Improving Health & Performance: Restoring Ankle Motion Utilizing a Manual Therapy Approach

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What's the Big Deal?

DF & Static Stretching

- 20 min of static stretching of the calf muscles increased the ankle dorsiflexion angle, decreasing the stiffness of the ankle joint and tendon but actual muscle stiffness and elongation were unchanged (Kato 2010).
- Static calf stretching exercises produced no significant reduction in the passive mechanical resistance into ankle dorsiflexion in a group of young, healthy male subjects (Youdas 1999).
- Jogging is more effective than stretching for decreasing muscle stiffness around the ankle joint (Youdas 1999).
- A two-minute static stretching protocol is not sufficient to increase active ankle dorsiflexion ROM in healthy subjects (Youdas 2003).
- A two-minute static stretch was no more effective than either the one minute of 30 second stretches for increasing ankle DF ROM in a group of young, healthy male subjects (Youdas 2008).
- A gastrocnemius stretching program in this study did not affect ankle DF, knee extension, or gastrocnemius muscle during gait in subjects with limited ankle ROM, especially noted during early to midstance (Johnson 2009).
- Combined SS and US treatment increased ankle DF more than static stretching alone (Wessling 1987).

Loss of DF and Injury

- Regional Interdependence Model (Wainner et al, 2007)
- Considerations for ACL program (Fong 2011)

DF Impacts Performance

Limited ankle DF shifts power from hips to knee and will decrease power output.

Running Requires 20-30 degrees of DF (Jundt, 1985)

Hallux Interphalangeal Joint Range of Motion in Feet with and Without Limited First Metatarsophalangeal Joint Dorsiflexion.
Is there a Problem?

- 60 NU athletes during spring clearance
- Great toe on tape measure, middle of heel on tape measure, heel stays down, no attempt to limit Pro/Sup – but knee had to touch wall in line.
- Measurements taken to the closest ¼ inch with angle recorded using ITouch (Clinometer app) (Bennell et al., 1998)

How Much DF Do We Need?

45 degrees?

- 113 Male/Female VB players
- Sit & Reach, ankle DF, VJ, PF strength, years competed, & activity level
- Having less than 45° of ankle dorsiflexion range increased the risk of patellar tendinopathy by 1.8—2.8 times.
- Only DF was associated with tendon injury (Malliaras 2006).

4 Inches?

- SFMA suggest 4 inches in their breakout of Deep Squat (Cook, pg.184)

Example of a Force vs. Time (Load Pattern) Graph

1. Indicates a rapid initial loading.
2. A 50% drop in force or loading.
3. An increase to about 10% more than the 1st peak.
4. A rapid decline in force to 0.

Relationship Between the Force Curves and the Pivots

- Foot (Gait)
- Heel
- Forefoot

Case Study 1

Pre: 2.25”/36 degrees
Post: 2.5” /40 degrees
Case Study 2
Pre: 2.25" / 36 degrees
Post: 2.5" / 39 degrees

Case Study 3
Pre: 1.25"
Post: 2.0", 3 Days Post 2.0"

Load vs. Capacity
Questions
1. Why did this happen to me?
2. How can I prevent this from happening again?
3. Why do I have to reduce my training?
4. Why can’t I just rest it?
5. I no longer have any symptoms – why do I need to continue treatment?
6. Why does this problem keep coming back?

All musculoskeletal injury is an imbalance between LOAD and CAPACITY.

Load is simply how much you ask your body to do. It’s a force applied to the body that has direction, magnitude and time.

Capacity is how much load the body can handle without damage, breakdown or dysfunction.

Load vs. Capacity
Healthy Balance
**Healthy Load vs. Capacity Balance**

Musculoskeletal Tissues

- muscle
- tendon
- ligament
- nerve
- cartilage
- disc
- bone

**Pathology/Dysfunction**

Each tissue type responds to excessive load in a predictable way producing a series of pathologies.

**Cumulative Injury Disorder**

<table>
<thead>
<tr>
<th>TISSUE TYPE</th>
<th>DYSFUNCTION (chronic)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Muscle</td>
<td>Adhesion</td>
</tr>
<tr>
<td>Tendon</td>
<td>Tendinosis (not tendonitis)</td>
</tr>
<tr>
<td>Ligament</td>
<td>Adhesion/Degeneration</td>
</tr>
<tr>
<td>Nerve</td>
<td>Entrapment</td>
</tr>
<tr>
<td>Cartilage</td>
<td>Degeneration</td>
</tr>
<tr>
<td>Disc</td>
<td>IDD, Herniation</td>
</tr>
<tr>
<td>Bone</td>
<td>Stress Response/Stress Fracture</td>
</tr>
</tbody>
</table>

**Question**

Can a normal load exceed capacity?
The Audit Process and DF Limitations

- Check Dorsiflexion
  - Functional & Weight Bearing
- Apply Treatment
- Re-Check Dorsiflexion

6 Possible Soft Tissue Limitations
1. Soleus
2. Post. Tib
3. FHL
4. FDL
5. Post. Talofib. lig
6. Post. Tibiotalar. lig

Gastrocnemius
- Seldom treated
- Treat prior to any underlying FDL, FHL and post. tib pathology
- Or
- Take out of equation by bending knee

Soleus
- Treat prior to any underlying FDL, FHL and post. tib pathology
- Pt positioned quadruped to remove gastroc tension and isolate
- Treat gastroc prior which lays overtop
- Common area of dysfunction is musculotendon junction

Posterior Tibialis
- Strongest and deepest central calf muscle
- Key ankle and foot stabilizer, supports medial arch
- Produces inversion and plantar flexion
- Originates on medial borders of tib/fib, inserts of cuboid/cuneiform/base of 2nd-4th metatarsals
- Patient is prone, knee flexed and ankle in PF
- Place contact on the portion of the ms to be treated, press through the soleus and draw tension proximally on the TP
- Maintain or increase tension & move the ankle into DF
- NOTE: Gastroc/Soleus must usually be treated first

Flexor Digitorum Longus
- One of deepest tissues in calf region
- Often involved in 'shin splints' and compartment syndrome
- Tissue becomes fibrous, increasing tension and likelihood of re-injury
- Begin sidelying, toes flexed and ankle in PF
- Place the contact on the portion of muscle to be treated, press through the soleus and draw tension proximally.
- Maintain or increase tension & move the ankle into DF and the toes into extension.
- Attachment on the posterior tibia will usually exhibit the most serious problems.
**Flx Hallucis Longus**
- If shortened, may alter push off and increase pronation during gait cycle
- Increases forces required for stabilization
- Originates at interposterior body of fibula, inserting on DIP of 1st digit
- Prone position, first toe in flexion and ankle in PF
- Place contact on the portion of the muscle to be treated, press through soleus and draw tension proximally
- Maintain or increase tension and move the ankle into DF and the toe into extension
- NOTE: Gastroc/Soleus must usually be treated first
- Or treat in quadruped position to relax

**Posterior Ligaments**
- Posterior Tibiotalar Lig.
  - Identification of tissue is paramount
  - Begin seated & plantar flexed
  - Contact posterior to flex tendons on posterior process of the talus and draw tension along the leg anteriorly
  - Maintain or increase tension and move ankle into DF
  - NOTE: contact should be anterior to extensor tendons.
- Posterior Talofibular Lig.
  - Seated and ankle in PF
  - Line of tension is oblique compared to vertical orientation from above
  - Start on posterior fib and move directly behind
  - Maintain or increase tension and move ankle into DF

**Why doesn’t it stick?**
- a. Reflexive Treatment
- b. Treated wrong tissue
- c. Irreducible block
- d. Mobility without Stability = Instability

**Arthrokinematic Restrictions**

**Manual Therapy Techniques**

**When the foot is inverted beyond its normal range, the fibula is wrenched forwards on the tibia at the inferior tibiofibular joint resulting in a positional fault**

**Mulligan Approach**

**Fibular Position in Individuals with Self-Reported Chronic Ankle Instability**
Hubbard TJ, Hertel J, Sherbondy P. Journal of Orthopaedic & Sports Physical Therapy
- ASSESSING DISTAL FIBULA POSITION WITH FLUOROSCOPY
  - distance from anterior margin of lateral malleolus to anterior margin of medial malleolus
  - A smaller distance equals a more anteriorly positioned distal fibula

**RESULTS**
- Fibula was positioned more anteriorly in the chronically unstable ankles (p<.05)
- Involved Side 14.8 +/- 3.1 mm
- Uninvolved Side 16.8 +/- 3.4 mm
- Agreement with Mavi et al. measuring with MRI
Anterior Positional Fault of the Fibula After Sub-Acute Lateral Ankle Sprain
Hubbard TJ, Hertel J.

RESULTS
- Fibula was positioned more anteriorly in the recently sprained ankles (p=.008)
- Involved Side 14.2 +/- 3.4mm
- Uninvolved Side 17.1 +/- 3.2mm

Manipulation Method for the Treatment of Ankle Equinus
Dananberg HJ, Shearstone J, Giuliano M.

RESULTS
- Manip increased DF more than 5 degrees; opposed to stretching 5 min/day for 6 months which showed 2.7 degree change in DF

Posterior talar glide restricted 12 weeks after ankle sprain

Conclusion:
1. Talocrural arthokinematics altered
2. Restriction may persist after DF has returned
3. Consider treating in rehab

Patients treated with posterior talar mobilization regained DF ROM quicker after ACUTE sprain
Green et al, Phys Ther. 2001

Mulligan’s MWM significantly increased DF initially in subacute ankle sprains.
Collins et al, Manual Therapy. 2003

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Single application of grade III AP Talocrural Jt mob increased DF ROM after 14 days of immobilization

Talar mobilization immediately increased DF ROM in pt’s with CAI
Vicenzino et al, JOSPT, 2006
**Take Home - Overall**

- What’s the tissue?
- What is the pathology that is affecting that tissue?
- What is the most effective treatment modality?
- Good Tx: Increase Capacity while normalizing Load

**Take Home - Mulligan**

- Patients with previous ankle pathology may have arthrokinematic restrictions
- Joint mobilizations & manipulations should be used with specific treatment goals in mind
- Joint mobilizations should be used as a part of a comprehensive treatment plan that includes therapeutic exercise
- If you don’t assess for restrictions, you won’t find them

**Thank You**

Enjoy the Social tonight

**References**