal plane stabilization and muscle control
  - Gluteus medius and peroneal weakness
Great Resource

Special Theme Issue: Ankle Instability
Journal of Athletic Training
Volume 37:4
Oct Dec 2002