

Footwear – Its affects on Running and Injuries

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Shoes,

There are all kinds. Good and bad.
What is good and what is bad ?

A bad shoe will act like an orthotic, of which most are !

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Shoes – limited examples for purpose sake here

- | | |
|--|--|
| ■ Shoes that will temper pronation (ie. You had better not be a supinator !) | ■ Shoes that will temper supination (ie. You had better not be a pronator !) |
| ■ Adidas supernova control | ■ Adidas supernova Cushion |
| ■ Saucony Trigon guide | ■ Saucony Trigon Ride |
| ■ Nike Cesium | ■ Nike Pegasus |
| ■ Asics 2110, 1110 (midfoot), Evolution | ■ Asics Nimbus, Cummulus |
| ■ Brooks Adrenaline, Beast and Addiction | ■ Brooks Radius, Glycerine |

- “ Choosing the wrong shoe for your foot type and its tendencies, and your torsional and developmental compensations, is like putting a orthotic in your shoe” !
- Your body might not like the shoe and its effects !!!

- It is the savy physician, therapist, trainer and certainly shoe salesman that knows the difference between the Asics 2110 and the Asics 1110.
- They look the same, but one controls pronation later in the the gait cycle as we pass into early, and through, late midstance phase of gait.
- If you choose the wrong shoe, you just bought a **ORTHOTIC !!!!!**

- We as a society must stop buying shoes that match our workout gear or stick with a company b/c of our loyalty or b/c of its savy marketing campaigns.
- Shoes have intrinsic postings and varying areas of EVA foam density. Thus they can act like an orthotic !

What is Proper Fit?

- *Ideally, a good shoe is a comfortable one that provides the appropriate amount of support.*
- *It has a minimal break-in time, incredible durability, keeps your feet dry, and doesn't give you blisters or bunions.*
- *Shoes are usually manufactured for ideal feet.*
- *The reality is that very few people have ideal feet.*
- *This presents a problem with fit.*
- *Remember, something has to flex, and if it's not the shoe, it's going to be you!*
- *A few basic facts and sometimes, when required, the use of the appropriate orthotic or therapy, can greatly aid in the perfect person/ boot fit.*

Most runners problems . . .

1. Wrong shoes, poorly fit shoes
2. Too much mileage on shoes
3. Bad technique
4. Poor anatomy – genes (Alignment)
5. bad orthotics
 1. “Good” orthotic in bad shoe, bad orthotic in any shoe
6. “the thigh is in control of the hip”
 - the glutes are too small and the quads and hamstrings are too big or too tight

■ Lateral flare vs. medial flare

- 2006 Nike Cesium.....strong medial flare with 3 degree intrinsic varus post
- Soft crash zone
- Shoe promotes supination
- WRONG choice for genu valgum, tibial varum or medial knee OA
 - Pushes knee outside of sagittal plane !! This will give knee-hip pain in most !

The Sole (also called the outsole)

- the part that comes in contact with the ground.
- made of rubber and provides for some degree of shock absorption and traction. It can be sewn, cemented or part of the midsole.
- Remember that the heel is supposed to strike the ground at approximately a 16° angle, lateral from the center of the heel (crash zone).
- The force is then transmitted from the sole of the shoe, up the lateral column of the foot and across to the first metatarsal for propulsion. This can be assisted by a “rocker” which is a “drop” put into the front portion of a shoe, to ease walking and assist in toe off.
- Different shoes have different rockers. This seems to work better in stiffer shank shoes (more torsional rigidity) to ease some of the stress off of the first metatarsophalangeal joint. (This is good for people with Morton’s toes, hallux rigidus or painful bunions).
- A flare (widening) of the sole of the shoe, particularly lateral can be important for stability on uneven surfaces. A **lateral flare** provides extra stability upon heel strike, but it speeds up the rate of pronation. This flare must extend the length of the sole, otherwise injury can occur at the mid tarsal joint as the foot comes through mid stance. A medial flare can help to prevent overpronation, as the foot comes through mid stance. Again, it must run the length of the shoe.

The Midsole- sandwiched between the sole and the upper

- Midsole material is very important, as it will accommodate to the load imposed on it from the person as well as any gear they may be carrying. It serves as the intermediary for load transfer between the ground and the person.
 - Softer density material in the heel of the shoe softens the forces acting at heel strike and is good for impact and shock absorption.
 - **The stiffer the material, the more motion control.**
- Duodensity Midsoles
 - This means that two of the midsole is softer on its lateral aspect, to absorb force and **decrease the velocity of pronation during heel strike and midstance**, with a firmer material medially that protects against overpronation as you come through mid stance and go through toe off.
 - Companies make variances within this category
 - **Asics 1110 and 2110 (stability but shifted dual density)**

The Midsole- sandwiched between the sole and the upper

- The Crash Zone and Entry Zone:
 - Softer Crash Zone: ie. Adidas supernova Line, Saucony Trigon Lines, Nike Triax
 - Good for pronator (flat flexible arch) but danger for supinator (high rigid arch)
- Beveled Entry Zone:
 - Good for pronator but danger for supinator
 - Why ?....it will keep the pronator on the outside of the shoe longer
 - Rather, it will allow the supinator to stay on the outside longer
 - On the contrary, putting a pronator in a wide buttressed lateral counter
 - will make them pronate earlier, faster and thus deeper

The Last- “the shape or how the shoe is assembled”

- The last (lock inside the shoe on top of the shank) is the surface that the insole of the shoe lays on, where the sole and upper are attached).
 - Shoes are board lasted, slip lasted or combination lasted.
 - A board lasted shoe is very stiff and has a piece of cardboard or fiber overlying the shank and sole (sometimes the shank is incorporated into the midsole or last). It is very effective for motion control (pronation) but can be uncomfortable for somebody who does not have this problem.
 - A slip lasted shoe is made like a slipper and is sewn up the middle. It allows great amounts of flexibility, which is better for people with more rigid feet.
 - A combination lasted shoe has a board lasted heel and slip lasted front portion, giving you the best of both worlds.
- When evaluating a shoe, you want to look at the shape of the last.
 - Bisecting the heel and drawing an imaginary line along the sole of the shoe determines the last shape. This line should pass between the second and third metatarsal. Drawing this imaginary line, you are looking for equal amounts of shoe to be on either side of this line.
 - Shoes have either a straight or curved last. The original idea of a curved last (banana shaped shoe) was to help with pronation. A curved last puts more motion into the foot and may force the foot through one channel that is not accustomed to. Most people should have a straight or semi-curved last shoe.

The Shank- this can be within the midsole or last

- The shank is the stiff area of the shoe between the heel to the transverse tarsal joint.
- It corresponds to the medial longitudinal arch of the foot, provides torsional rigidity to this shoe and helps to limit the amount of pronation and motion at the subtalar and mid tarsal joints.

The Upper- the sides and top of the shoe

- This is the part above the midsole that holds your foot on the sole. It is usually made of leather, nylon, Gore-Tex or some other man made material.

The Heel Counter- the back of the upper

- This is part of the upper.
 - A strong, deep heel counter with medial and lateral support is also important for motion control
 - lateral support especially for people who invert a great deal or when you're going to place an orthotic in the shoe which inverts the foot a great deal.
 - The **lateral counter** provides the foot something to give resistance against. This needs to extend at least to the base of the fifth metatarsal, otherwise it can affect the foot during propulsion.
 - A deep heel pocket helps to limit the motion of the calcaneus and will also allow space for an orthotic.
 - The heel counter should grip right above the calcaneus, hugging the Achilles tendon.

The Toe Box

- The toe box should be generous enough to prevent crowding and pressure on the metatarsal heads
 - The widest portion of the shoe should parallel a line bisecting the metatarsal heads. Excessive pressure can result in bunions and/or hammertoes.
- **When measuring feet and determining shoe sizes, do it both sitting and standing and on toes**
 - because the laxity of ligaments can become very evident, especially when the foot is weight bearing
 - If the person has greater than one size of splaying in both length and width when going from one position to the other, go for the bigger size.
 - **Always use ball length rather than sole length – toe length *****
 - People usually buy smaller shoes because when you pronate, there is less volume in the mid foot. A small size shoe will feel better.
 - Use a Brannock Device to help you if you are not sure – that is what it is for!

The Heel Counter- “the back of the upper”

- Construction errors
- Not infrequently the rear of the top cover is not set square into the heel counter
- Sometimes this can appear to be a vamp-counter interface offset and sometimes it is a mid and outsole problem as in this case

The Toe Box

- The widest portion of the shoe should parallel a line bisecting the metatarsal heads. Excessive pressure can result in bunions and/or hammertoes.
- **When measuring feet and determining shoe sizes, do it both sitting and standing and “tip toe”**
 - If the person has greater than one size of splaying in both length and width when going from one position to the other, go for the bigger size.
 - Heel-to-toe & heel-to-ball length
 - Always use **ball length** rather than sole length.
 - Ball length corresponds to crease or fracture line in shoe – **where it bends**
 - A person with short toes will have much toe box length room, that is OK
 - **You want the toe to bend where the shoe does !!!!**

The 9 Steps to proper fit include the following:

1. Determine the usage of the shoe. Will it be for running, scrambling, light hiking, heavy backpacking or mountaineering?
2. Ask if they have problems with their feet? If so, is it pain, corns, blisters, bunions? Where are these problems located? This will often give you clues as to problems they may have with their boots and/or feet.
3. Perform a foot evaluation while they are sitting and standing. Watch them walk. Note any obvious visual abnormalities.
4. Determine their foot type. Do they have a low, medium or high volume foot?
5. Measure the foot in a standing position. Measure the width of the foot at its widest point. Always use the ball length.

Step #1

Determine the usage of the shoe. Will it be for running, scrambling, light hiking, heavy backpacking or mountaineering?

The 9 Steps to proper fit include the following:

6. Determine the flexibility of the forefoot. Do they pronate a great deal?
7. Get new socks that they will be wearing in that footwear.
8. Try on the shoes. Give lacing tips if needed.
9. Test the shoe for fit and function. How do they feel while standing and walking on flat ground? They should have:
 1. Good heel lock (little heel lift in trail runners, <1/8 inch in medium weight hikers and < 1/4 inch in heavy hiking/mountaineering boots)
 2. Adequate arch support, especially when weight bearing
 3. No pressure over the top of the foot under the laces
 4. Flex point at the 1st metatarsophalangeal joint (ball of foot)
 5. Room in the toe box
 6. No pressure at cuff or gussets on shin
 7. Walking up an incline, the flex at the ball of the foot should not change significantly and the heel should not lift more than previously
 8. Walking down an incline, the toes should not touch the front of the shoes and there should be no more than 1/4" of forward movement of the foot

Step #2

Ask if they have problems with their feet, knees or hips?

1. If foot pain is it corns, blisters, bunions, ankle or lower leg? Where are these problems located?
2. If knee, is it front, inside or outside?
3. If hip, is it front, back or side?

This will often give you clues as to problems they may have with their boots and/or feet, knees or hip.

Step #3

Perform a foot evaluation while they are sitting and standing.
Watch them walk. Note any obvious visual abnormalities.

Step # 5

Measure the foot in a standing position.
Measure the width of the foot at its widest point. Always use the larger of ball or sole length.

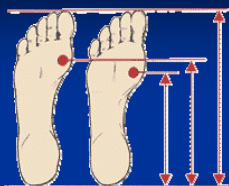
Step # 4

Determine their foot type. Do they have a low, medium or high volume foot?

The Brannock Device

Knowing the true length of your patients foot and how to determine shoe fit

Why Heel-to-Ball Is Essential



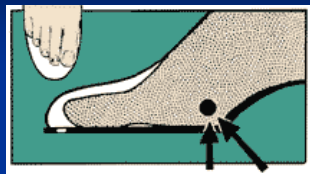
- This illustration shows **two feet which are the same length, but each require different size shoes**. There are different fittings for short-toed feet and long-toed feet. Proper shoe-fitting incorporates not only overall length (heel-to-toe measurement) but also arch length (heel-to-ball measurement). **Shoes are designed to flex at the ball of the foot, how much room is left in the toe box length is irrelevant**. Correct fitting properly positions the ball joint in the shoe and provides room for the toes so they are not confined.

Step # 9

Test the shoe for fit and function. How do they feel while standing and walking on flat ground? They should have:

- ▶ Good heel lock (little heel lift in trail runners, <1/8 inch in medium weight hikers and <1/4 inch in heavy hiking/mountaineering boots)
- ▶ Adequate arch support, especially when weight bearing
- ▶ No pressure over the top of the foot under the laces
- ▶ Flex point at the 1st metatarsophalangeal joint (ball of foot)
- ▶ Room in the toe box
- ▶ No pressure at cuff or gussets on shin
- ▶ Walking up an incline, the flex at the ball of the foot should not change significantly and the heel should not lift more than previously
- ▶ Walking down an incline, the toes should not touch the front of the shoes and there should be no more than 1/4" of forward movement of the foot

The Brannock Foot-Measuring Device® Ensures Correct Fit



- The foot above is correctly fitted. **The arch of the shoe and ball joint of the foot meet at the same point**. The foot arch is correctly positioned in the shoe. **The foot and shoe bend at the same location, with the arch fully supported**, allowing the toes to remain straight. There is ample space in front of the toes to allow adequate ventilation. This will ensure a correct and comfortable shoe which will keep its shape.

Most runners problems . . .

1. Wrong shoes, poorly fit shoes
2. Too many miles on shoes
3. Bad technique
4. Poor anatomy – genes (Alignment, loss of ROM)
5. bad orthotics
 1. “Good” orthotic in bad shoe, bad orthotic in any shoe
6. “the thigh is in control of the hip”
 - the glutes are too small and the quads and hamstrings are too big or too tight

Foot Function and the Effects on the Core and Body Dynamics

Presenter: Dr. Shawn Allen

The Foot Basics

- **Rockers x 3 (the 3 foot rockers)**
 - Heel
 - Ankle
 - Forefoot
- **Without all 3 rockers working correctly you WILL compensate in EVERYTHING you do**

The foot and the core

- What do we really know about the feet ?
- By the end of this brief lecture you will have a mere morsel of knowledge about the foot but it should change everything you do from here on out regarding your clients and how you look at them

The Rockers

- **Loss of heel rocker**
 - Early departure onto forefoot
 - Bouncy gait
 - Weak anterior compartment
- **Loss of ankle rocker**
 - Hyperextended knees
 - More low back arch (lordosis)
 - Weak anterior compartment
- **Loss of forefoot rocker**
 - Turf toe
 - No push off
 - No glutes.....no glutes no abs....more hamstring tightness.....MBT shoes etc

The Foot Tripod

- We are bipedal humans working on 2 tripods
- How is the foot like a tripod ?

Movement Rules

1. When the foot is on the ground, the gluteal muscles are in charge
2. When the foot is off the ground, the abdominals are in charge

Thus, would it suffice to say then that we need balanced, symmetrical, SSE, in all 3 divisions of the glutes and all layers of the abdominals and their synergists to follow these rules correctly ?

Foot Tripod

- Rudimentary tripod rules
1. must have >90 degrees at ankle rocker
 2. Must have enough EHL, EDL, tib anterior to get there
 3. Must have enough **strength and skill and endurance** to use it

Movement Rules

3. you have 2 choices always
 - fall into weaknesses
 - Avoid weaknesses
- Example: medial TRIPOD failure
 - You can cave into the medial tripod
 - pronate
 - You can go onto lateral tripod
 - supination

Movement Rules

4. You must not cheat the CNS
 - *The power of compensation*
 - Repetitive movement patters made in compensation to an injury or improper training techniques get recorded in your central nervous system, both in the cerebellum (the motor coordination center) and your parabrachial nucleus (the pattern generator in the brainstem)
- *Example: when the toes go down, the arch should not follow the pattern

- Injury
- Habit
- Bad shoes
- Orthotics
- Pain avoidance
- Training surfaces
- etc

How Do Foot mechanics become dysfunctional?

Effects on the lower extremity mechanics when foot mechanics are dysfunctional / pathologic

Effects on the lower extremity

- We will keep it simple for this venue
- 1. loss of medial tripod (2 choices, “cave in” here)
 - FF varus foot
 - Relative pronation
 - “knocked knee”
 - Valgus knee
 - APT (loss of lower abdominals !)
 - Relative leg adduction
 - Medial chain weaknesses
 - Quadriceps dominant strategy (because no abdominals or glutes)

You must not cheat the CNS

The power of compensation

- **Repetitive movement patters made in compensation to an injury or improper training techniques get recorded in your central nervous system, both in the cerebellum (the motor coordination center) and your parabrachial nucleus (the pattern generator in the brainstem)**

Effects on the lower extremity

- We will keep it simple for this venue
- 2. loss of lateral tripod (2 choices, “cave in” here)
 - FF valgus foot
 - Relative supination
 - Bow legged
 - Varus knees
 - PPT
 - Relative leg abduction
 - Lateral chain weaknesses
 - Gluteal dominant strategy

- If the glutes are not in charge when the foot is on the ground

- You will find the abdominals are not effectively or efficiently working and they will default into strategies of quad dominance

- **Runners.....small buttocks, huge quads.... !**

Orthotics, Shoes and Shoe Inserts

- How can they be a problem in what we do ?
 - They can reverse the biomechanics and resolve the symptoms but are you fixing the issue or bandaiding it ?
 - They can cause new biomechanical forces that in time can cause new issues ?
 - Initial symptom changes
 - New layers of issues and layers of new strengths that might not be wished upon anyone

Foot Views

- How can you quickly screen your clients to see if they have bad foot and toe mechanics that can cripple the body dynamics and core ?
 - The toes are the window into the system !

Shoes

- 3 types
- See our new DVD in 2009 for entire presentation

Foot Views

- How can you quickly screen your clients to see if they have bad foot and toe mechanics that can cripple the body dynamics and core ?

Screen tests

Screen Tests

1. Standing lean to get buy in
2. Standing forefoot lift
3. Single leg tripod with toe lift
 1. Symmetrical ?
4. Single leg tripod, with toe lift, with squat and glutes in charge
 1. A window into whether they can do a squat without cheating
 2. No quads, all glutes !

Exercises to start with

- Client AWARENESS of problems !
- Tripod stance and gait
- Disassociate toes and arch
- *** Single leg tripod squat**
 - *This is the KING of all exercises, this version*
 - *Glutes and tripod must be in charge or forget it !*
- Total gym protocol

How to begin making changes in your clients

- Screen them (new DVD in 2009)
- Tripod
- Toe extension
- Stop clawing strategy
- Orthotic removal ?
- Neurologic disassociation of arch and toes
- Assess rockers of the foot and ankle
- Look at the toes !
- Shoe changes

Exercises to start with

*** Single leg tripod squat**

- How far into this exercise can you go before you cheat ?
- When do you begin laying down a bad pattern in your central nervous system during the squat ?