Trigger Point Therapy of the Lower Extremity

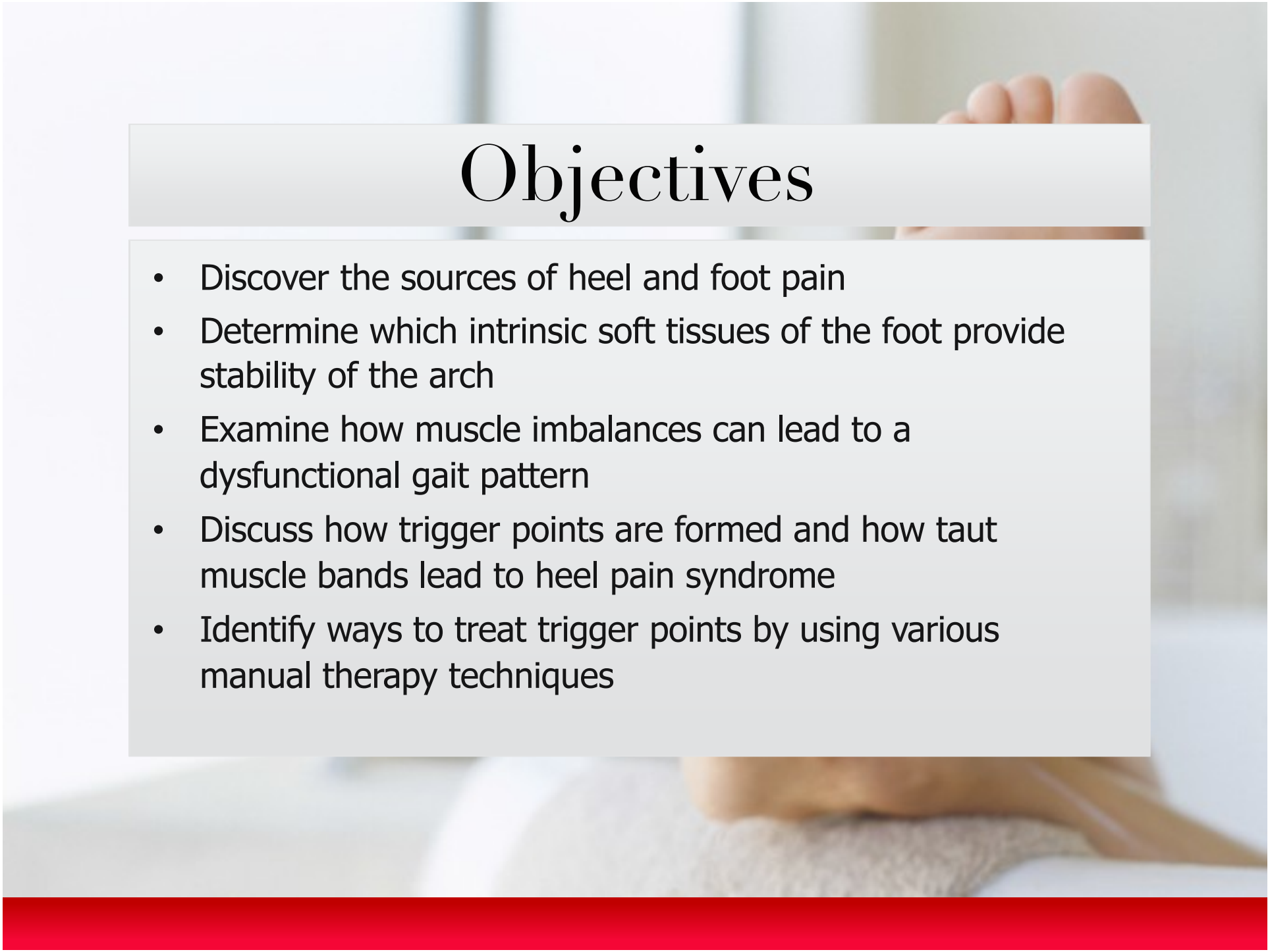
Heel and Foot Pain

Thomas Bertoncino, PhD, ATC

Introduction

- Dr. Tom Bertoncino (tom.bertoncino@park.edu)
  - Pittsburg State University (Bachelor's)
  - Kansas University (Master's and Doctorate)

- Professional Experience
  - Athletic Trainer, Pembroke Hill High School
  - Athletic Trainer, HealthSouth Rehabilitation
  - Head Athletic Trainer, Park University
  - ATProgram Director, Park University
  - Department Chair of AT, Park University
  - Associate Professor, Park University



Objectives

- Discover the sources of heel and foot pain
- Determine which intrinsic soft tissues of the foot provide stability of the arch
- Examine how muscle imbalances can lead to a dysfunctional gait pattern
- Discuss how trigger points are formed and how taut muscle bands lead to heel pain syndrome
- Identify ways to treat trigger points by using various manual therapy techniques

Sources of Heel and Foot Pain

"Heel pain is the most common foot problem and affects 2 million Americans every year."

(New York Times, 2012)

Sources of Heel and Foot Pain

"Heel Pain Syndrome" occurs from:

- Sudden increase in activity
- Repetitive stress, impact on the foot
- Inadequate flexibility in the foot & calf muscles
- Biomechanical dysfunction (i.e. over pronation)
- Lack of arch support
- Worn out shoes
- Obesity
- Too much time on the feet
- **Referred Pain from TRIGGER POINTS!**

Sources of Heel and Foot Pain

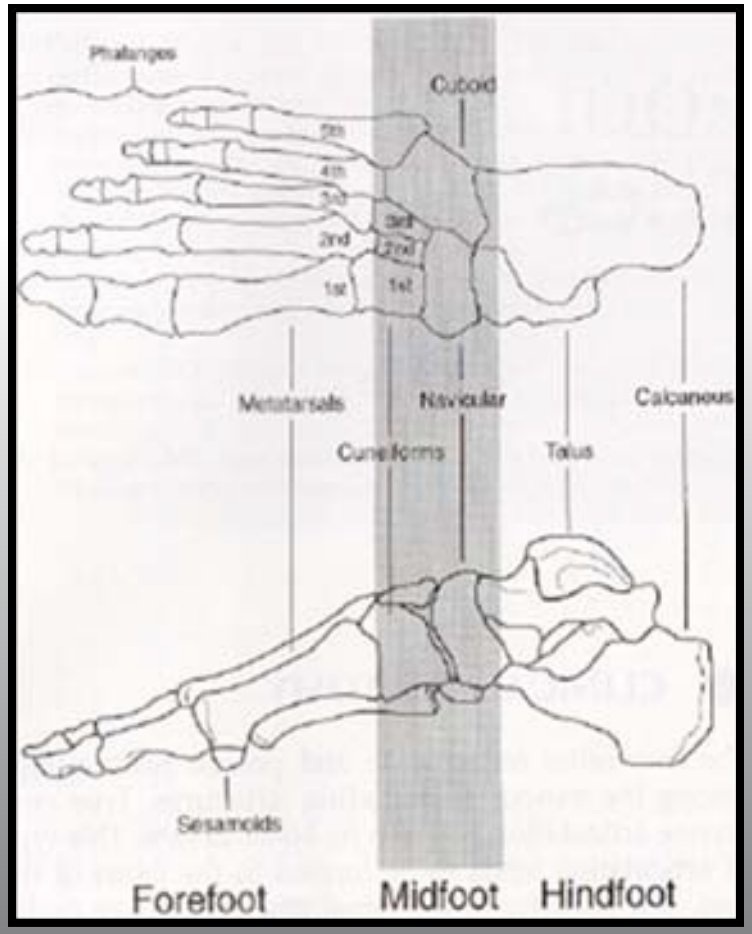
Description of Pain

- Heel and foot pain typically present as a cramping, tight or sharp pain that develops along the medial longitudinal arch and at the insertion of the fascia and intrinsic muscles of the medial calcaneal tuberosity.

Stability of the Foot

Regions of the Foot

- Rearfoot
  - ✓Calcaneus
  - ✓Talus
- Midfoot
  - ✓Navicular
  - ✓Cuneiforms
  - ✓Cuboid
- Forefoot
  - ✓Metatarsals
  - ✓Phalanges
  - ✓Sesmoids



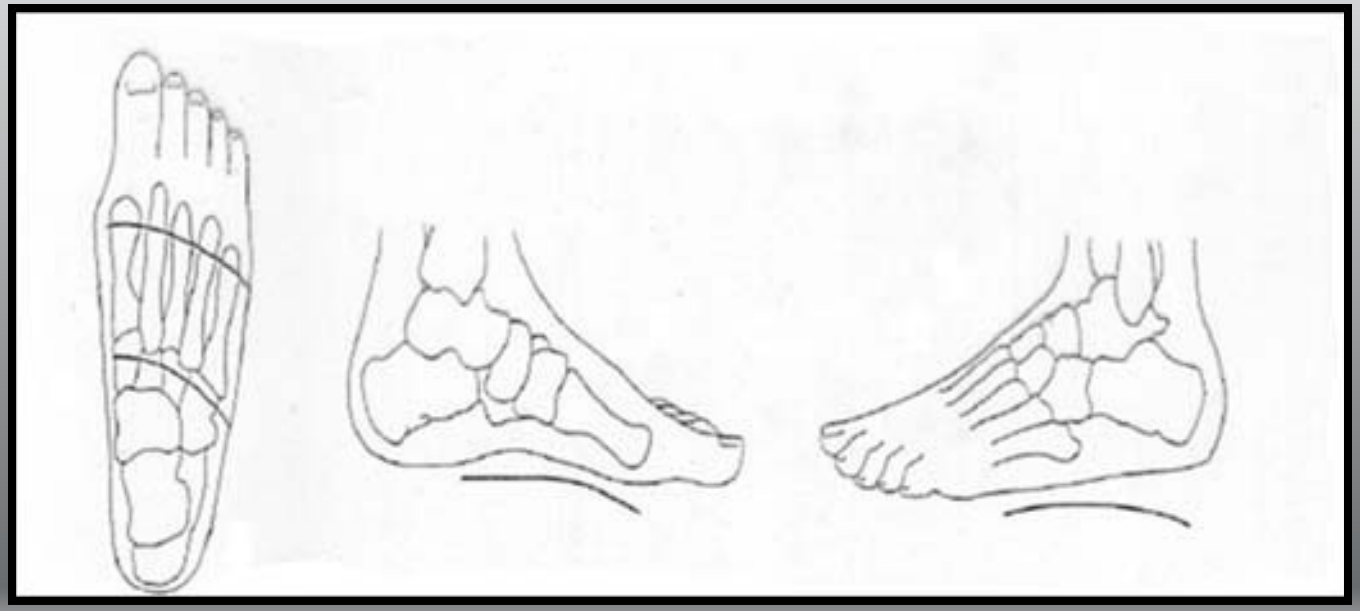
Within these three regions are four arches!

Stability of the Foot

Four Arches of the Foot

- Medial Longitudinal
- Lateral Longitudinal
- Transverse
  - ✓ Tarsalmetatarsal
  - ✓ Metatarsalphalangeal

❖ Basic function of the arch is to provide shock absorption and foot stability during propulsion.



Stability of the Foot

"Muscles of the sole of the foot that support the arches can be divided into four layers." (Bowden et al., 2005)

Superficial Layer

- Flexor Digitorum Brevis
- Abductor Hallucis
- Abductor Digiti Minimi

Third Layer

- Flexor Hallucis Brevis
- Adductor Hallucis

Second Layer

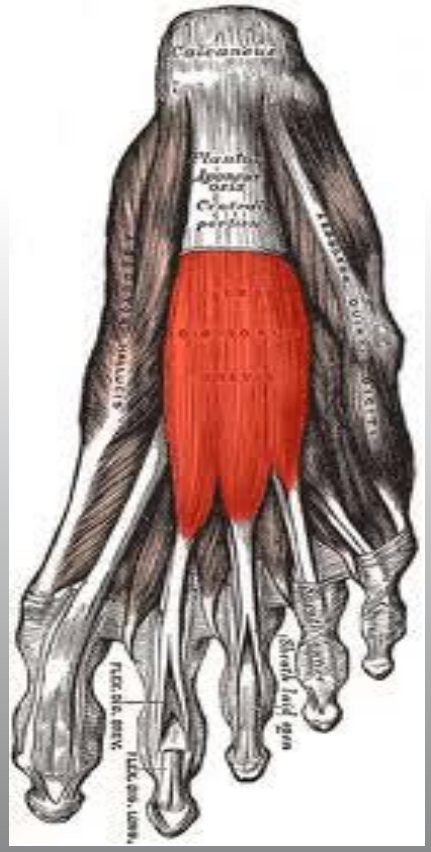
- Quadratus Plantae
- Lumbricles

Fourth Layer

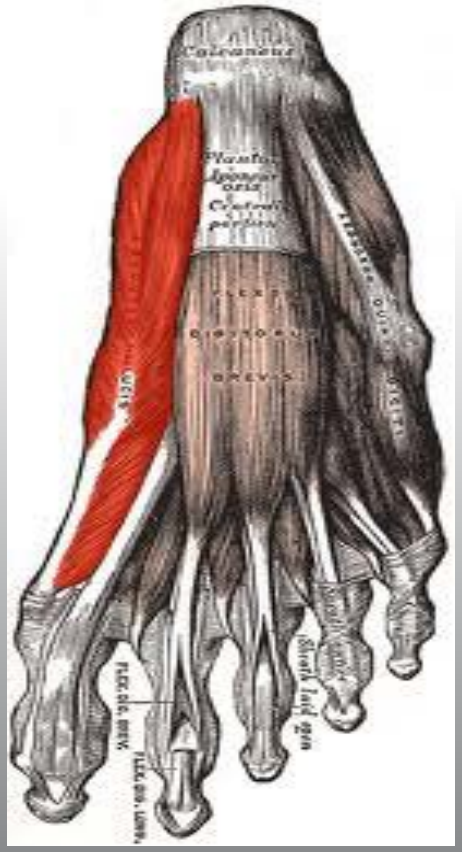
- Flexor Digiti Minimi
- Interossei

Stability of the Foot

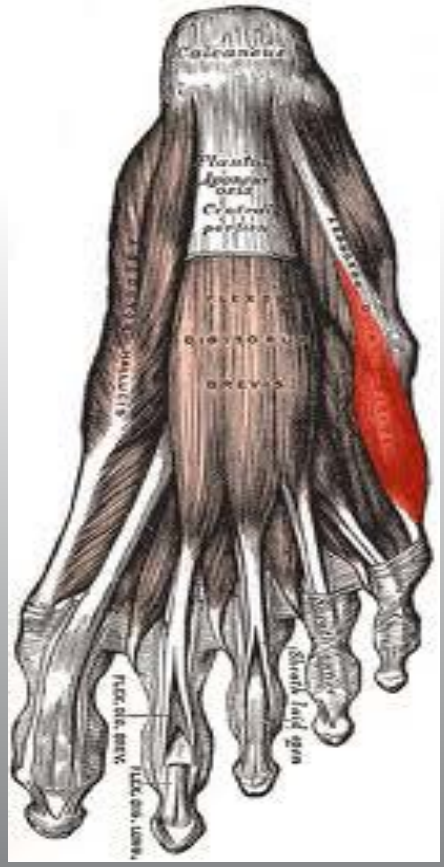
Superficial Layer



Flexor Digitorum Brevis



Abductor Hallucis

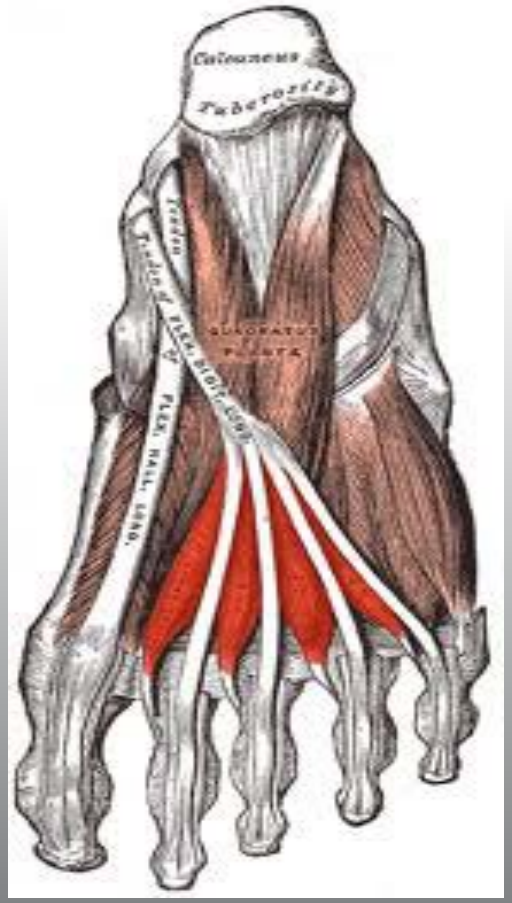


Abductor Digiti Minimi

Stability of the Foot

Second Layer

Quadratus Plantae

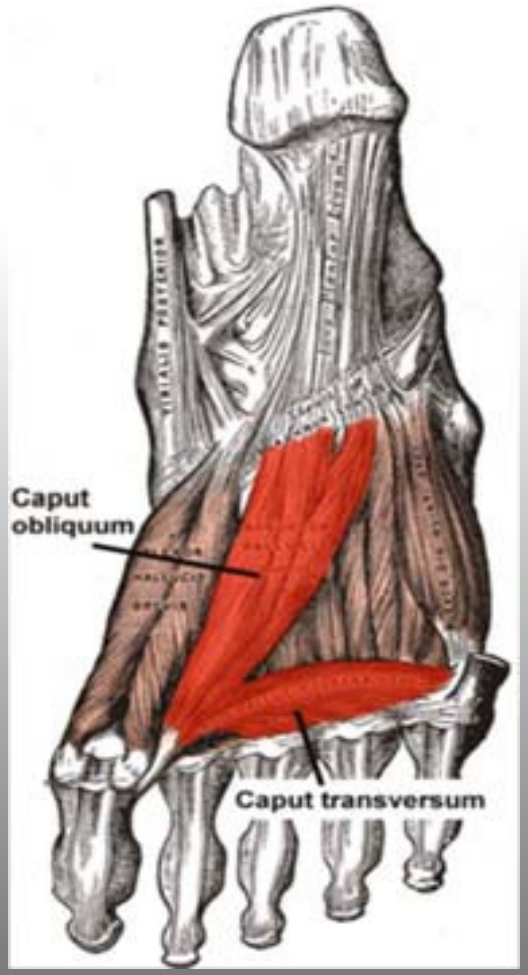


Lumbricles

Stability of the Foot

Third Layer

Flexor Hallucis Brevis

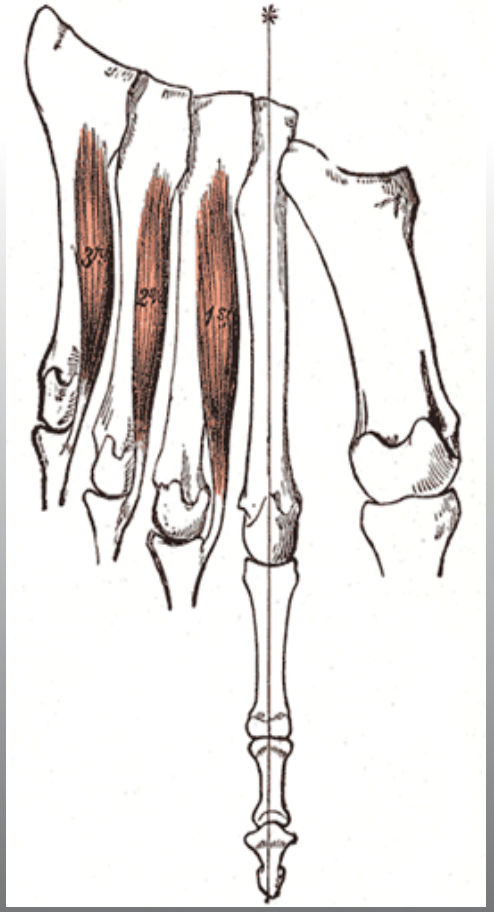


Adductor Hallucis

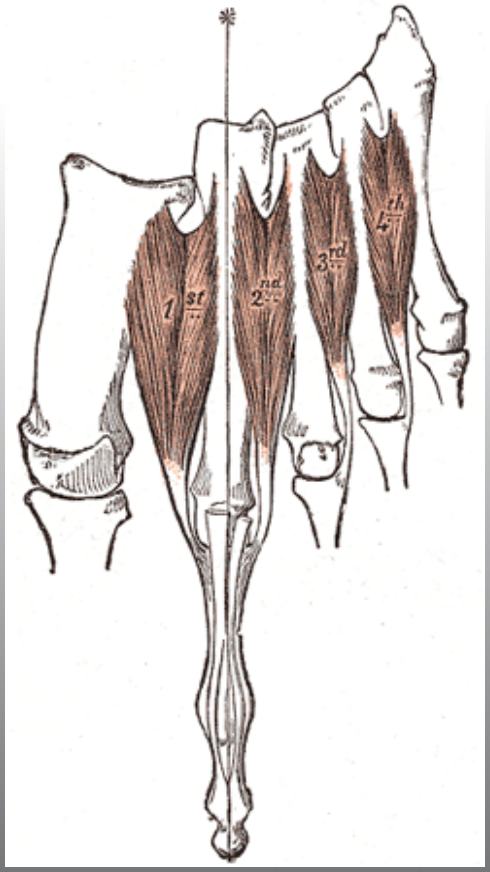
Stability of the Foot

Fourth Layer

Flexor Digiti Minimi



Plantar Interossei

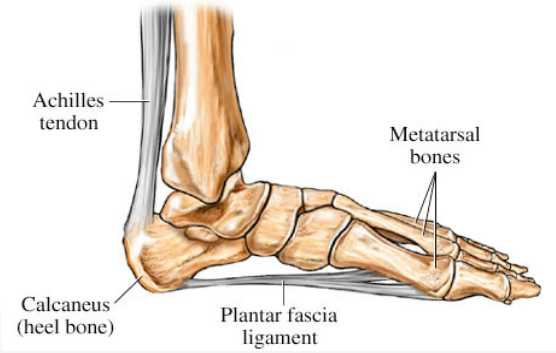


Dorsal Interossei

Stability of the Foot

Plantar Fascia

- Gives shape to the arch by forming a "truss" with calcaneus, midtarsals, and metatarsals.
- This "truss" prevents the spreading of the calcaneus and the metatarsals to maintain the medial arch.
- Creates a "windlass mechanism" during weight bearing. During toe off, toes extend and the plantar fascia pulls the calcaneus forward and lifting the arch even more to give more stability.



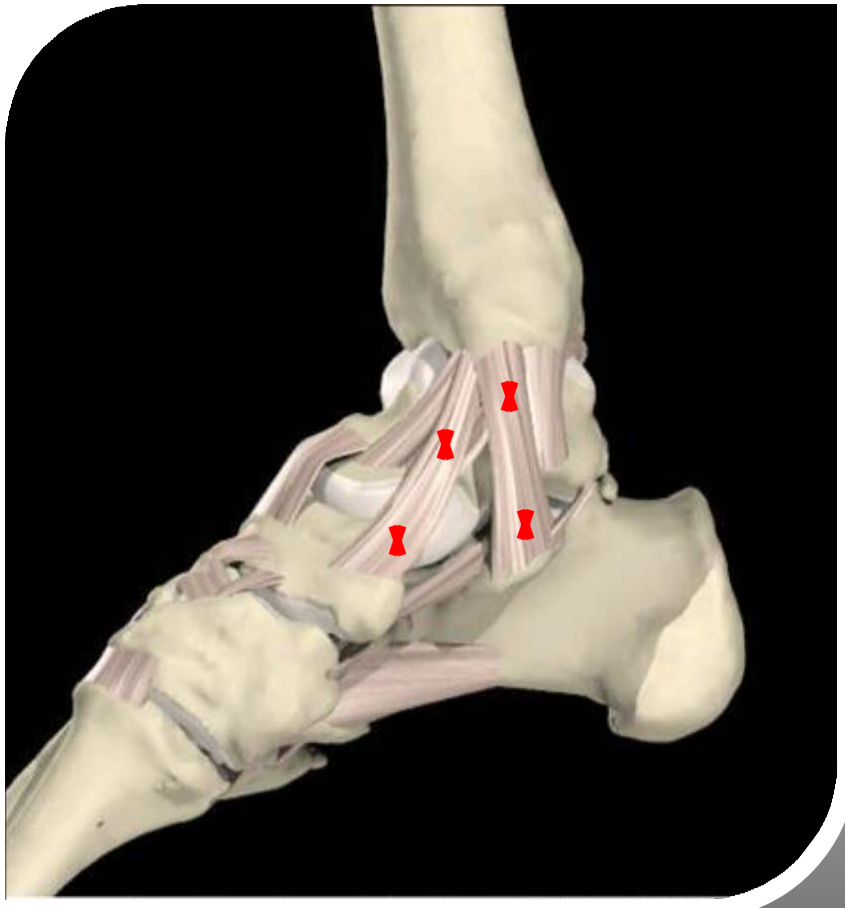
Stability of the Foot

Other soft tissue that supports the arch

- Deltoid Ligament
- Plantar calcaneonavicular "Spring" Ligament
- Short Spring Ligament
- Intermetatarsal Ligaments

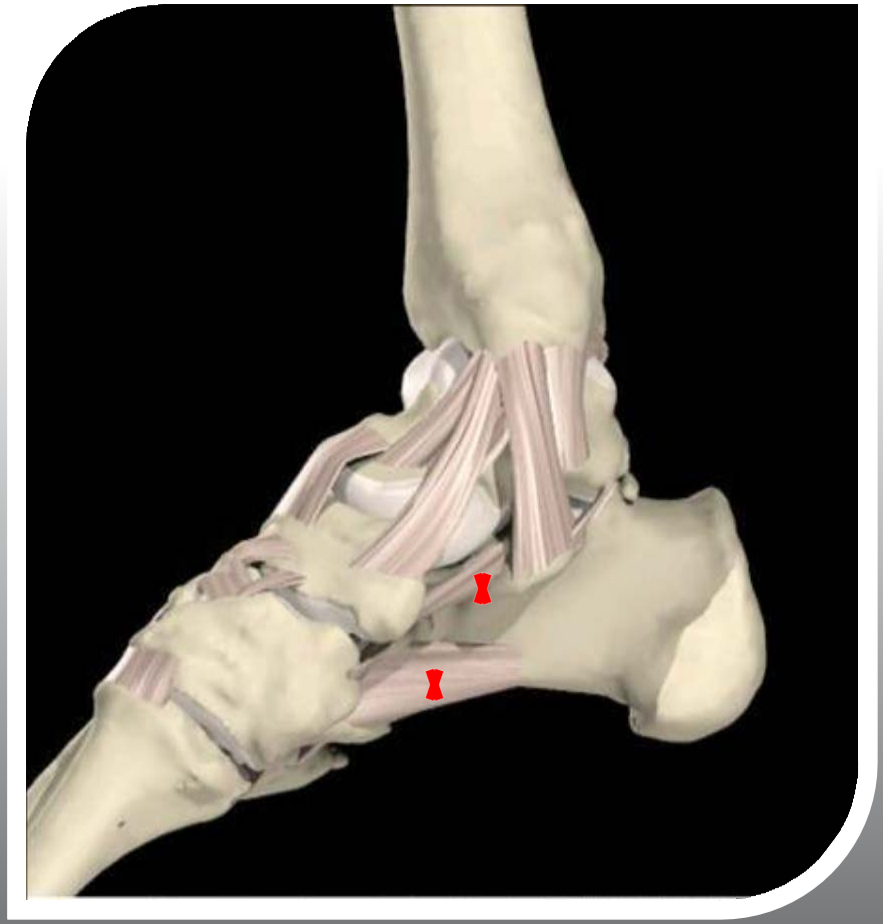
Stability of the Foot

- **Deltoid Ligament Complex**
  - ✓Anterior Tibiotalar
  - ✓Tibionavicular
  - ✓Tibiocalcaneal
  - ✓Posterior Tibiotalar



Stability of the Foot

- Plantar Calcaneonavicular "Spring" Ligament
- Short Plantar Ligament



Stability of the Foot

- Intermetatarsal Ligaments

Treating heel and foot pain starts with a thorough assessment of the lower extremity!

(Whyte-Ferguson et al., 2005)

- **Inspection of Mechanics**
- **Inspection of Gait**
- **Inspection of Joint and Soft Tissue Restrictions**

Inspection of Foot Mechanics

"Historically, literature attributes plantar fasciitis to excessive pronation, which increases stress applied to medial musculofascial tissue. However, plantar fasciitis with high arches have been reported."

(Bolgla et al., 2004)

Inspect Mechanics

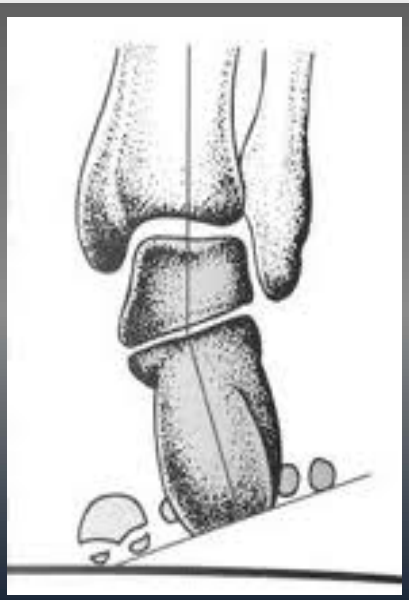
- Forefoot Valgus
- Rearfoot Valgus
- Forefoot Varus
- Rearfoot Varus
- Fick Angle

Inspection of Foot Mechanics

Forefoot Valgus

- With rearfoot in the neutral position, the 5th MT is elevated relative to the 1st MT.

Inspection of Foot Mechanics



Rearfoot Valgus

- The calcaneus is everted relative to the long axis of the tibia and can be associated with a valgus tibial alignment. Rearfoot valgus is rarely observed.

Inspection of Foot Mechanics

Forefoot Varus

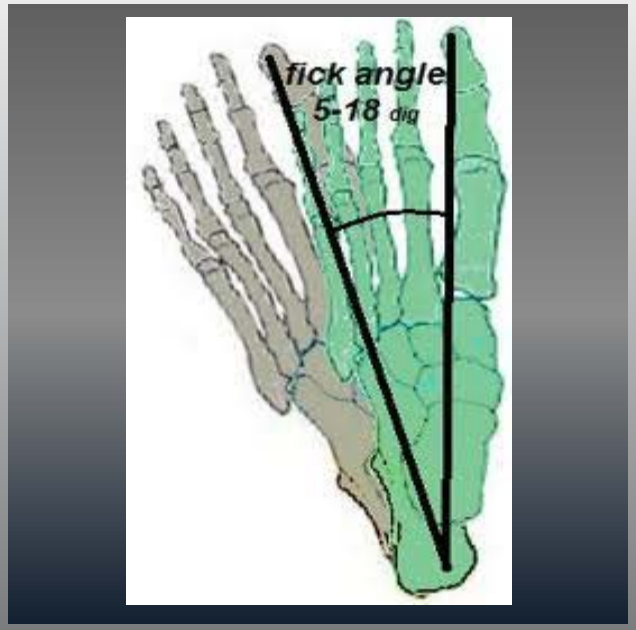
- The rearfoot is in a neutral position, but the 1st MT is elevated relative to the 5th MT.

Inspection of Foot Mechanics

Rearfoot Varus

- The calcaneus is inverted relative to the long axis of the tibia and may be related to a varus alignment of the tibia or calcaneus.

Inspection of Foot Mechanics



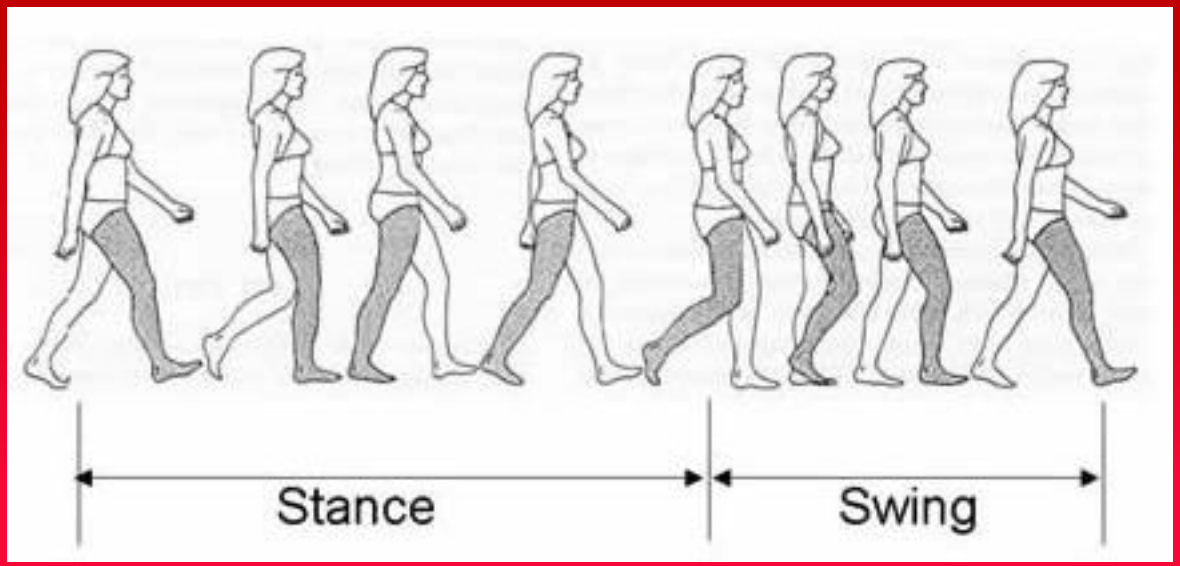
Fick Angle

- The angle of the foot is approximately 5-18 degrees from the sagittal axis of the body

Inspection of Gait

Two Phases of Gait

- Stance Phase
- Swing Phase



Inspection of Gait

Stance Phase

- Heel Contact
- Flat Foot
- Midstance
- Heel Off
- Toe Off

Inspection of Gait

Heel Contact

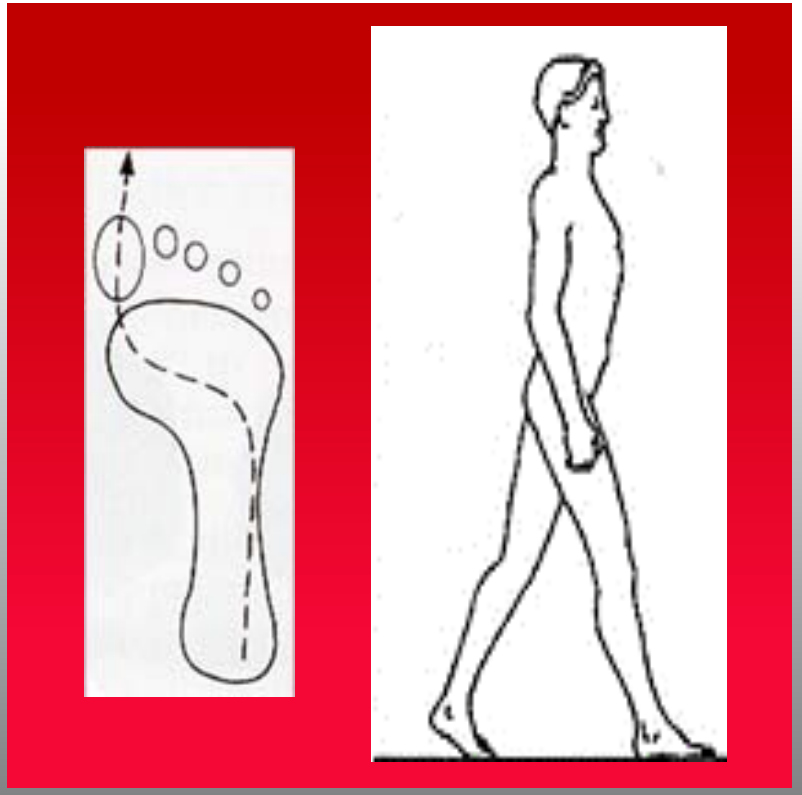
- Begins the instant the foot touches the ground
- Foot is slightly supinated (~5 degrees)
- Opposite leg is ending with toe off

Inspection of Gait

Flat Foot

- Starts when the entire plantar surface of the foot comes in contact with the ground.
- The subtalar joint pronates to unlock the midtarsal joints, allowing the foot to become more flexible.

  "Metatarsal Break"
- During the "Metatarsal Break," weight is directed through the midtarsal region: from the 5th metatarsal, cuboid, navicular, cunieforms and then to the metatarsals.



Inspection of Gait

Flat Foot – Continued

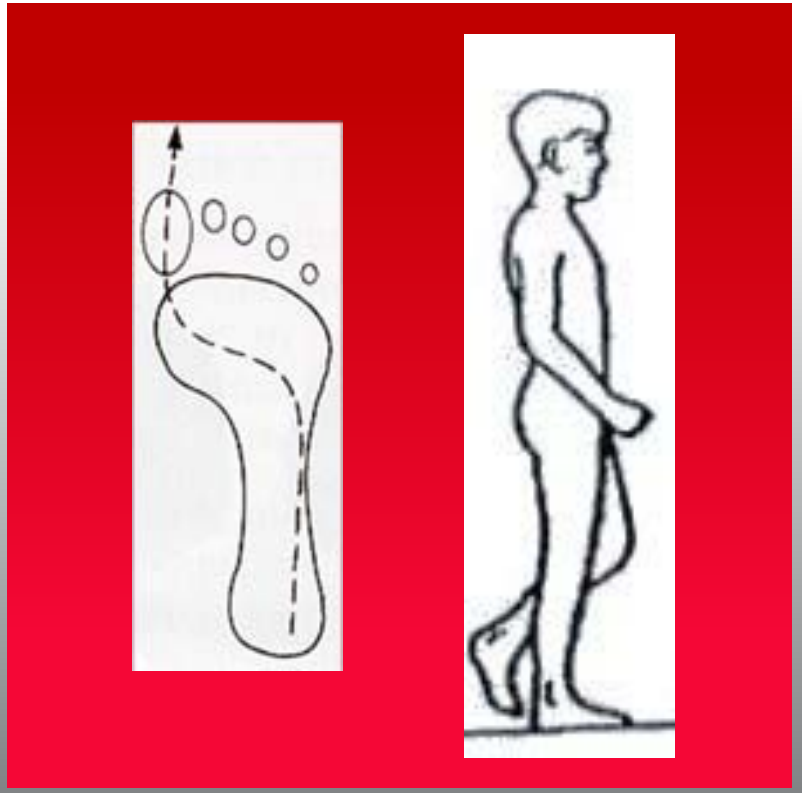
- Also, during pronation the talus slides anteriorly increasing the distance between the calcaneus and metatarsals and applies a tension stress to the plantar fascia.

Inspection of Gait

Midstance

- The point where the body's weight passes directly over the supporting lower extremity.
- The foot starts to slightly supinate back – occurs in the subtalar to prepare for push off.
- During supination, the talus moves posterior into the ankle mortise.
- The "windlass mechanism" begins.

Supination transforms the foot into a rigid lever arm needed for propulsion!



Inspection of Gait

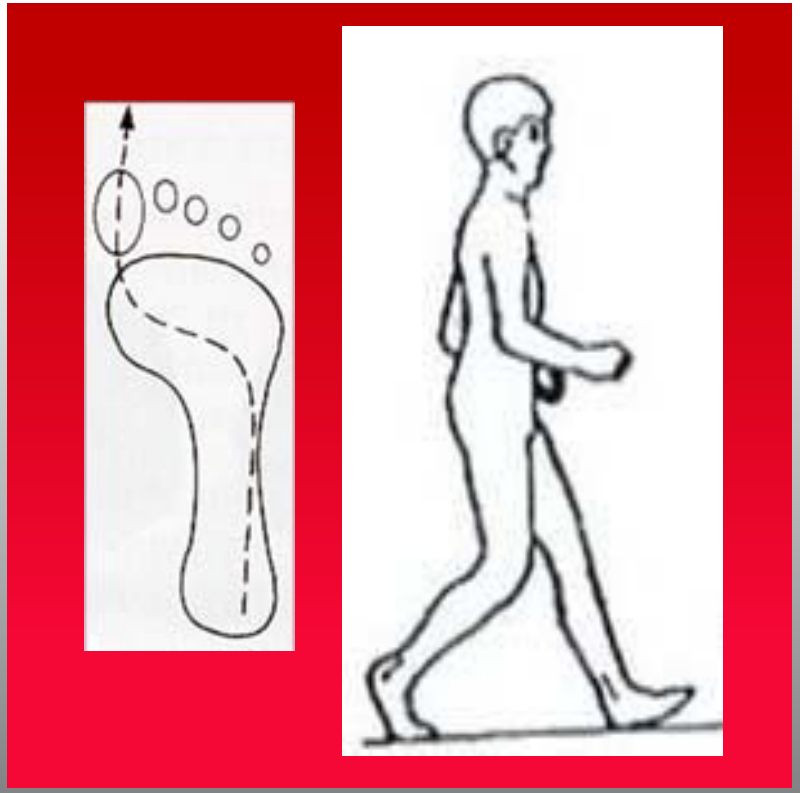
Heel Off

- The instant the heel comes off the ground.
- The body moves ahead of supporting joint.

Inspection of Gait

Toe Off

- Transition period of double support.
- Involves a shift from pronation to slight supination as propulsion is achieved.



"Disorders result if the shift from pronation to supination fails to occur!"
(Whyte-Ferguson et al., 2005)

Inspection of Gait

A lack of shifting from pronation to supination causes:

- Weight-bearing to be placed on the medial aspect of the heel.
- Shearing forces that originate from the medial calcaneal tubercle.
- Eventually, the lack of "toe off" will result in the entire limb to abduct – creating more stress on the medial calcaneal tubercle.
- The fascia and tendons of the intrinsic muscles start to pull away from their calcaneal origin.

Inspection of Gait

WHY?

The excessive pronation or lack of shifting occurs because of shortened muscle groups.

- Intrinsic Foot Muscles
- Triceps Surae

Inspection of Gait

Let's Critically Analyze this Situation!

Normally:

- The triceps surae stretches as the body weight pass over the foot.
  - ✓ For Example: During Midstance
- When the posterior muscle complex reaches its normative reflex length, it contracts and affects heel lift.
  - ✓ For Example: During Heel Off

There is a balance between supination and pronation.
All is Well!

Inspection of Gait

However!!!

- A shortened posterior muscle complex causes the heel to lift much sooner in the gait cycle.
  - ✓ For example: During Flat Foot or Midstance
- A lifting of the heel activates the intrinsic foot muscles to stabilize the foot.
- A lifting of the heel activates the "windlass mechanism" to stabilize the foot as well.

The foot becomes "locked or rigid" much sooner than it should!
It is locked in a pronated position, never moving back into supination,
thus causing medial heel and foot pain!

Inspection of Gait

- When the foot becomes "locked" in this pronated position, the first MPJ does not fully extend for normal toe off. Then, the foot must evert as well as the entire limb must abduct abnormally to accommodate the restriction of motion at the first MPJ.
  - ✓ Stress is placed on the medial side of foot.
  - ✓ Medial weight bearing is de-stablizing which often causes subtalar and midtarsal joints to collapse and create flat feet.
  - ✓ Thereby increasing risk of trigger points and plantar fascia tears.

Inspection of Gait

- As problem continues to persist and pain worsens, the patient will naturally move away from pain.
- They start to walk on the lateral side of foot.
- Walk on toes to avoid heel contact.
- Form calluses on the lateral side of foot.

- All of which further shorten muscles that further place you in eversion.
  - ✓ Lateral intrinsic foot muscles
  - ✓ Peroneal muscles
  - ✓ Biceps femoris
  - ✓ TFL

Inspection of Joint and Soft Tissue Restrictions

Joint Mobility

- ✓ Talocrural joint
- ✓ Subtalar joint
- ✓ Midtarsal joint
- ✓ First metatarsal phalangeal joint

Soft Tissue Mobility

- ✓ Intrinsic foot muscles
- ✓ Triceps surae
- ✓ Peroneals
- ✓ Hamstrings
- ✓ Deep hip rotators
- ✓ TFL

End Feel Restrictions

Abnormal Joint End Feels

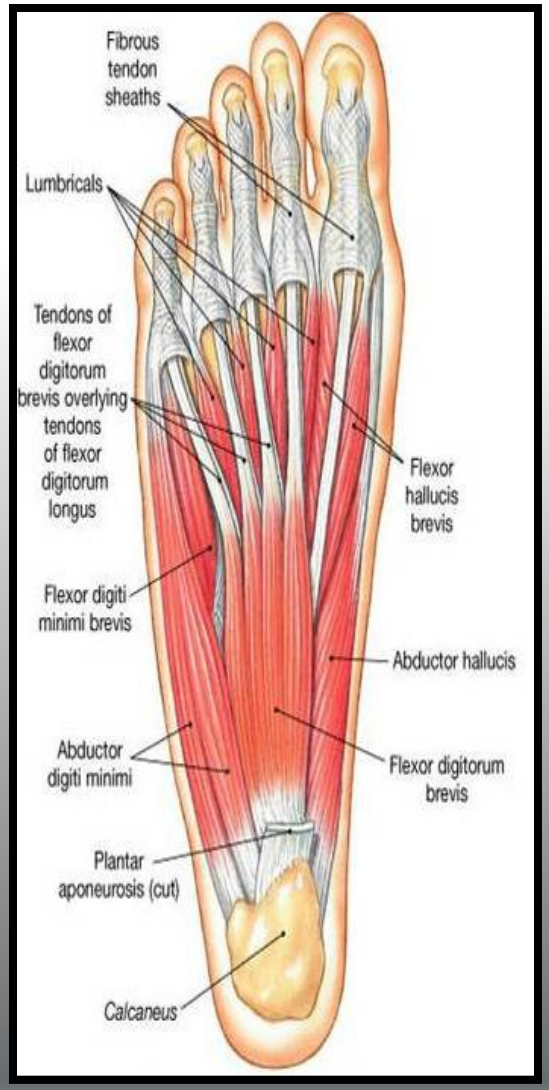
- Muscle Spasm
  - ✓ Caused by movement with a sudden dramatic stop of movement often accompanied by pain.
- Capsular
  - ✓ Very similar to tissue stretch, however, occurs earlier in the ROM and tends to have a thicker feel.
- Bone-to-Bone
  - ✓ Similar to the normal bone-to-bone type but restriction occurs before the end of ROM would normally occur (e.g. osteophyte formation).
- Empty
  - ✓ Detected when considerable pain is produced by movement. Movement cannot be performed because of the pain, although no real mechanical resistance is being detected. (e.g. subacromial bursitis).
- Springy Block
  - ✓ Occurs where one would not expect it to occur; found in joints with menisci. There is a rebound effect.

Treatment of Heel and Foot Pain

- Treatment of **TRIGGER POINTS** often will improve mobility as well as correct gait mechanics.

Treatment of the "locked" foot involves delaying heel lift until later in gait!

(Whyte-Ferguson et al., 2005)



Treatment of Heel and Foot Pain

What are trigger points?

- "Palpable, hyperirritable, tender knots or taut bands in muscles."

(Lo, 2010)

Treatment of Heel and Foot Pain

What contributes to trigger point formation?

- Emotional stress and tension
- Postural strain
- Biomechanical dysfunctions
- Trauma
- Fatigue
- Sleep deprivation
- Prolonged immobility
- Infections

"Initiating factors of trigger point formation include excessive mechanical forces, overload, repetitive loading which damages fibers throughout the muscle."

(Gerwin, 2008)

Treatment of Heel and Foot Pain

Where are trigger points found?

- **Muscle**

  Trigger points in skeletal muscles usually develop at the origins , insertions and bellies of muscles, particularly at the neuromuscular junction.

  (Grace, 2011)

Can also be found in:

- Fascia
- Ligaments
- Tendons
- Periosteum

Treatment of Heel and Foot Pain

Three Types of Trigger Points

1. **Active**
    - Ongoing and persistent muscular pain
    - Tender to the touch
    - Causes pain to be referred to other body parts
    - Leads to muscle weakness and may prevent them from fully stretching
2. **Latent**
    - Only painful when compressed
    - Do not refer pain to other parts of the body
    - Thought to cause of joint stiffness and reduced range of motion as we age
3. **Satellite**
    - Develop at the point of referred pain of an active trigger point
    - For example, an active trigger point in the calf muscles can create leg pain and eventually a satellite trigger point in the referred pain area of the heel

Treatment of Heel and Foot Pain

"Increased tension of the taut muscular bans associated with TrP can maintain displacement stress on the joint. Alternatively, joint hypomobility may reflexively activate TrPs. It is also conceivable that TrPs provide a nociceptive barrage to the dorsal horn neurons and facilitate joint hypomobility."

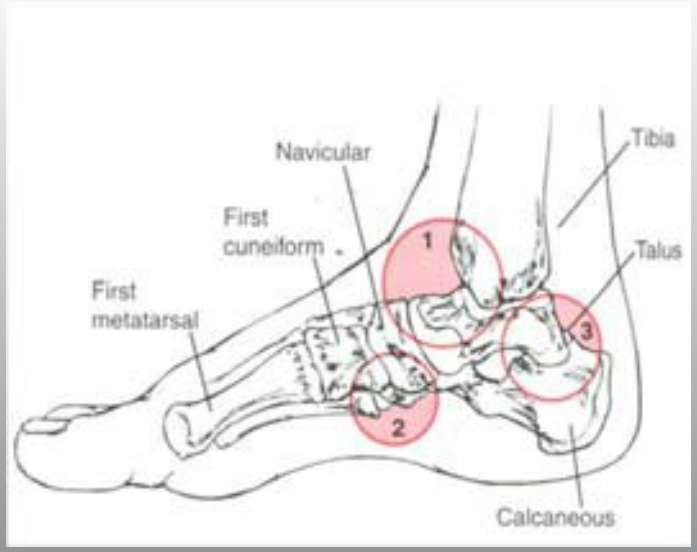
(Penas, 2009)

Treatment of Heel and Foot Pain

- **Start with <u>Joint Mobilization Techniques</u> to realign joints and to correct tissue length.**

Common sites of joint restriction

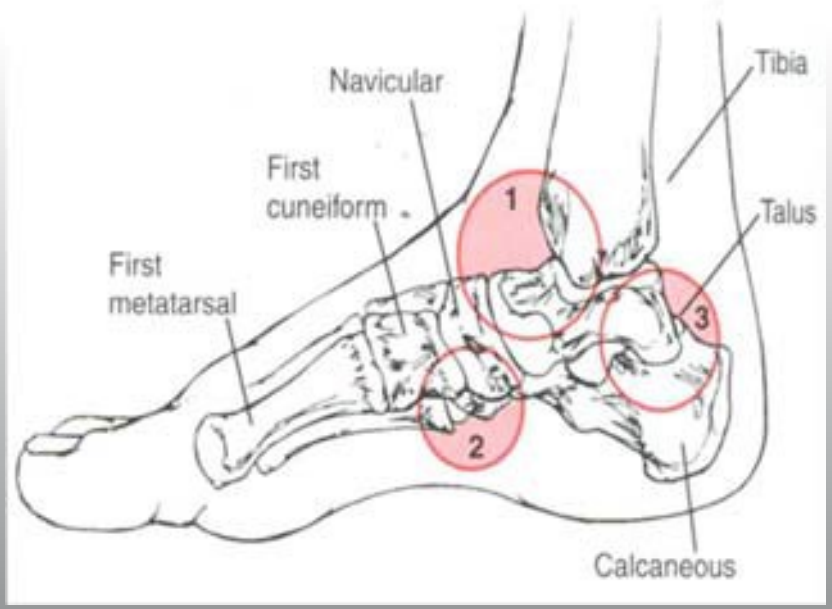
1. Talus may be anterior (reduced posterior glide).
2. Calcaneus may be posterior (reduced anterior glide); hypermobility in a posterior direction increases the tension placed on the plantar fascia and intrinsic muscles.
3. First cuneiform-navicular joint maybe dropped rather than maintaining the normal arch.



Treatment of Heel and Foot Pain

Other joint restricted sites

1. Cuboid – may be dropped
2. Tarsalmetatarsal joint
3. Metatarsalphalangeal joint



Treatment of Heel and Foot Pain

Joint Mobilization

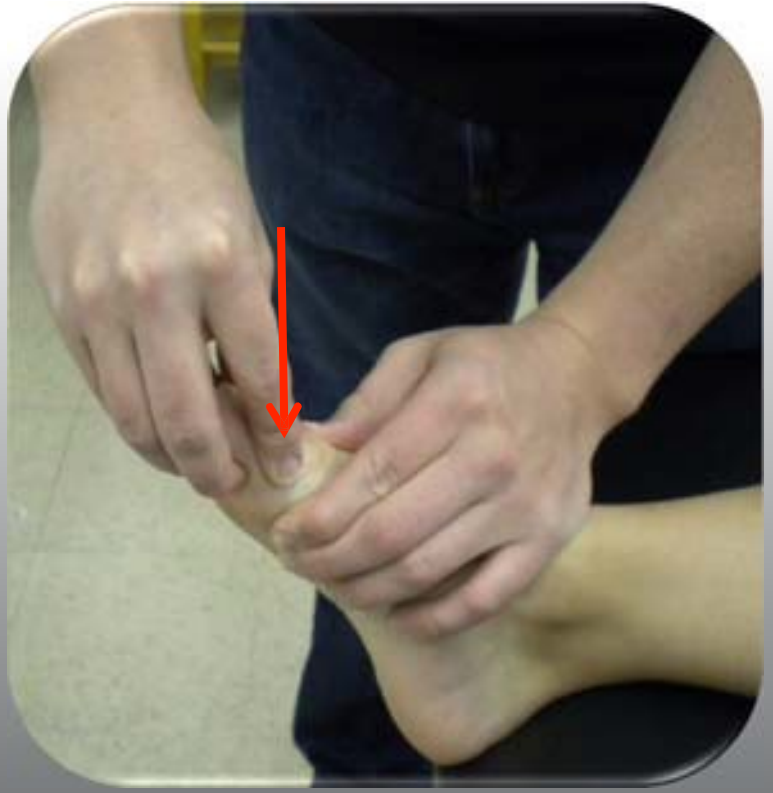
Talocrural

Tarsals (Cuboid/Navicular)

Treatment of Heel and Foot Pain

Joint Mobilization

Subtalar



MP Joint

Treatment of Heel and Foot Pain

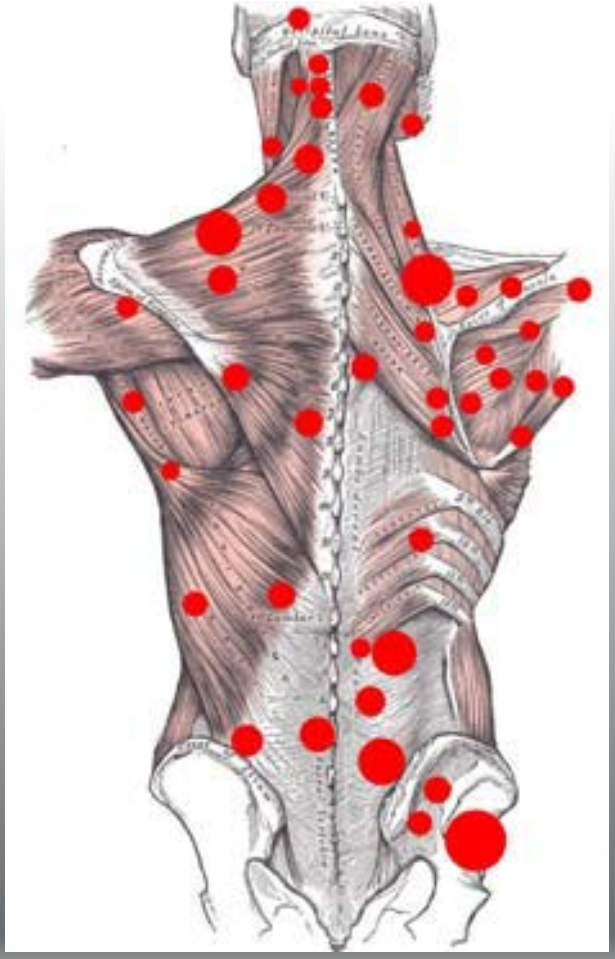
- **Next, apply <u>Trigger Point Release Techniques</u> to get taut tissue to "release."**

Trigger Point Release Techniques

1. Ischemic Compression – slow, progressive pressure until taut band subsides, followed by a gentle stretch.
2. Stripping – deep, firm stroking pressure along the length of the taut band

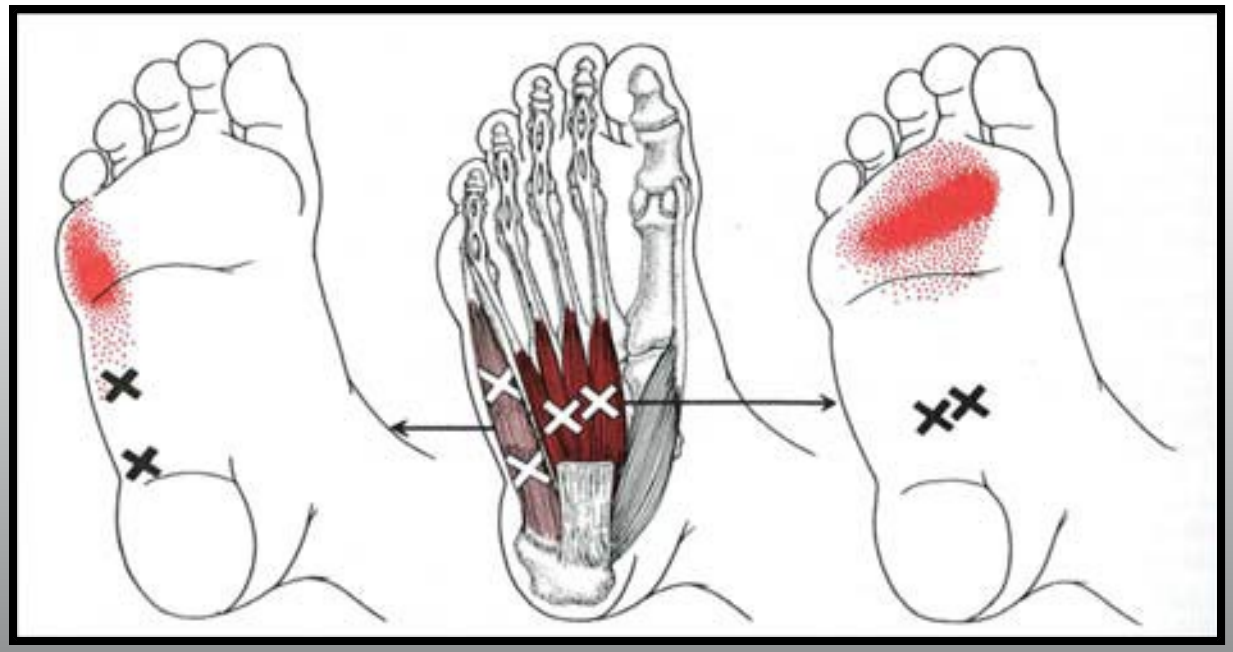
"The application of IC is a safe and effective method to successfully treat elicited myofascial trigger points. The purpose is to deliberate the blockage of blood in the trigger point area in order to increase local blood flow. This washes away waste products, supplies necessary oxygen and helps the affected tissue to heal."

(Montanez-Aguilera et al., 2010)



Treatment of Heel and Foot Pain

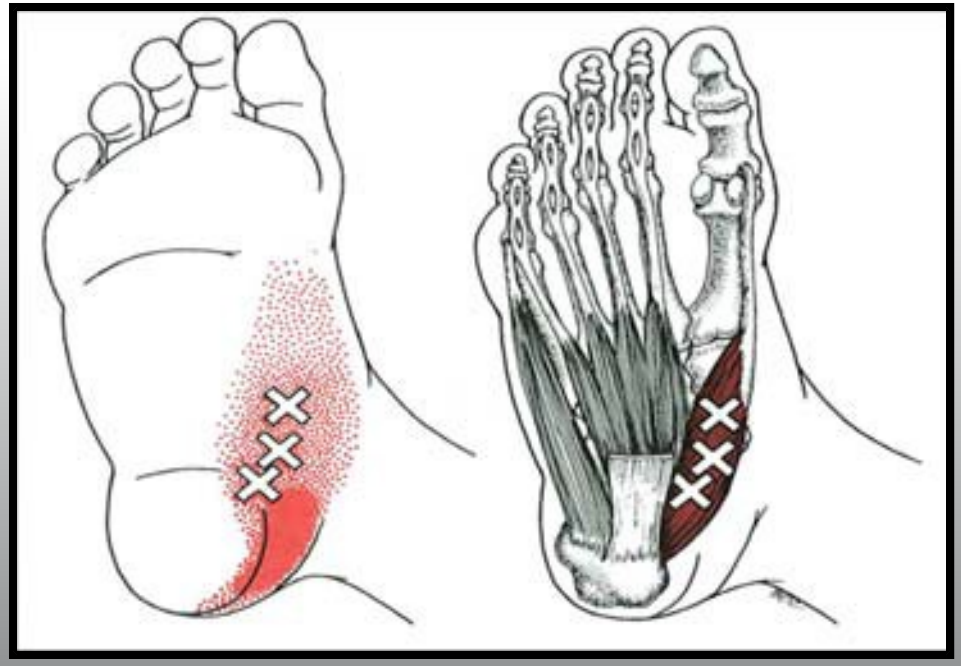
Trigger Points and Pain Referral Patterns



Flexor Digitorum Brevis
and Abductor Digiti Minimi

Treatment of Heel and Foot Pain

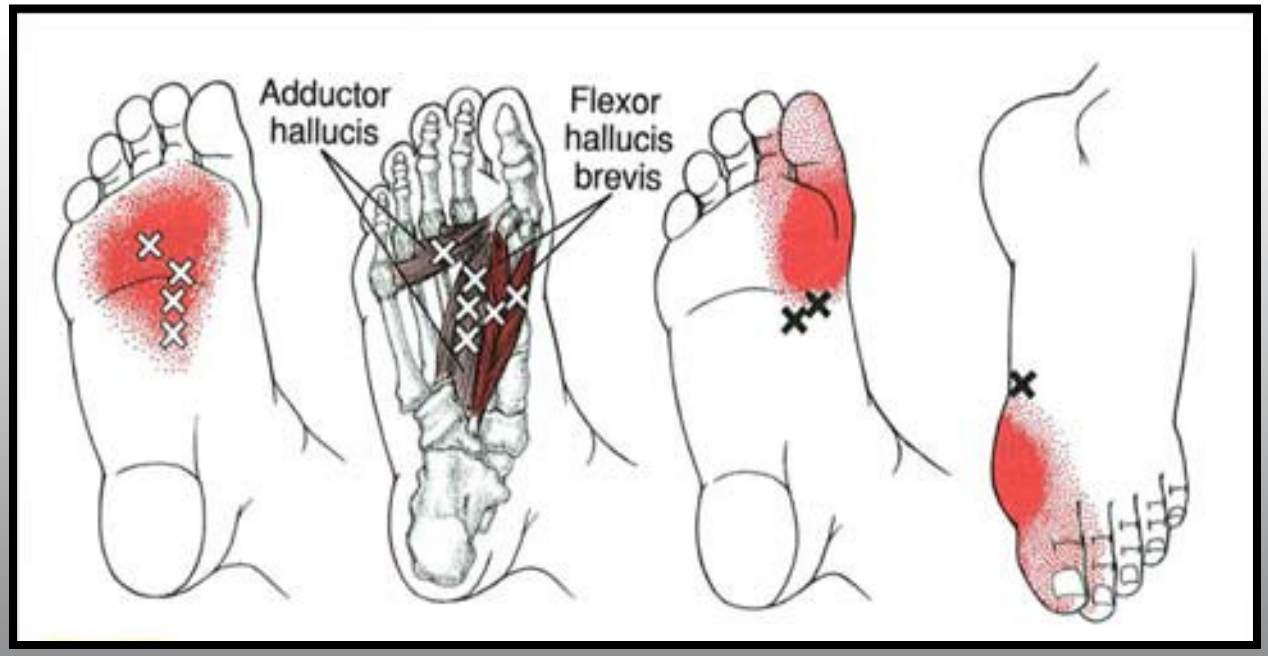
Trigger Points and Pain Referral Patterns



Abductor Hallucis

Treatment of Heel and Foot Pain

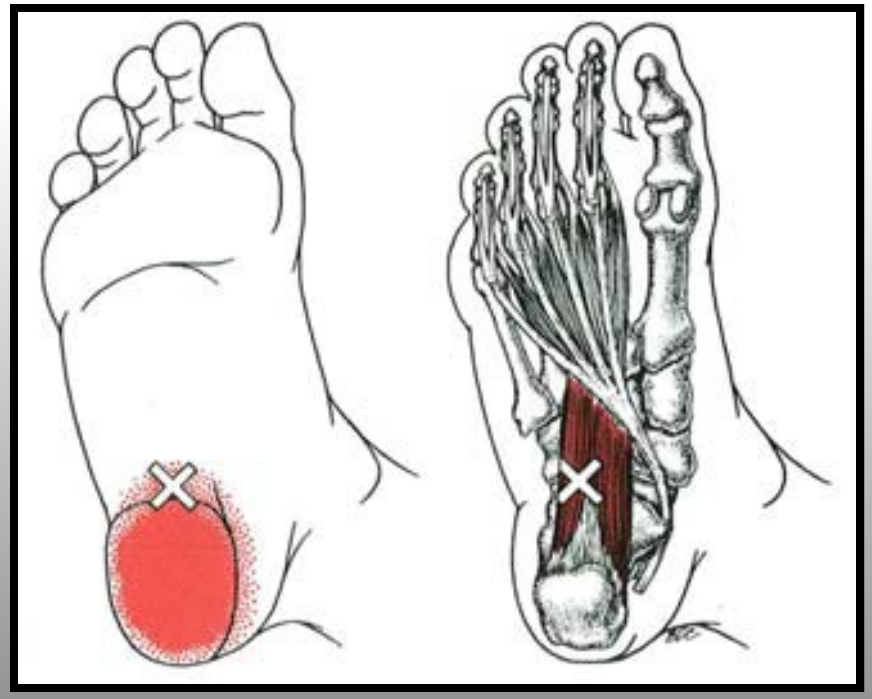
Trigger Points and Pain Referral Patterns



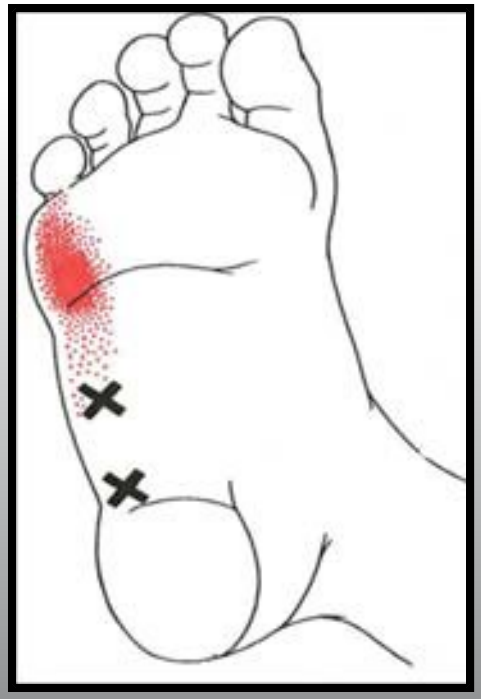
Adductor Hallucis and Flexor Hallucis Brevis

Treatment of Heel and Foot Pain

Trigger Points and Pain Referral Patterns



Quadratus Plantae



Flexor Digiti Minimi

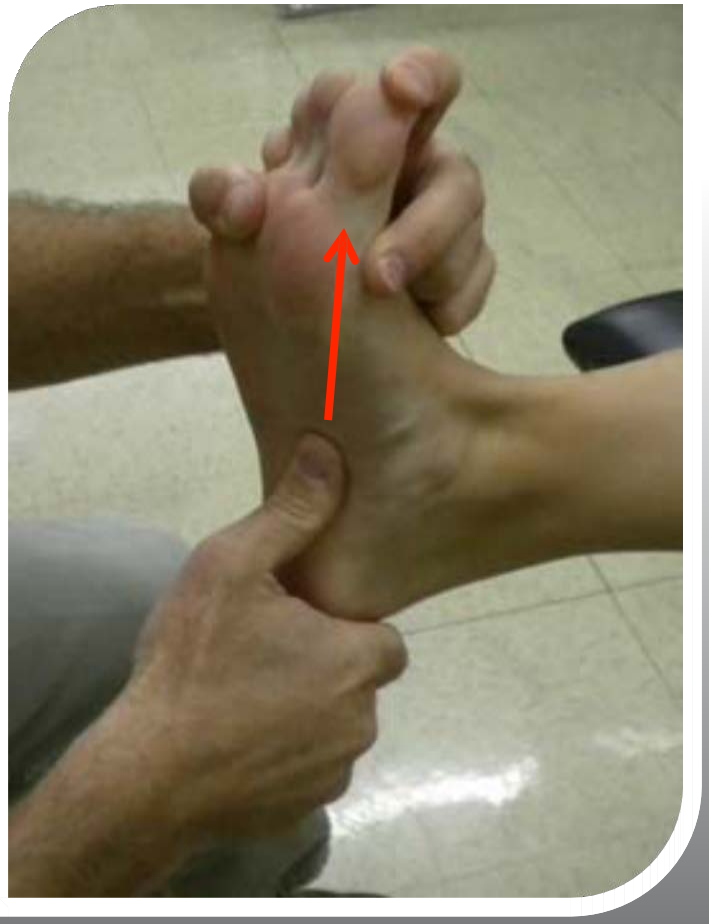
- An isolated pain pattern is not established for flexor digiti minimi; however it is similar to abductor digiti minimi. (Travell et al., 1992)

Treatment of Heel and Foot Pain

Soft Tissue Mobilization

Intrinsic Muscles

The patient is long sitting. The clinician presses on or strips the intrinsic muscles under medial border of the plantar fascia, while extending and adducting the big toe.



Treatment of Heel and Foot Pain

Soft Tissue Mobilization

Deeper Layers of Intrinsic Muscles

The patient is prone with the knee flexed and the ankle dorsiflexed. The clinician applies deep pressure with the elbow to tender trigger points, while the forefoot is slightly dorsiflexed.

Treatment of Heel and Foot Pain

Soft Tissue Mobilization

Triceps Surae

The patient is prone with the knee flexed. Ischemic pressure is performed on the trigger point within these muscles while rocking the ankle into plantar flexion and dorsiflexion to stretch the taut bands of the muscles.

Treatment of Heel and Foot Pain

Soft Tissue Mobilization

Triceps Surae

With the patient prone and the knee straight, pressure is performed on the gastrocnemius trigger points while rocking the ankle into plantar flexion and dorsiflexion, thus stretching the taut bands of the muscle.

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Treatment of Heel and Foot Pain

Soft Tissue Mobilization

Soleus, Gastrocnemius, Posterior Tibialis

The clinician strips and performs localized tissue traction along the entire length of the muscles.

Treatment of Heel and Foot Pain

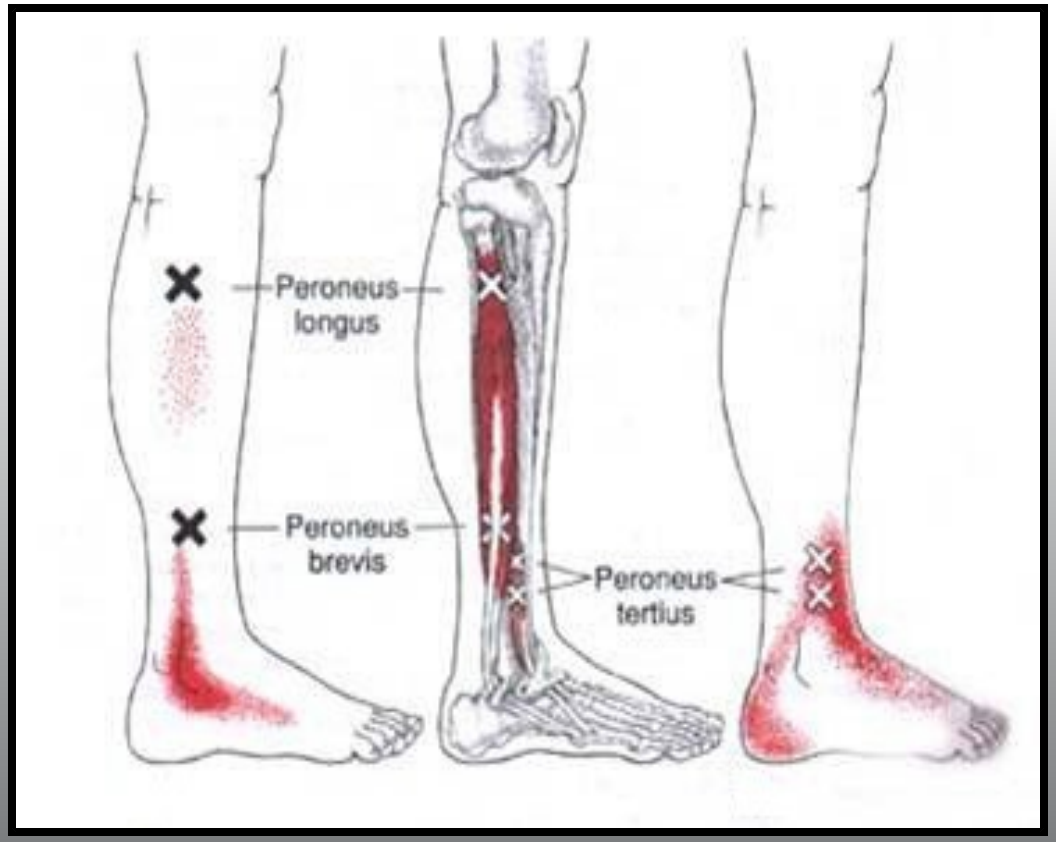
Other Muscles that Contribute to Heel and Foot Pain

- Peroneal Longus and Brevis
- Triceps Surae
- Hamstrings
- Tensor Fascia Latae
- Deep Hip Rotators

These shortened muscles contribute to valgus at the knee and pronated position of the foot!

Treatment of Heel and Foot Pain

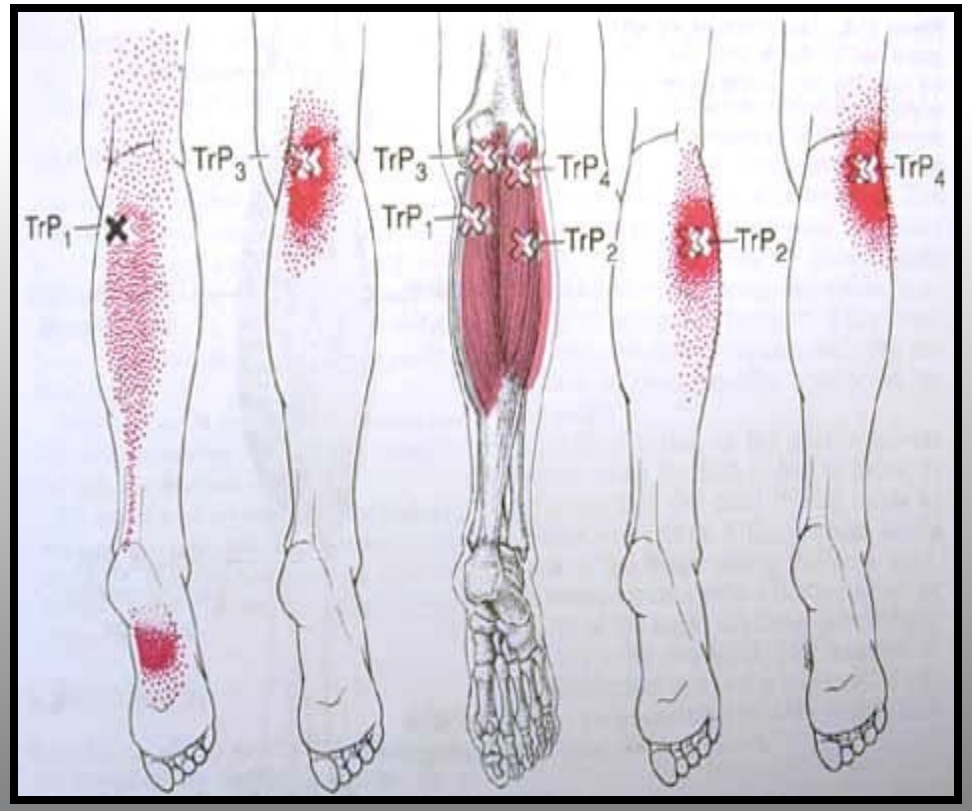
Trigger Points and Pain Referral Patterns

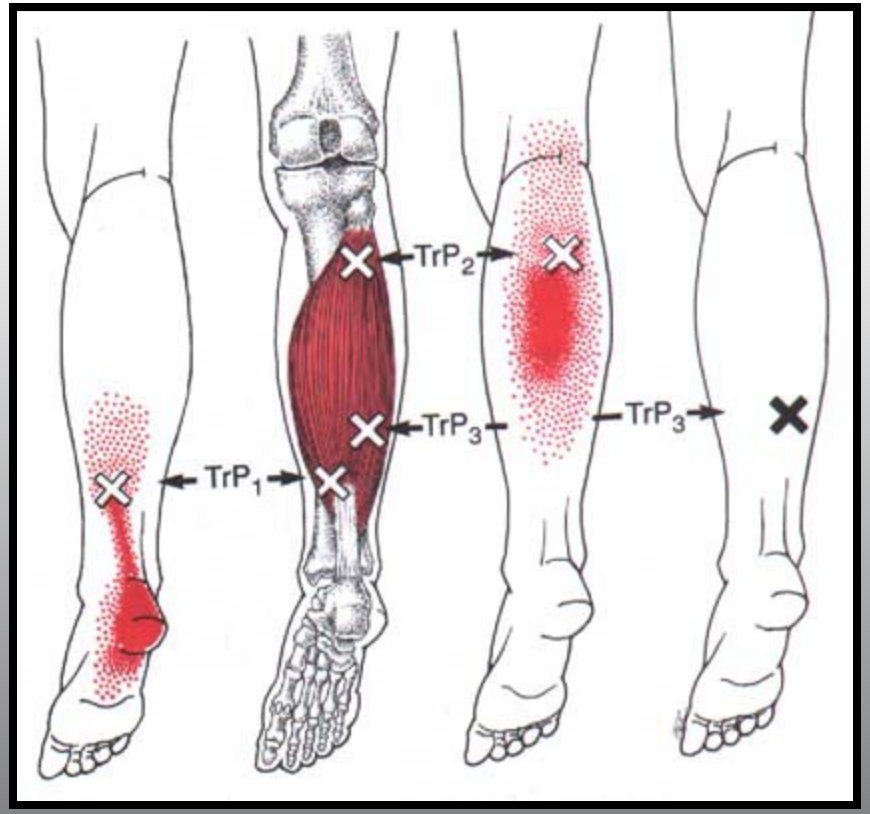


Peroneal Longus and Brevis

Treatment of Heel and Foot Pain

Trigger Points and Pain Referral Patterns

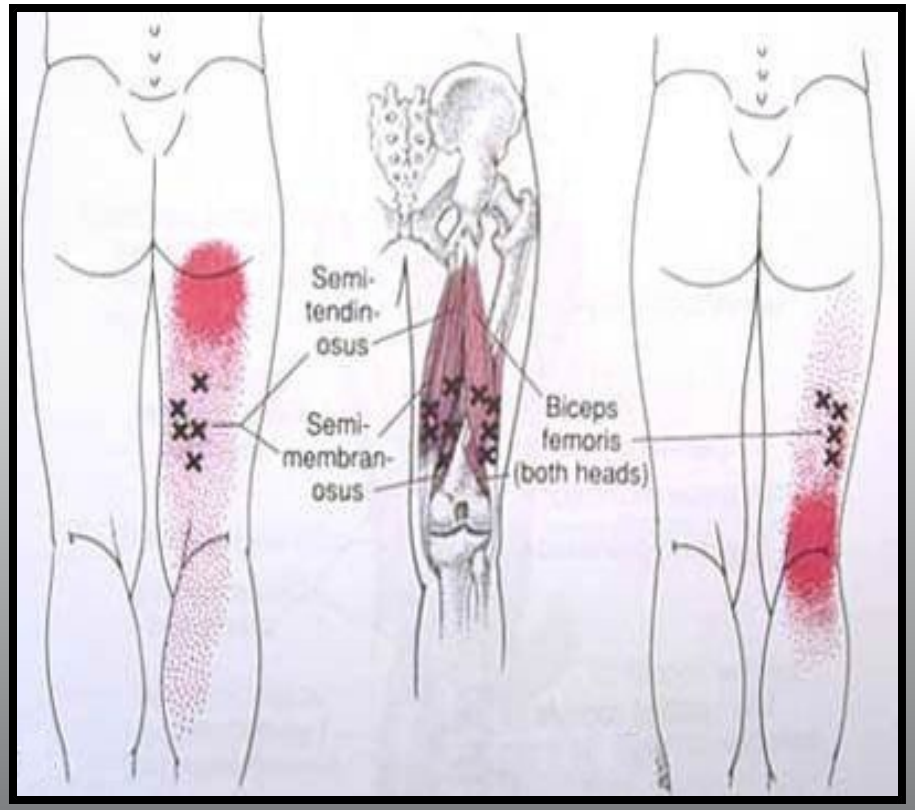




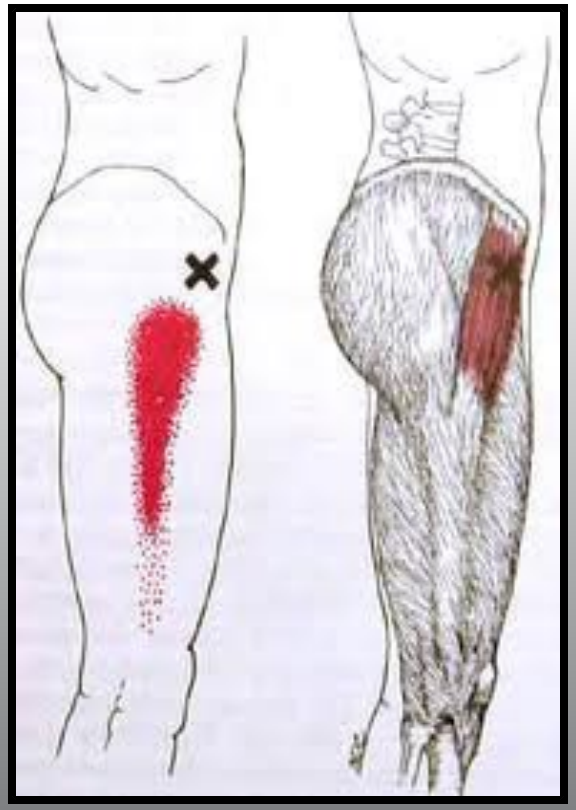
Triceps Surae

Treatment of Heel and Foot Pain

Trigger Points and Pain Referral Patterns



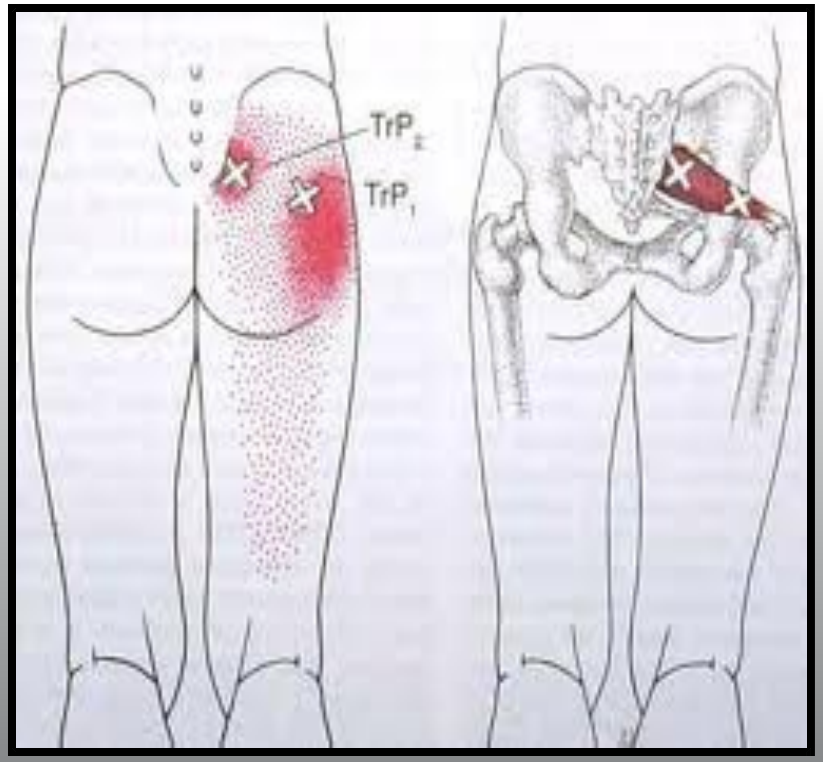
Hamstrings



TFL

Treatment of Heel and Foot Pain

Trigger Points and Pain Referral Patterns



Deep Hip Rotators

Treatment of Heel and Foot Pain

- If more manual therapy is needed, apply Muscle Energy Techniques to improve ROM and decrease muscular hypertonicity.

Muscle Energy Techniques

1. A technique that uses voluntary muscle contraction(s) in a controlled direction, at varying levels of intensity, against a counter force.
2. Based on the premise that joint misalignments occur when the body becomes unbalanced due to muscle spasms, weak muscles being overpowered by a stronger muscle, or restricted mobility of a joint.

Treatment of Heel and Foot Pain

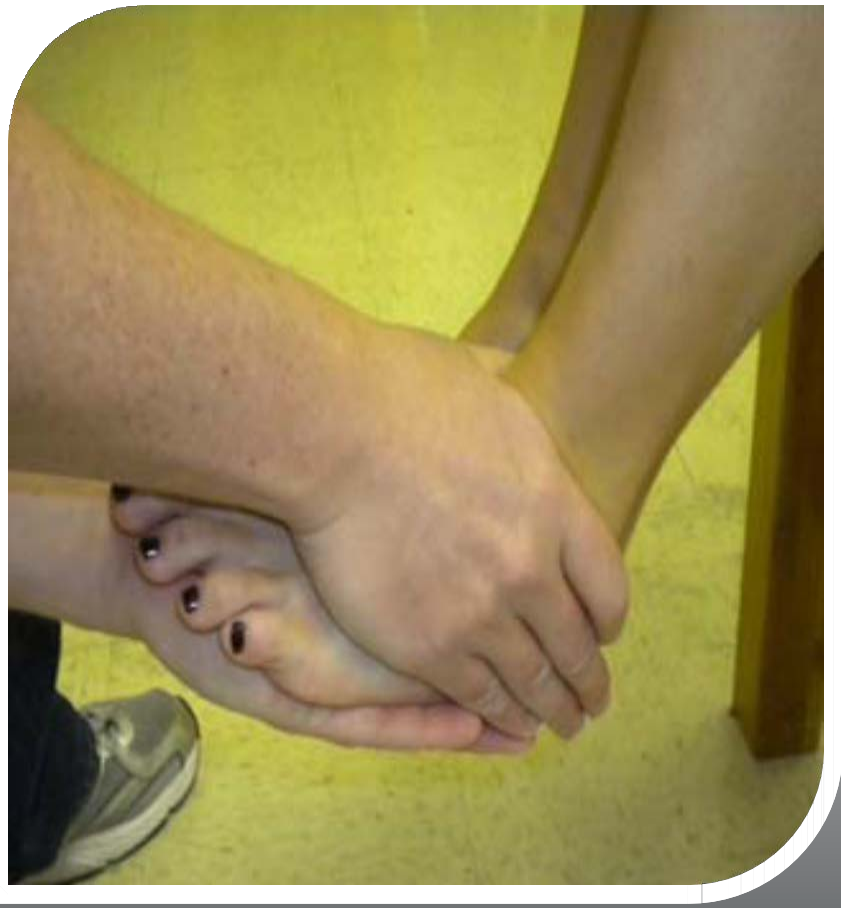
Application of Muscle Energy Techniques

- Isometric Contraction – involves very little force.
- Isotonic – involves using just enough force to allow motion at an even, controlled speed.

1. Joint is moved to its pain-free end range and held by the therapist
2. Patient performs a pain-free sub-maximal isometric contraction for 5 seconds
3. Patient takes a deep breath and relaxes
4. Patient actively (or passively) moves joint toward new limit of motion
5. Repeat the sequence 3-5 times

MET of Dorsiflexion Restriction at the Talocrural Joint

- The patient is short sitting.
- Therapist sits in front of the patient and supports the plantar surface of the forefoot with one hand while placing the webbing of the other hand against the talus.
- The dorsiflexed barrier is engaged by a combination of dorsiflexing the foot and applying posterior force to the talus.
- The patient then plantarflexes against the therapist unyielding resistance, for 5-7 seconds, utilizing no more than 25% of available muscle strength.
- On complete relaxation, the therapist engages a new restriction barrier.

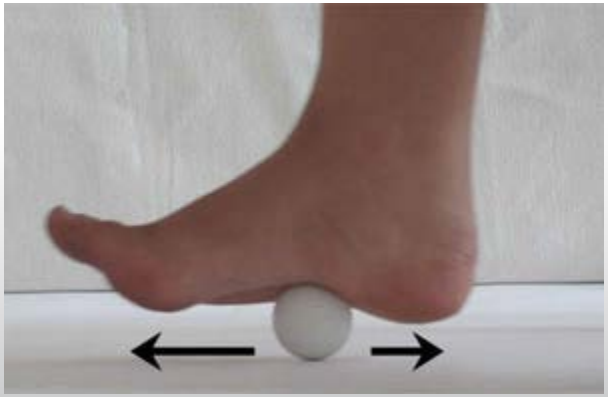


MET for Shortened Gastrocnemius and Soleus

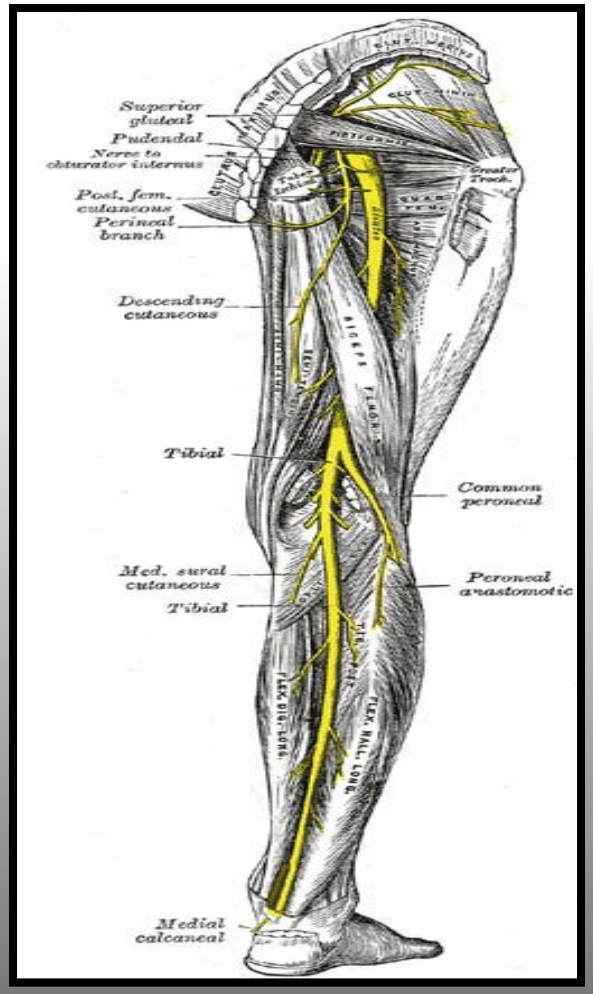
- The patient is long sitting.
- The heel lies in the palm of the hand.
- The other hand is placed so that the fingers rest on the dorsum of the foot (these are not active and do not apply any pulling stretch), with the thumb on the sole.
- Starting at the restricted barrier, the patient is asked to plantarflex against unyielding resistance.
- The contraction is held for 7-10 seconds or up to 15 seconds for chronic conditions.
- On relaxation, the foot is dorsiflexed, with patient's assistance, to a new restriction barrier.

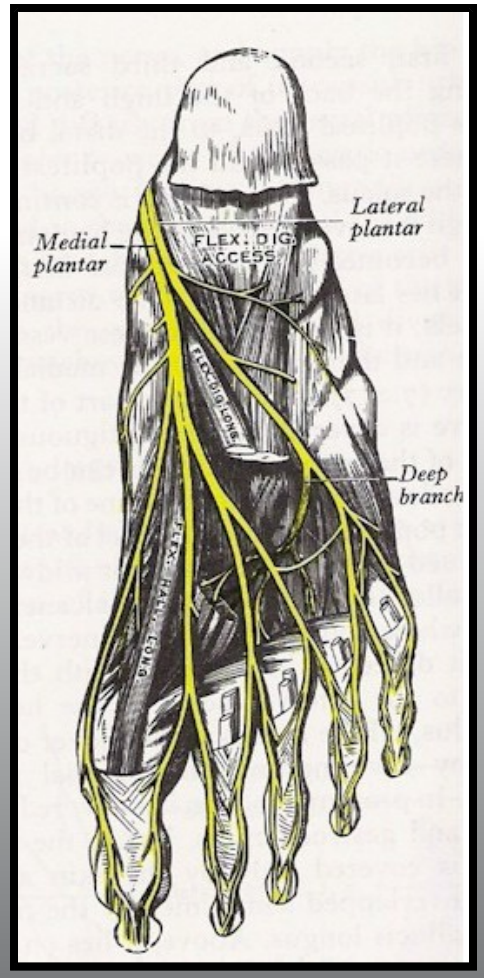
Treatment of Heel and Foot Pain

Home Treatment Program of Trigger Points



Treatment of Heel and Foot Pain





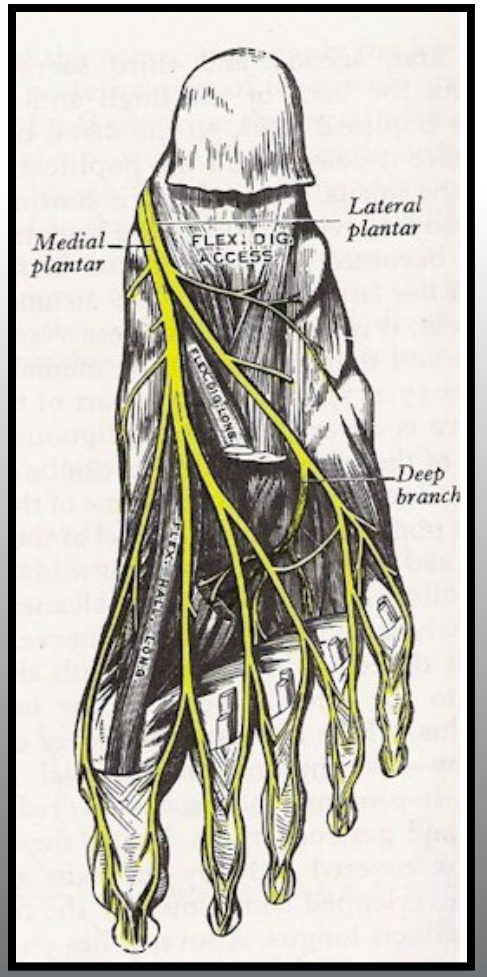
Myofascial Entrapments

Treatment of Heel and Foot Pain

Nerve Tissue Mobilization

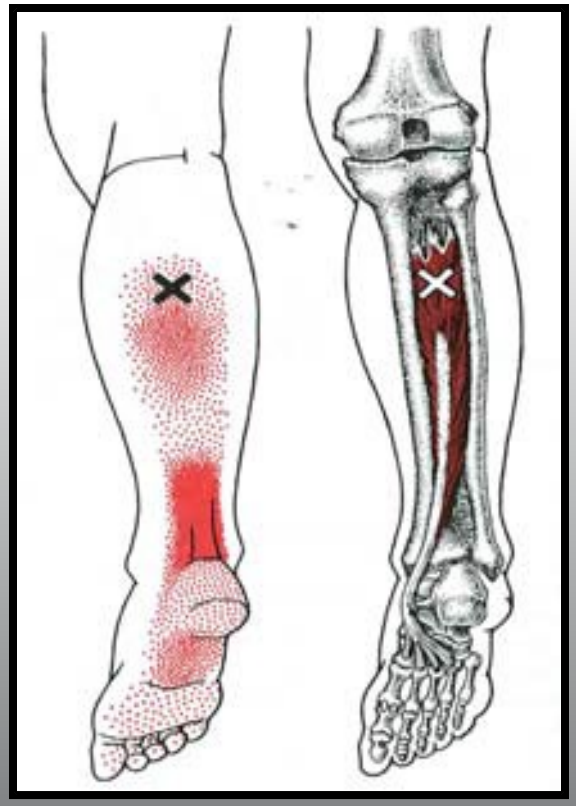
Stretching and weakening of the medial plantar structures can inflame:

- ✓Posterior tibial nerve
- ✓Calcaneal or superficial branch of the lateral branch of the posterior tibial nerve
  - ❖ (Baxter's Nerve)

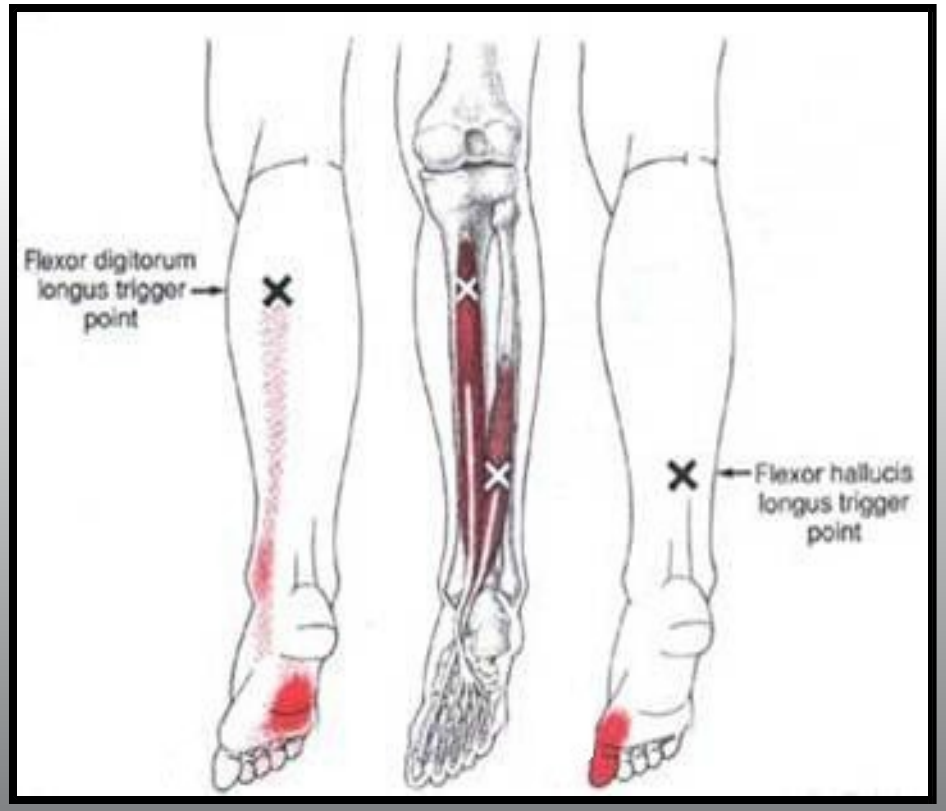


Treatment of Heel and Foot Pain

Trigger Points and Pain Referral Patterns



Posterior Tibial



Flexor Digitorum Longus and Flexor Hallucis Longus

Treatment of Heel and Foot Pain

Nerve Tissue Mobilization

Technique #1

The clinician's active contact is in the arch, more dorsal and higher in the arch than the calcaneal tubercle. Initially, the foot is relaxed, and then it is dorsiflexed and pronated to stretch the tissues entrapping the nerve. The stretch during contact is repeated three or four times.

- Done both passively and actively!

Treatment of Heel and Foot Pain

Nerve Tissue Mobilization

Technique #2

The clinician contacts the points along a line in the medial calf that are tender. Contact is maintained while the nerve is stretched by dorsiflexing the ankle and pronating the foot. This is repeated three or four times. Multiple points of contact are treated by advancing the contact up the medial calf a few centimeters at a time, until the whole extent of the nerve in the calf has been treated.

- Done both passively and actively!

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Questions
& Answers