

# Barefoot Running:

## What does the “science” say?



# Introduction

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- T.J. Stites, PT
  - Practicing physical therapist for over 10 years and will complete an advance certification in Manual Therapy in December
  - Select Physical Therapy in Christiansburg
  - Well acquainted with the ins and outs of running as a competitive age group triathlete having finished first in age group for the 2009 Virginia Triathlon Series

## Goals of this seminar

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- Provide a general overview of recent published scientific literature regarding barefoot running
- Apply findings of the literature to the management of running related injuries
- Have fun and create a lively discussion about a fun running topic

## **What we won't do**

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- Teach you to critically review and analyze scientific literature
- Bore you to death with numbers and statistical analysis of numbers

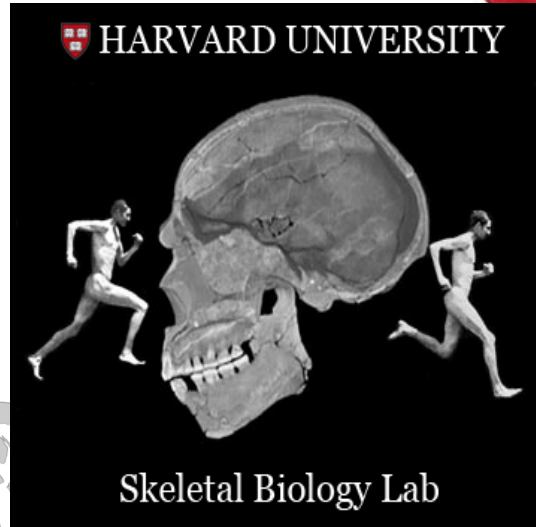
## **A Physical Therapist perspective**

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Barefoot running has the potential to cause serious problems for runners, but also appears to have some good therapeutic benefits



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# What does the “science” say?

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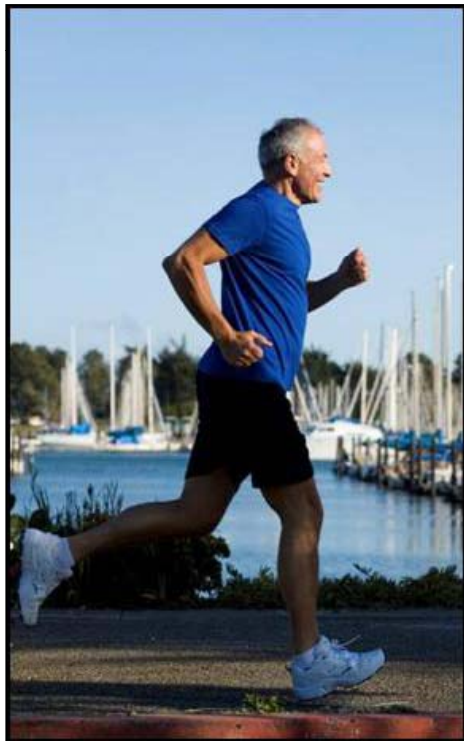
I

Barefoot runners tend to land on the front part of their foot and shod runners tend to land on their heels

# Why is this important?

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Completely different muscle groups are used to lower your foot to the ground when landing on the heel versus landing on the middle or the front of your foot



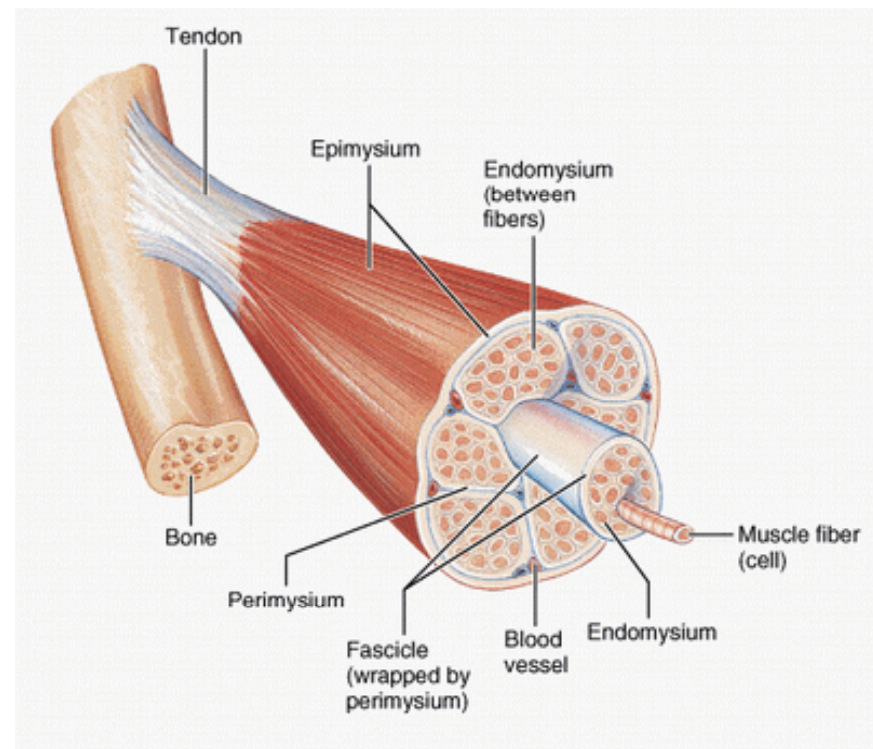
## Putting it to use (benefits)

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- Barefoot running could help with anterior compartment pain by decreasing the demands on these muscles
- Barefoot running could be used as a training tool to increase calf muscle connective tissue thickness and strength
- The barefoot/forefoot strike pattern increases the elastic recoil of the gastroc and the potential for greater propulsive force when running

# Increased connective tissue strength

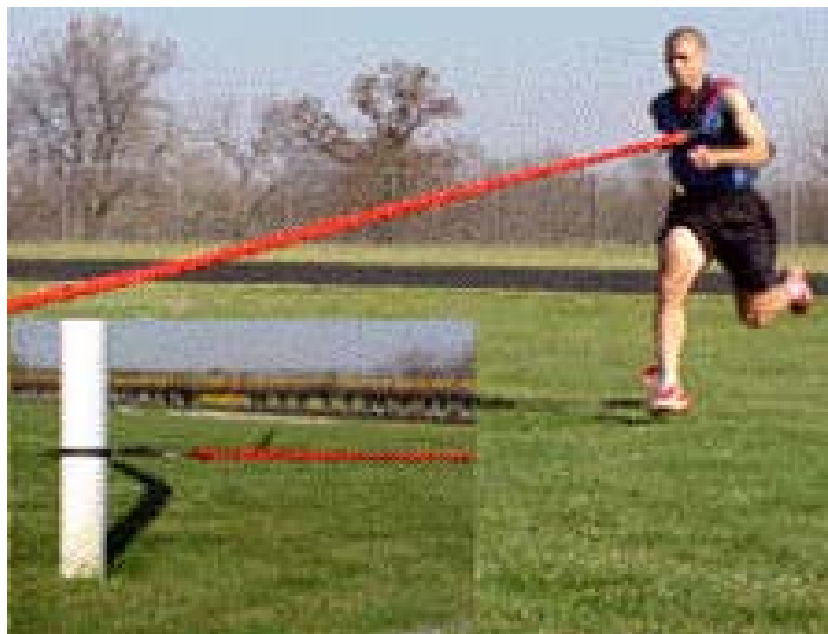
- When your foot hits the ground your leg muscles contract eccentrically (they get longer instead of shorter while they contract)
- Eccentric muscle activity places maximum tension through the muscle's connective tissue
- The connective tissue responds to this stress by building more connective tissue



## **Eccentric elastic recoil**

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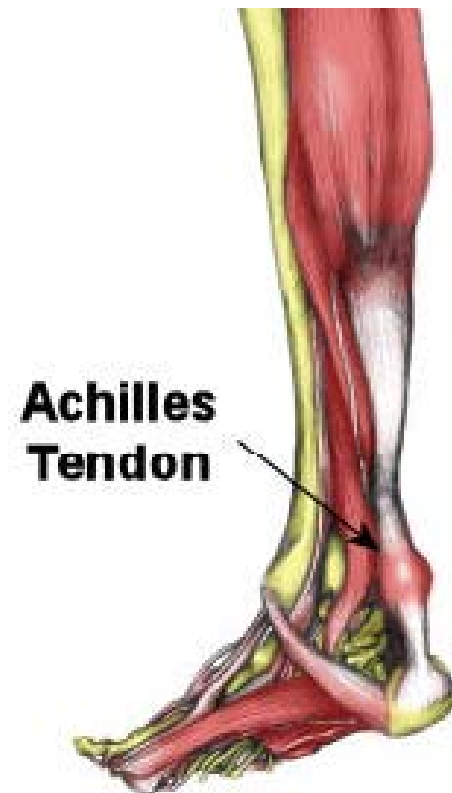
As the muscle is loaded eccentrically the connective tissues acts like a spring to produce greater force during the propulsion phase of your stride



## Putting it to use (challenges)

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- Eccentric muscle activity places maximum tension through the muscle's connective tissue
- Barefoot running forces your calf muscles to work eccentrically, putting you at a higher risk for injury because you have **NOT** trained it to work this way
- Heel strike runners have trained their calf muscle concentrically and there is a very big difference in the effect on the tissues



**What problems can this cause for me?**

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**DO NOT try barefoot running with  
Achilles tendonitis**

# What does the “science” say?

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## II

Barefoot runners demonstrate decreased ground reaction forces when their foot hits the ground [..\..\clinical papers\barefoot3.pdf](#)

# Ground reaction force (GRF) defined

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The measure of the amount vertical force the runner puts through the ground to keep upright, usually



2009 Boston finish

[http://www.boston.com/sports/marathon/gallery/2010/04\\_19\\_10\\_pain\\_determination?pg=2](http://www.boston.com/sports/marathon/gallery/2010/04_19_10_pain_determination?pg=2)

# Why does this matter to me?

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Running is hard on the body and in theory the more vertical force you put through your leg the harder the running is on your body

- Did you know that running at an 8 minute pace and 85 strides a minute is 35,632 impacts over the course of a marathon.

2009 Boston [http://www.boston.com/sports/marathon/gallery/2010/04/19/10\\_pain\\_determination?pg=8](http://www.boston.com/sports/marathon/gallery/2010/04/19/10_pain_determination?pg=8)



## Putting it to use

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**CAUTION**

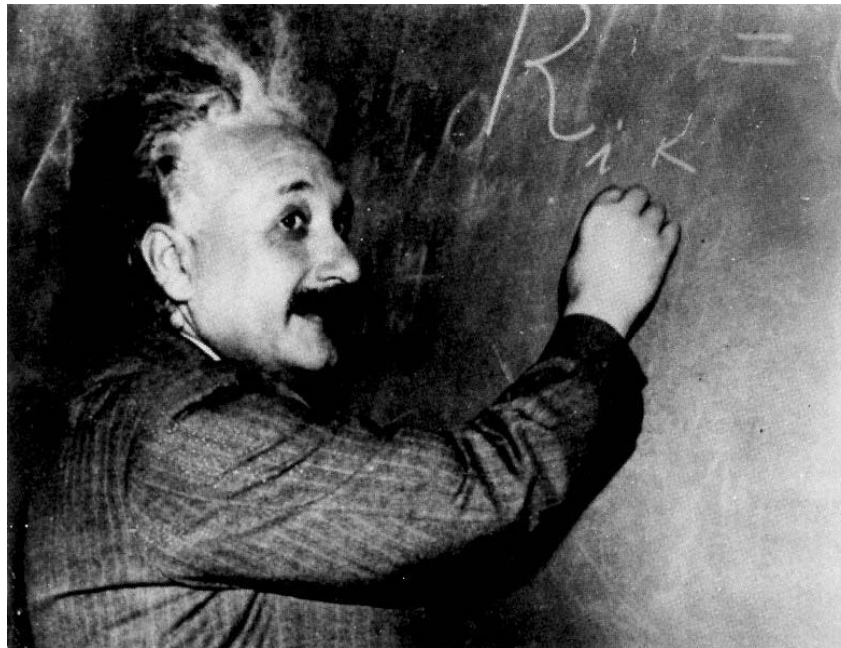
On the surface it appears that barefoot running decreases GRF, but there are **MANY** other less risky and more productive ways of decreasing GRF

# Safer ways to reduce GRF

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Force equals mass times acceleration (or deceleration)

- Mass = Mostly related to **body weight**
- Acceleration = how quickly you put your weight on your foot and then start to take it off



## Weight loss

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**Eat 4 Success**  
with Crystal Pruitt

- Weight loss when you ARE over weight is the best thing you can do to reduce your GRF
- Weight loss when you are NOT over weight is dangerous and will not help your running
- It is best to consult with a Licensed Dietician knowledgeable in sports nutrition to determine ideal body weight and proper diet

# What does the “science” say?

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## III

Barefoot runners tend to have a shorter stride length and a faster cadence for the same pace

## Why does this matter?

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Finding that a faster cadence lowers GRF is consistent with other running research for shod runners that increase their cadence



## Putting it to use

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Learning to increase your cadence can decrease your GRF and help reduce or control impact related injuries



# What does the “science” say?

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## IV

Landing on the middle or front of your foot creates a more efficient transfer of your weight over your foot

<..\..\clinical papers\barefoot3.pdf>

## Why does this matter?

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A smoother transfer of your weight over your foot allows you to put more energy into going forward instead of up and down



## Putting it to use

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Incorporating short bouts of barefoot running with shod running can give you real time feedback on your running technique

For example: Try running laps around a soccer field alternating between your shoes and barefoot every couple of laps. Pay close attention to how your body feels as you change between shoes and barefoot.

## Summary of recent “science”

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- I. Barefoot runners tend to land on the front part of their foot and shod runners tend to land on their heels
- II. Barefoot runners demonstrate decreased ground reaction forces when their foot hits the ground
- III. Barefoot runners tend to have a shorter stride length and a faster cadence for the same pace
- IV. Landing on the middle or front of your foot creates a more efficient transfer of your weight over your foot

# Limitations of the “science”

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- Point of measurement
  - Barefoot- measure force directly to the foot
  - Shod- measures force to the bottom of the shoe
  - There is no demonstrated link between GRF and injury rates for running
- Very small sample sizes
- Methods of force measurement
  - Force plates
  - Treadmills

## Other points to consider

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- Will different shoes require different muscle activation patterns?
- Can you enjoy the best of both world by wearing shoes and landing on the front of your foot?
- How much does the position of your foot really effect how your run?
- What do the Kenyans think about barefoot running?

## Different shoe types

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Is there a difference in muscle activity between trainers and racing flats since racing flats have a much smaller heel cushion?



## Application: Specificity of training

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- Spend some time training in your racing flats to ensure proper conditioning and coordination of the muscles of your lower leg
- Finding out race day that your legs weren't prepared for running in racing flats is a big let down and it can even start you down the path to an overuse injury

“I started having this pain after my last race”

# The best of both worlds

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Can I get the best of both worlds by trying to land on the middle or the front of my foot while wearing my trainers?

Krispy Kreme Challenge  
NCSU February 2010



## Application: Proceed with caution

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- To avoid hitting your heel you will have to increase the amount of ankle plantar flexion to clear the large heel of your trainer
- Excessive ankle plantar flexion can increase the compressive forces on the back part of your ankle joint



# How much does foot position at impact really effect your running?

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- The impact of your foot on the ground effects no more that 25% of your stride
- Don't forget you also have a head, arms, trunk, and legs that need to be in to proper position for running at your best



## Following the Kenyans' example

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If running barefoot is so great why don't native Kenyans, who grew up running barefoot, keep running barefoot?



# Bringing it all together

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- Barefoot running would appear to be an effective training tool if used in moderation
  - Benefits include
    - Improved running efficiency
    - Improved connective tissue strength and elastic recoil of the calf muscle
  - Risks include
    - Overloading and damaging connective tissues
    - Stepping on sharp things and cutting your foot
- Spend some time training in your racing flats
- Increasing your cadence can lead to decreased GRF's

## Seeking Physical therapy

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- For most insurances you have to have a written prescription from a doctor or physician extender
- Once you have your prescription you can call our office and set up an appointment
- If your doctor suggest another clinic let them know you would like to see me because you prefer to see someone familiar with your condition
- If they still suggest someone else come and see me anyways. It's your money you are spending and you have a legally protected right to see whoever you want

## **Next Month: Proper training and its role in injury prevention**

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- Patient: “Every time I run more than 5 miles my hip starts hurting”
- Physical therapist: “How often do you run more than 5 miles?”
- Patient: “You see, I’m training for this marathon and I only get to run a couple times a week so...”

# Acknowledgements

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- James Demarco for tireless support of our running community
- Select Physical Therapy for providing the opportunity to help people for a living
- My wife and family for support and encouragement
- God for making such a fascinating human machine

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# Questions?

Select Physical Therapy

Christiansburg office: 381-4166

24 hour injury Hot-line: 1-877-INJ-6999