

## Treating Running Related Foot Pain.

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Encore Sports Medicine Symposium  
July 2017

### OBJECTIVES

- 1) Perform a gait and running analysis to detect and correct faulty movement patterns.
- 2) Use lower extremity soft tissue and neuro mobilization techniques to address symptoms related to muscle stiffness and adverse neural tension.
- 3) Piece together an exercise program to improve strength and endurance including eccentric loading, circuit training and gait retraining.

### WHAT IS "ADVANCED"?

- An expert does the basics well
- "Secret ingredient" = clinical decision-making
- Consider:
  - Ways to adapt techniques & reinforce with your HEP
  - How you screen regions above and below
  - How you prioritize impairments
  - How you blend with exercise and education
  - "Active Constructive" Communication (enthusiastic support)

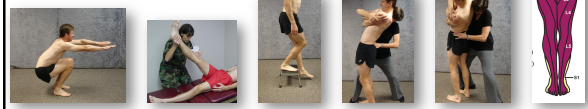
Simple is not always so simple.

### ASSUMPTION



#### A LQ screening exam & other key tests/measures should have already been included as indicated:

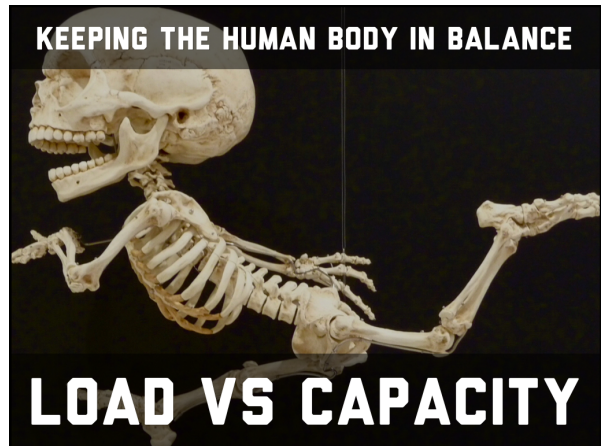
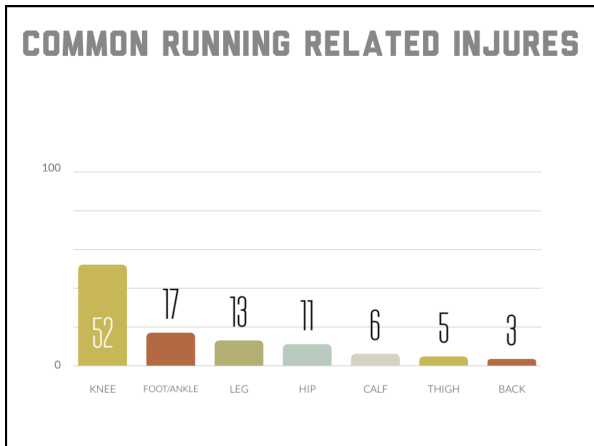
- History & Pain Assessment (description, where, NPRS scores)
- Observation, Postural Exam
- Functional Tests (Gait, Squat, Step Up/Down, Cross legs, Jump, Hop, Walk, Run, Etc)
- Neuromotor Screen & Vascular Screen to LEs
- Lumbar Clearing Exam (flexion, extension, quadrants, + overpressures, accessory glides from T/L junction down)
- Screening of hip, knee, ankle/foot ROM with overpressures
- Neurodynamics assessment

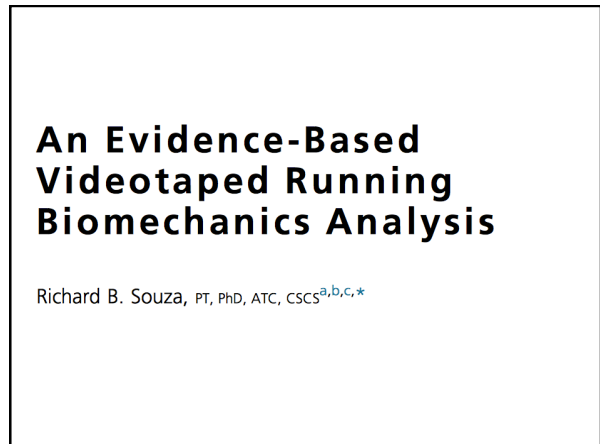
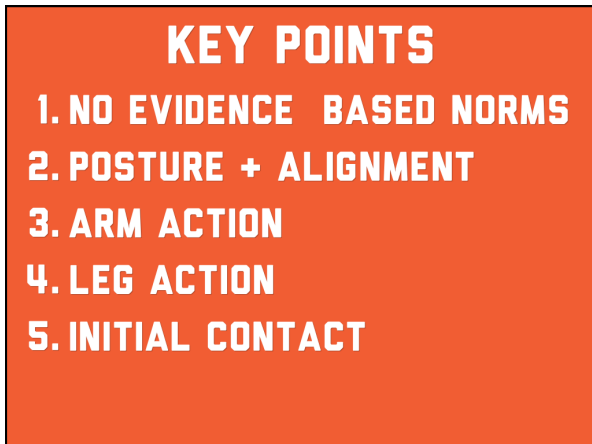
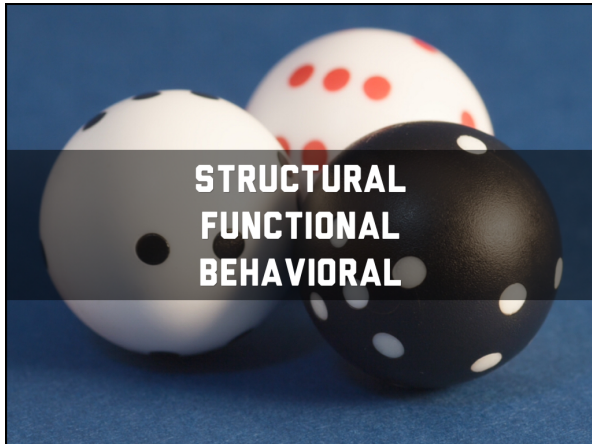




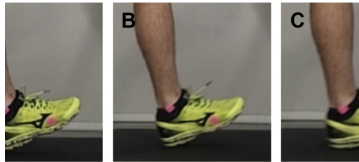
**Evidence Review**

- Epidemiology
- Biomechanics
- Current trends





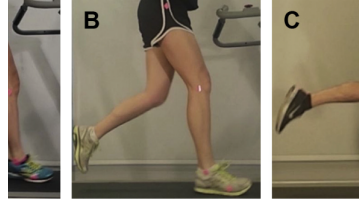
TERMINAL SWING > INITIAL CONTACT > LOADING RESPONSE



phases of running. (A) The end of terminal swing is identified from the treadmill, just before initial contact. (B) Initial contact when the foot hits the ground. (C) Loading response which the runner's weight is being transferred onto the foot in the presence of shoe deformation.

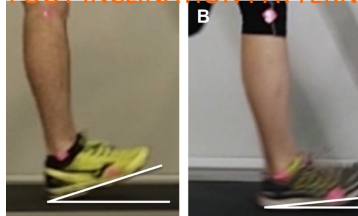
KEY PHASES OF GAIT

FOOT STRIKE PATTERN



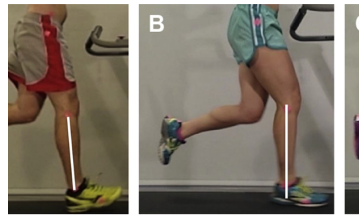
strike patterns. (A) Forefoot strike. (B) Midfoot strike. (C) Heel strike.

FOOT INCLINATION PATTERN



Foot inclination angle. (A) A relatively high foot inclination angle in contact with the ground. (B) A relatively low foot inclination angle.

SIDE VIEW



Tibia orientation. (A) Extended tibia. (B) Vertical tibia. (C) Flexed tibia.

SIDE VIEW

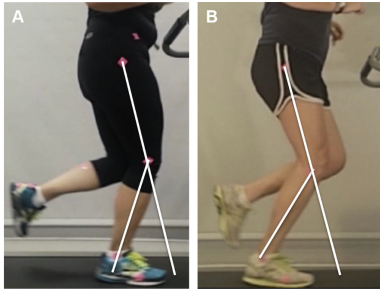


Fig. 5. Knee flexion during stance. (A) A runner demonstrating limited knee flexion during stance and (B) a normal amount of knee flexion during stance.

**SIDE VIEW**

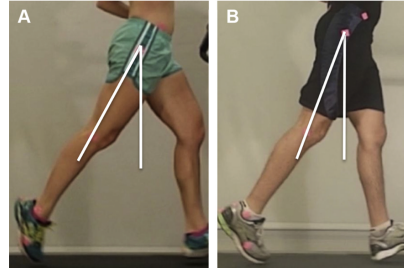


Fig. 6. Hip extension during late stance. (A) Runner with normal hip extension. (B) Runner with limited hip extension.

**SIDE VIEW**

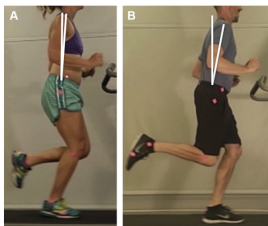


Fig. 7. Trunk lean. (A) A relatively upright trunk posture and (B) a runner a forward trunk lean.

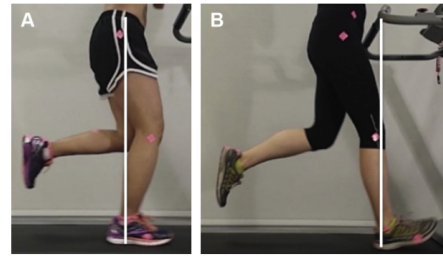


Fig. 8. Overstriding, measured at loading response. (A) A runner demonstrating normal stride mechanics and (B) a runner demonstrating an overstride, characterized by a vertical line through the lateral malleolus falling anterior to the runners pelvis.

**SIDE VIEW**

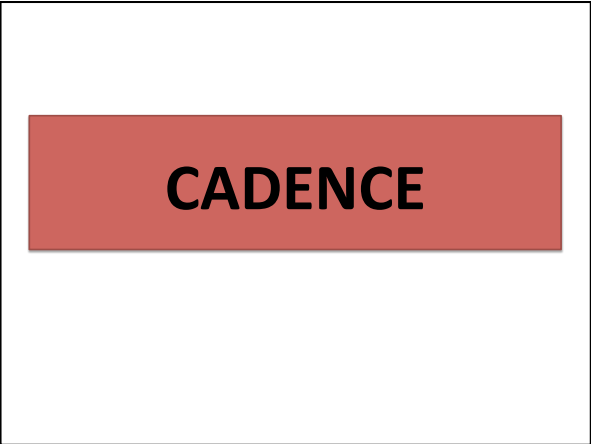
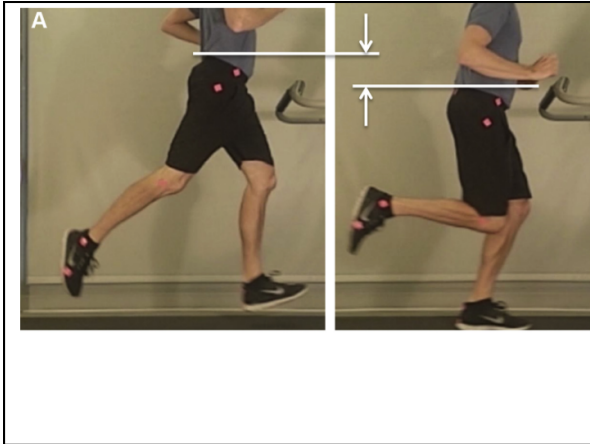


Fig. 10. Heel eversion. (A) A runner with normal alignment of the heel during running and (B) a runner with mildly excessive heel eversion during running.



Fig. 14. Knee window. (A) Normal knee window and (B) "closed" knee window.



Fig. 15. Excessive pelvic drop. (A) At initial contact the runner's pelvis is fairly level and (B)

Milner C. Distinct Hip and Rearfoot Kinematics in Female Runners with a History of Tibial Stress Fractures. JOSPT. 2010;40(2):59-66


- RUNNERS WITH TIBIAL STRESS FRACTURES EXHIBIT GREATER HIP ADD AND REARFOOT EVERSION VS. CONTROLS



**KEY POINTS BAREFOOT RUNNING**

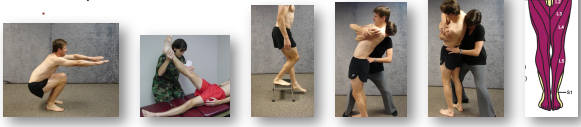

- 1. MIDFOOT STRIKE**
- 2. QUIET GROUND IMPACTS**
- 3. DECREASED STRIDE LENGTH**
- 4. INCREASE STRIDE RATE**

**ASSUMPTION**



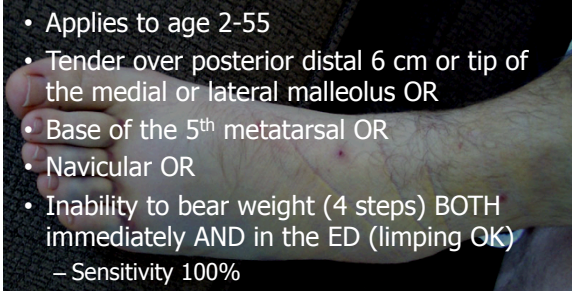
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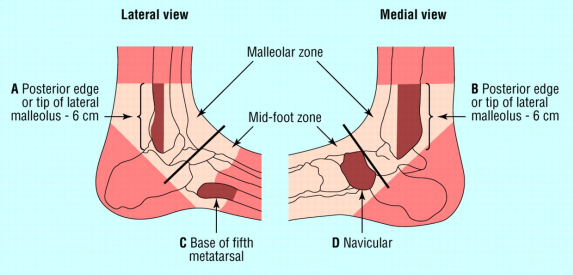



Ottawa Ankle Rules

- Applies to age 2-55
- Tender over posterior distal 6 cm or tip of the medial or lateral malleolus OR
- Base of the 5<sup>th</sup> metatarsal OR
- Navicular OR
- Inability to bear weight (4 steps) BOTH immediately AND in the ED (limping OK)
- Sensitivity 100%



Stiell JAMA 1994, Bachmann BMJ 2003



A series of ankle x ray films is required only if there is any pain in malleolar zone and any of these findings:

- Bone tenderness at **A**
- Bone tenderness at **B**
- Inability to bear weight both immediately and in emergency department

A series of ankle x ray films is required only if there is any pain in mid-foot zone and any of these findings:

- Bone tenderness at **C**
- Bone tenderness at **D**
- Inability to bear weight both immediately and in emergency department



## Manual Physical Therapy and Exercise Versus Supervised Home Exercise in the Management of Patients With Inversion Ankle Sprain: A Multicenter Randomized Clinical Trial

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KRISTIN CARPENTER, DPT<sup>5</sup> • KATHERINE KULP, DPT<sup>6</sup> • JULIE M. WHITMAN, PT, DSc<sup>2</sup>  
*J Orthop Sports Phys Ther* 2013;43(7):443-455.

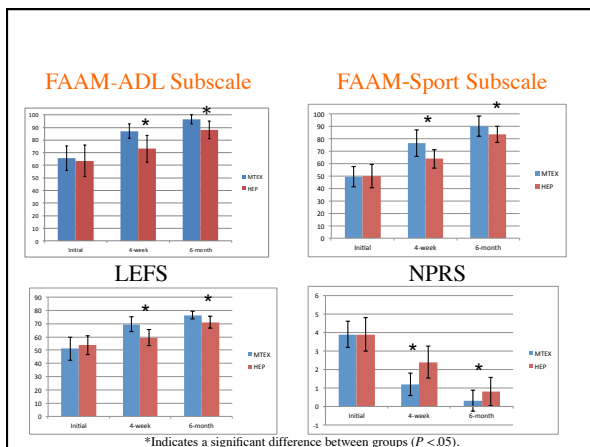
### Objective:

To compare the effectiveness of a manual therapy and exercise approach (MTEX=8 sessions) to a supervised home exercise program (HEP=4 sessions) in the management of individuals with inversion ankle sprain

### Manual Therapy Interventions



Whitman et al JOSPT 2009, Cleland et al JOSPT 2013



## Manual Physical Therapy and Exercise Versus Electrophysical Agents and Exercise in the Management of Plantar Heel Pain: A Multicenter Randomized Clinical Trial

*J Orthop Sports Phys Ther* 2009;39(8):573-585. doi:10.2519/jospt.2009.3036  
Joshua A. Cleland, J. Haxby Abbott, Martin O. Kidd, Steve Stockwell,  
Sheryl Cheney, David F. Gerrard, Timothy W. Flynn



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Is manual therapy and exercise more effective than a traditional approach in the management of heel pain?

- 60 subjects with heel pain
  - (18-60 yrs, LEFS  $\leq$  60 points)
- RCT, 2 groups, 6 visits over 4 weeks:
  - EPAX: traditional approach exercise and modalities
  - MPEX: manual therapy and exercise
- Outcomes:
  - LEFS (MCID = 9)
  - FAAM (MCID = 8)
  - NPRS
  - GRC

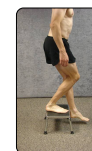


RESEARCH TO SUPPORT THE USE OF MANUAL THERAPY FOR THE ANKLE

Study	Population	Interventions	Outcomes
Green Phys Ther 2001	RCT: N=38, acute sprain	RICE vs. RICE + mob	RICE+Mob group T DP, stride length and speed
Bienhart JGAA 2003	RCT: N=55, acute sprains in ED	RICE, analgesics, crutches vs. Same + Manual Rx	Manual group had sig change in pain, edema and ROM
Coetzer J of Neuromusc System, 2001	RCT: N=50, Gr I-II, acute RCT	RICE + Physiotherapy vs. RICE + Manipulation	Both groups improved in pain, ROM, function, no between group difference
Fellow and Birmingham MJPT, 2001	RCT: N=36, Gr I-II, sub-acute & chronic	Placebo US (5 min) vs. Moirise "Adjustment"	Adjustment group had improved pain, ROM, function
Anderson ACO 2003	RCT: N = 52 with inversion sprain	No intervention vs. TCJ distraction thrust	TCJ group demonstrated change DP, ROM. No difference between groups
Lopez-Rodriguez JMPT 2007	RCT: N = 52 field hockey players with Gr II sprains	TC and talar manip vs. Placebo (setup, no manip)	Significant change in load distribution both in manual group
Taylor JACA 2007	RCT: N = 30 recurrent Gr I-II ankle sprains	1 session distraction manip vs. 6 sessions distraction manip	Decreased ankle DP and joint position sense at 5 weeks in 6 session group
Reid et al. Physio Canada 2007	Randomized cross over: N = 23 sprain in last year with limited DP	WB MWM vs. Sham	Change in WB DP: MWM: .63 cm Sham: .19 cm
Collins Man Ther 2004	Within subjects design N=16 sub-acute Gr II	MWM vs. Placebo MWM	MWM T DP ROM (within session)
Vicenzino JOSPT 2006	Within subjects design N=16, chronic sprain	WB MWM MWB MWM Control	Both MWM resulted in increased WB DP ROM and posterior talar tilt
Dannenberg JAPMA 2000	N = 22 patients with ankle sprain	All received manipulation to TCJ and Posterior tib/fb.	Average increase DP 5 degrees

FUNCTIONAL QUICK TESTS

- Patient demonstrates activity that causes symptoms or therapist identifies functional activity that is problematic
- Frequent 'functional quick tests for the LE
  - Step-Up, Step-Down, Squat (double, single)
  - Jump, hop, walking (fwd/back), running
  - Cross legs (FABER vs Flex/Add)
  - Y Balance Testing
- Assess quality, ROM, pain (0-10), symptom location
- Use for:
  - Re-assessment after interventions ('test/retest')
  - Differential diagnosis of primary pain generator



## FOOT & ANKLE EXAMINATION

### Standing

- Observation & lumbar clearing exam
- Functional test (“Show me what causes your pain”)



### Sitting or Supine

- AROM (+/- overpressure)
- Resisted Tests
- As Indicated:
  - Neurological Screen, adverse neural dynamics assessment, knee clearing, palpation, hip clearing, special tests



## REARFOOT DISTRACTION THRUST MANIPULATION

- Grasp the dorsum of the patient's foot with interlaced fingers
- Provide firm pressure with both thumbs in the middle of the planar surface of the forefoot
- Engage the restrictive barrier by dorsiflexing the ankle & applying long axis distraction
- Pronate & dorsiflex the foot to fine-tune the barrier
- Apply a high velocity, low amplitude thrust in a caudal direction



## TALOCRURAL JOINT *ANTERIOR TO POSTERIOR GLIDE IN SUPINE*

- Use your left hand to firmly stabilize the lower leg at the malleoli
- Grasp the anterior, medial, and lateral talus with your right hand
- Apply an anterior to posterior oscillatory mobilization force to the talus

### Tip:

- Use your thigh to help stabilize the foot and to progressively increase the amount of ankle dorsiflexion used with this technique
- You may need to adjust the amount of supination / pronation to optimize the technique



## TALOCRURAL JOINT (TCJ) & SUBTALAR JOINT (STJ) *EVERSION/LATERAL GLIDES*

### TCJ Lateral Glide


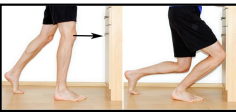
- Grasp the malleoli just proximal to TCJ with your left index/thumb and use your forearm to stabilize the patients left leg against table
- Place your right thenar eminence on the talus just distal to malleoli and grasp the rearfoot
- Use your body to impart a mobilizing force through your right arm and thenar eminence to the medial talus

### STJ Lateral Glide

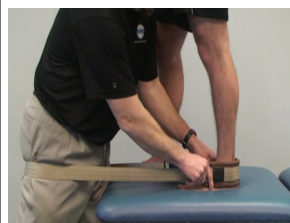
- Shift your left hand/forearm distally and grasp the talus with left index/thumb
- Place your right thenar eminence on the patients medial calcaneus and grasp the rearfoot
- Use your body to impart a mobilizing force through your right arm and thenar eminence to the medial calcaneus



## SELF-MOBILIZATION DORSIFLEXION & EVERSION

Ankle Eversion Self Mobilization	<ul style="list-style-type: none"> <li>Stabilize your leg with your arm as shown.</li> <li>Your stabilizing hand should wrap around the very end of your leg, just above your ankle.</li> <li>Use your other hand to grasp the back part of your foot and push towards the floor.</li> </ul>	<p>Perform in an on-off fashion for 30 seconds, repeat three times. Can also use sustained holds.</p> 
Dorsiflexion Self Mobilization	<ul style="list-style-type: none"> <li>The foot/ankle you are stretching should be placed in front of the other as shown.</li> <li>Make sure that your foot is pointed straight forward. Bring your knee forward toward the wall while "driving" the heel down and back.</li> <li>Keep your heel in contact with the floor at all times.</li> <li>You should feel a stretch deep in the back part of the ankle.</li> <li>If you feel a "pinch" in front of the ankle, try rolling your foot outward (unweight the great toe) to minimize the "pinch" and maximize the stretch.</li> </ul>	<p>Perform in an on-off fashion for 30 seconds, repeat three times. Can also use sustained holds.</p> 

## DORSIFLEXION MWM IN STANDING



- Place a belt over the posterior distal leg of the patient and around the clinician's buttock region
- Grasp and support the arch of the foot
- Apply a stabilizing force over the anterior talus
- Guide the patient into dorsiflexion while simultaneously producing a posterior to anterior force to the distal leg by leaning backwards/ pulling on the belt
- Adjust the forces, direction of motion, and stabilization until the patient experiences a pain-free motion of ankle dorsiflexion
- Reassess after mobilization

## Patient Assisted Stretching "Pin & Stretch"



- PRINCIPLE-** Therapist uses his/her hands to target specific areas of muscle tightness and uses patient assistance to increase ROM.
- TECHNIQUE**
  - Place the muscle on slack.
  - Place a firm grip around the proximal muscle belly of the Gastroc
  - Have the patient actively go into the ankle dorsiflexion while you hold the gastroc
  - Repeat 2-3 contractions.
  - Move your hands more distal on the muscle belly, placing greater pressure over the area deemed most restricted or fibrotic.


## CUBOID MANIPULATION




- Place the tips of your thumbs over the plantar & medial aspect of the cuboid
- Translate the foot in a caudad and lateral direction while simultaneously ulnarly deviating your right hand
- Ensure that you create the fulcrum of motion and approach the restrictive barrier at the cuboid
- Once at the restrictive barrier, apply a high velocity, low amplitude manipulative thrust in a sweeping J like motion (plantar flexion & varus)

### 1<sup>ST</sup> METATARSAL JOINT MOB/MANIP

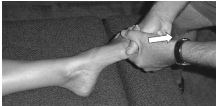
Multi-directional Thrust & Non-Thrust Mobilization/ Manipulation



Distraction Non-Thrust Manipulation



Distraction Thrust Manipulation



### SESAMOID MOBILIZATIONS



- Proximal to distal mobilization of sesamoids
- Distal hand stabilizes hallux and distal foot, proximal thumb contacts on sesamoids and performs oscillatory mobilization force.


### PLANTAR FASCIA SOFT TISSUE MOBILIZATION & STRETCHING







### Plantar Fascia Specific Stretching


- Bedside in AM & after periods of inactivity
  - Patient places involved leg over other knee



Step 1: Grasp ball & dorsiflex 15-20 times



Step 2: Extend toes & dorsiflex 15-20 times



Step 3: Maintain stretched position & massage

DiGiovanni et al. *J Bone Joint Surg Am.* 2006;88:1775-1781.  
DiGiovanni et al. *J Bone Joint Surg Am.* 2003;85-A:1270-1277.

## Short Foot Exercise

Prentice, 2009

- Short foot exercise is performed to activate the intrinsic muscles by pulling the metatarsal heads toward the heel while the long toe flexors are relaxed (vs. curling the toes)

How to perform the short foot exercise:

Step 1: Sit in a chair with both feet placed flat on the floor

Step 2: Raise the arch of your foot by sliding your big toe toward your heel without curling your toes or lifting your heel

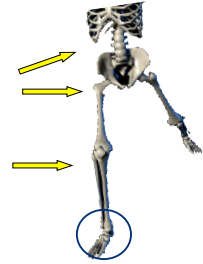


(a)

(b)

## Summary: Manual Therapy for Ankle & Foot Disorders

- Moderate-high quality evidence for the use of MT
- MT should complement other evidence based interventions.
- Consideration of Regional Interdependence
- If there is impaired joint mobility, assess, treat and reassess!
- As Tim Flynn says "Move It and Move On!"



## Dynamic Warm Up

- Leg Swings AP, ML x 20 each
- Knee Hugs
- Groin Walks
- High Kicks

## Gambetta Leg Circuit

- All reps 1 per second
- 20 Squats
- 10 Lunges
- 10 Scissor Jumps
- 20 Ankle Pogos

## Dumbbell Complex

- 5 Reps, 5 Sets, 1-10 lbs. , Inter & Intra Rest
- Upright Rows
- Push Press
- Squat
- Bent Over Rows
- Push Ups

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