Barefoot Training For Injury Prevention And Performance Enhancement

National Athletic Trainers Association 2011 Annual Meeting and Clinical Symposia

New Orleans, LA

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Disclosures

- Neither I, Art Horne, nor any family member(s), have any relevant financial relationships to be discussed, directly or indirectly, referred to or illustrated with or without recognition within the presentation.
- I do NOT run barefoot
- I barely run at all

Objectives

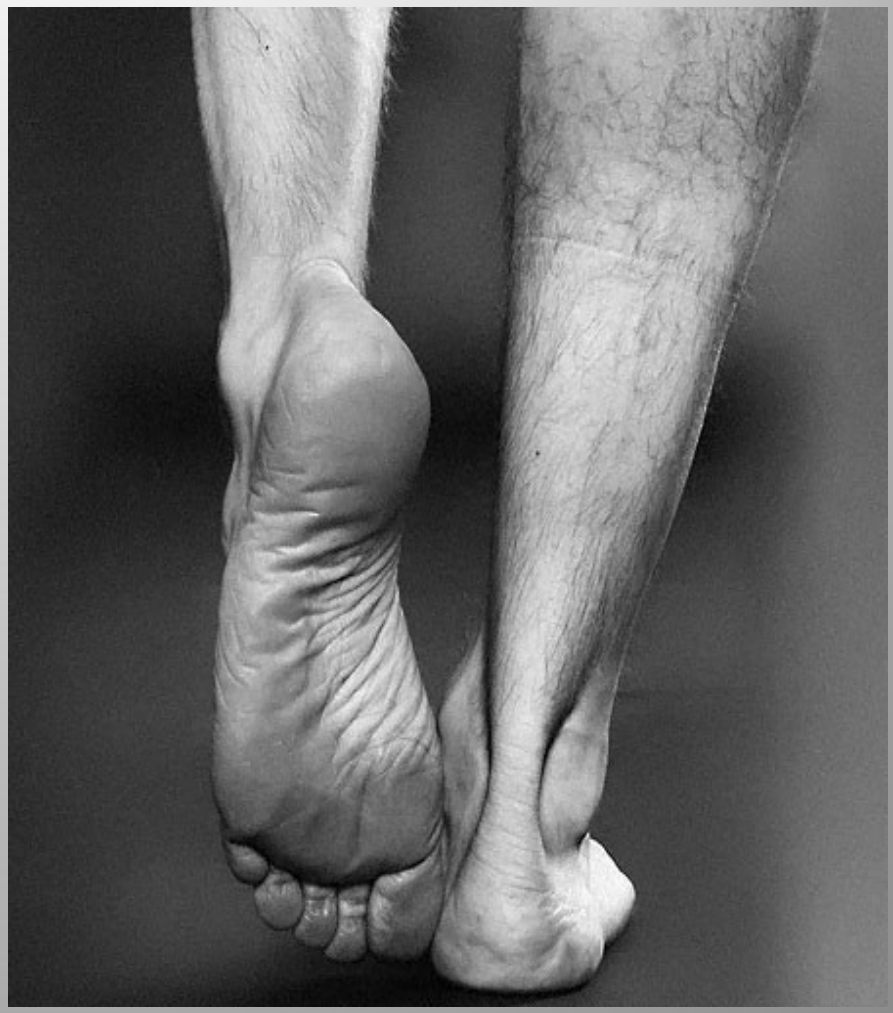
- Explore and analyze current literature:
  - History
  - Benefits & Dangers
  - Research
- Establish clear contraindications / precautions
- Offer a safe program with recommendations in both rehabilitation and sport performance training

"The residents who live here, according to the parable, began noticing increasing numbers of drowning people caught in the river's swift current and so went to work inventing ever more elaborate technologies to resuscitate them. So preoccupied were these heroic villagers with rescue and treatment that they never thought to look UPSTREAM to see who was pushing the victims in."

Sandra Steingraber
- Living Downstream: An Ecologist Looks at Cancer and the Environment

What's Everyone Talking About?

- Hoffman 1905
- Abebe Bikila
- Born to Run
- Lieberman
- Vibram, Nike Free and other Minimalist brands



History – Hoffman 1905

- Objectives:
  1. General observations on the foot including its shape, functions, range of voluntary and passive motion, and relative length as a whole and of its component parts.
  2. Height and shape of the longitudinal arch and its bearing on the usefulness of the foot.
  3. Relationship between the height of the arch and gait.
  4. Collection of specimens.

Hoffman P. Conclusions Drawn From A Comparative Study Of The Feet Of Barefooted And Shoe-Wearing Peoples. J Bone Joint Surg Am. 1905;s2-3:105-136

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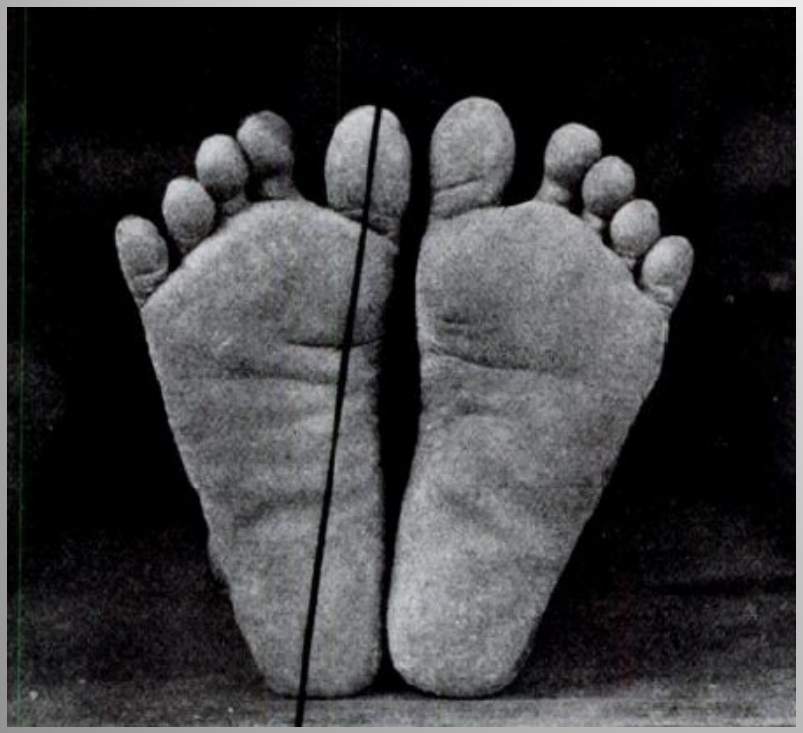
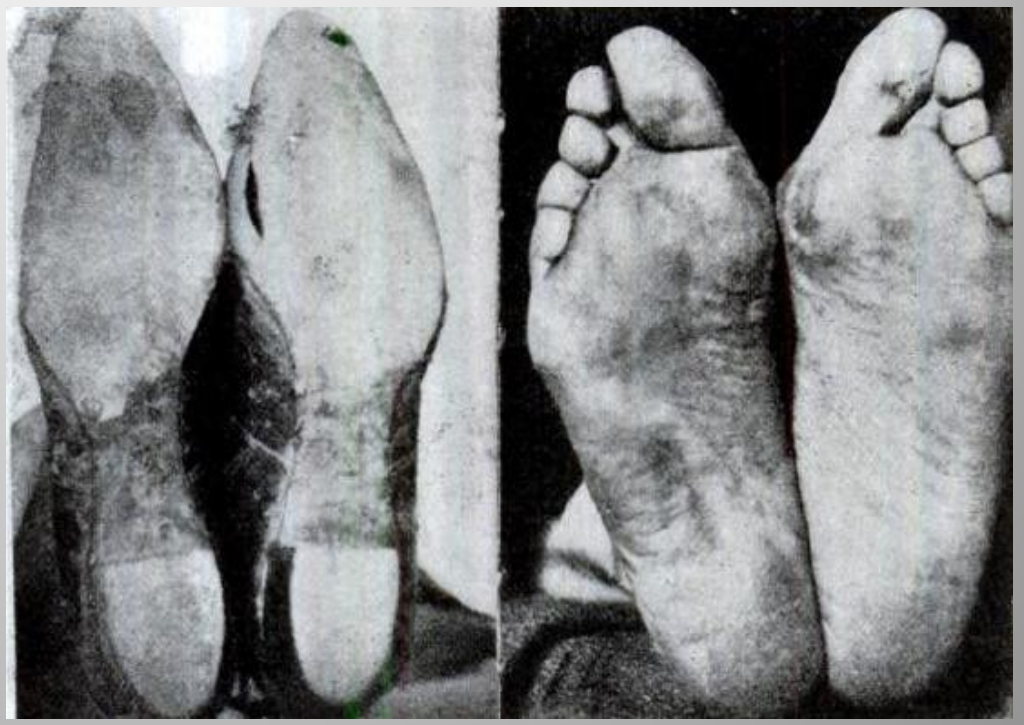
History – Hoffman 1905





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History – Hoffman 1905

Hoffman P. Conclusions Drawn From A Comparative Study Of The Feet Of Barefooted And Shoe-Wearing Peoples. J Bone Joint Surg Am. 1905;s2-3:105-136

but we're smarter than that…

History – Hoffman 1905

Hoffman P. Conclusions Drawn From A Comparative Study Of The Feet Of Barefooted And Shoe-Wearing Peoples. J Bone Joint Surg Am. 1905;s2-3:105-136

Abebe Bikila – WR 2:15:16

Born To Run – Christopher McDougall

Born to Run: A Hidden Tribe, Superathletes, and the Greatest Race the World Has Never Seen, by Christopher McDougall

Born To Run – Tarahumara Ultrarunners

Born to Run: A Hidden Tribe, Superathletes, and the Greatest Race the World Has Never Seen, by Christopher McDougall

Lieberman – Nature

- Humans ran for millions of years without modern running shoes.
- Q:How did they do this?
- A: Avoid Heel Strike
- Study: Compared BF and Shod runners

Lieberman – Nature

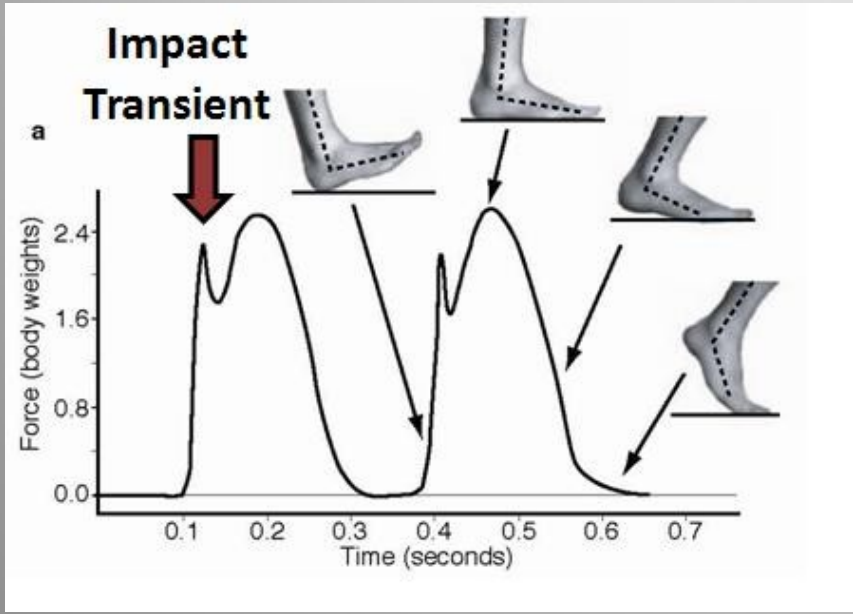
- Compared foot strike kinematics of:

1. Habitually shod USA runners
2. Athletes from Kenya (famed for running – most grew up barefoot but run with shoes now)
3. US runners who grew up shod, but now run barefoot or minimal
4. Kids from Kenya school who have never worn shoes, and
5. Kids from Kenya school who grew up shod.

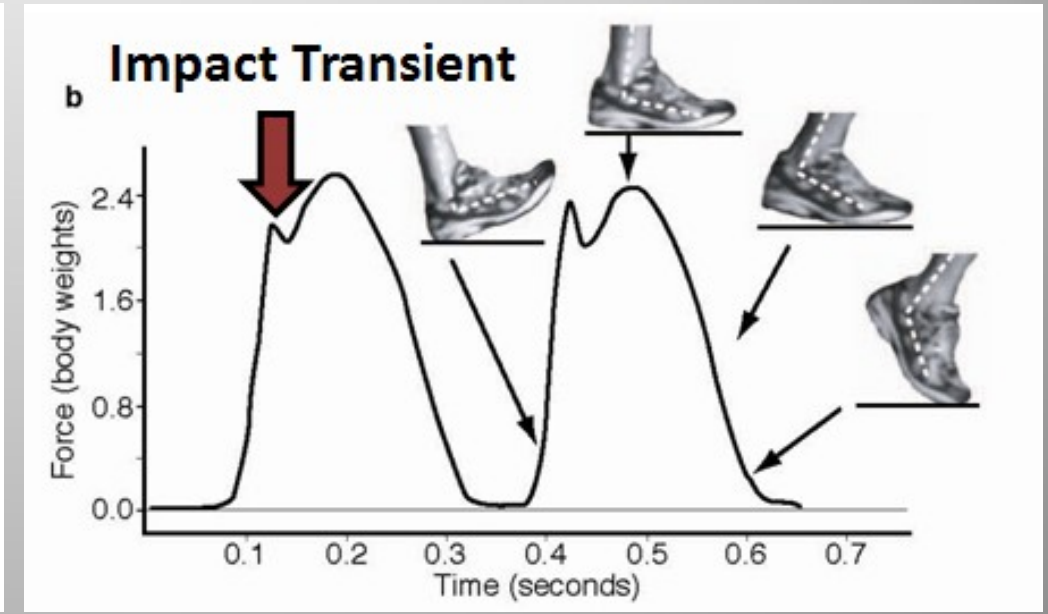
Lieberman et al. 2010. Foot Strike Patterns And Collision Forces In Habitually Barefoot Versus Shod Runners. Nature 463: 531-5.

Lieberman – What's the difference

Barefoot Heel Strike



Shod Heel Strike

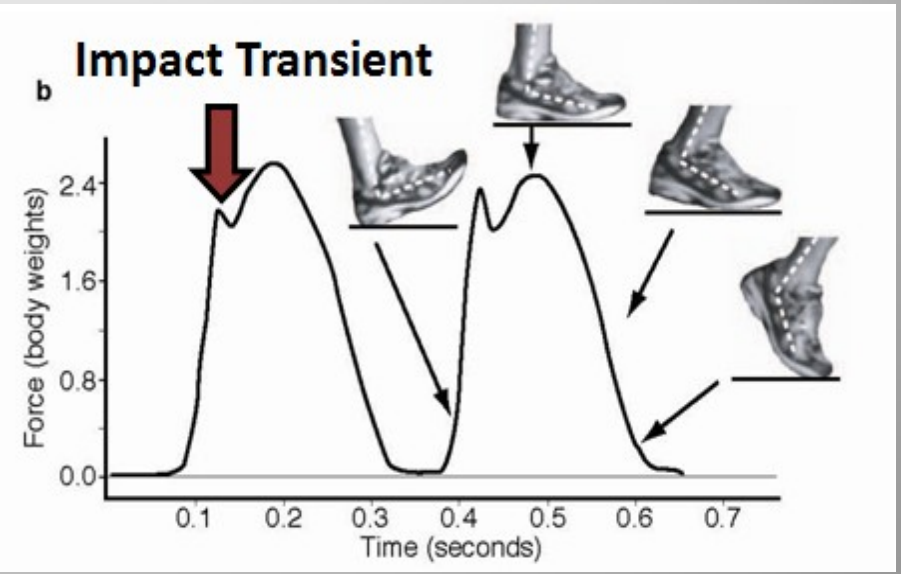


Lieberman et al. 2010. Foot Strike Patterns And Collision Forces In Habitually Barefoot Versus Shod Runners. Nature 463: 531-5.

Lieberman – Modern Shoes

- Modern shoes have a very cushioned heel that facilitates landing on the heel
- Cushions some of the landing impact force caused by collision with the ground
- About 75% people heel strike (Hasegawa et al., 2007)
- Is it a choice to heel strike?

Heel Strike



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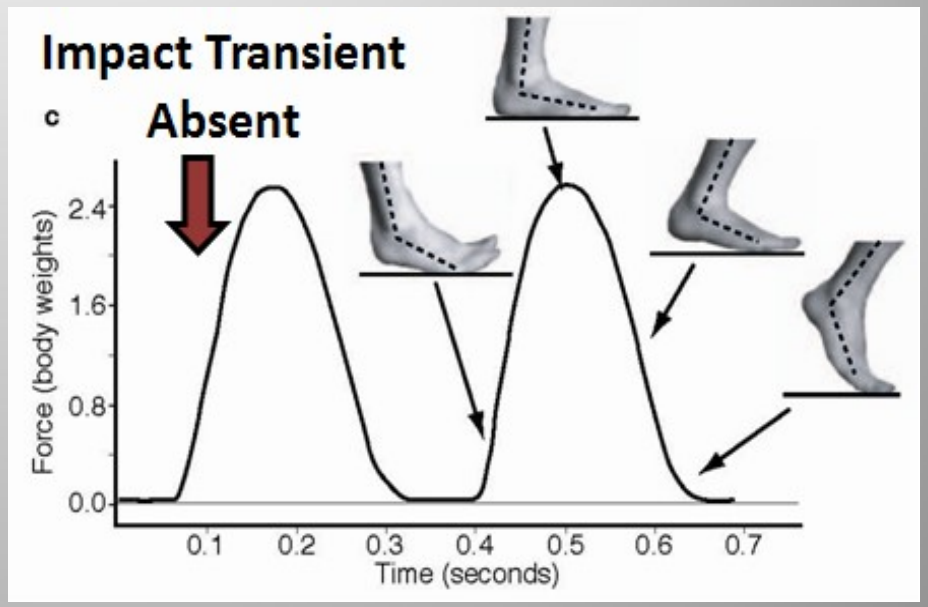
Elite Kenyan Runner

Lieberman et al. 2010. Foot Strike Patterns And Collision Forces In Habitually Barefoot Versus Shod Runners. Nature 463: 531-5.

Lieberman – Barefoot

- According to the research, most barefoot runners land either mid-foot (flat-foot) or forefoot (on balls of the feet)
- followed by an eccentric lowering of heel and then propulsion
- It hurts to heel strike on bare feet!

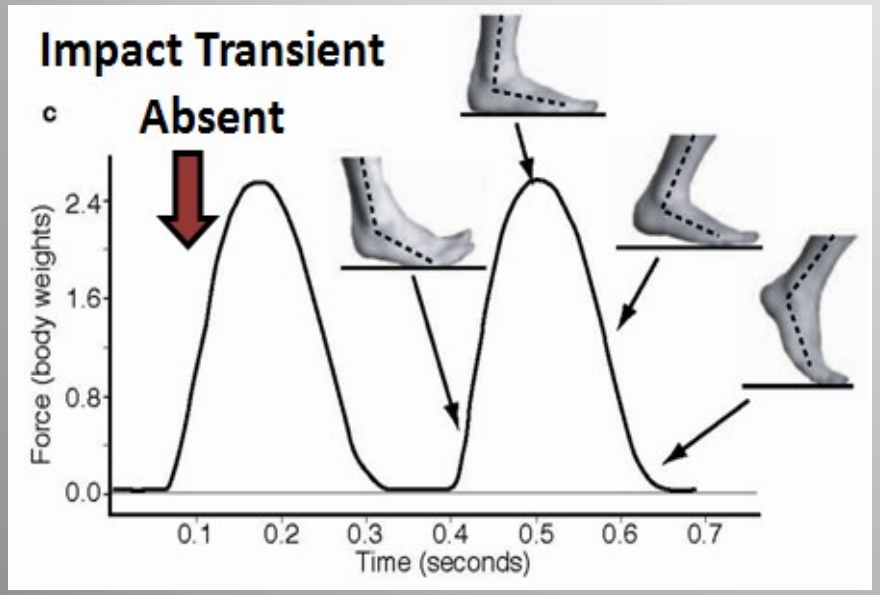
Forefoot Strike

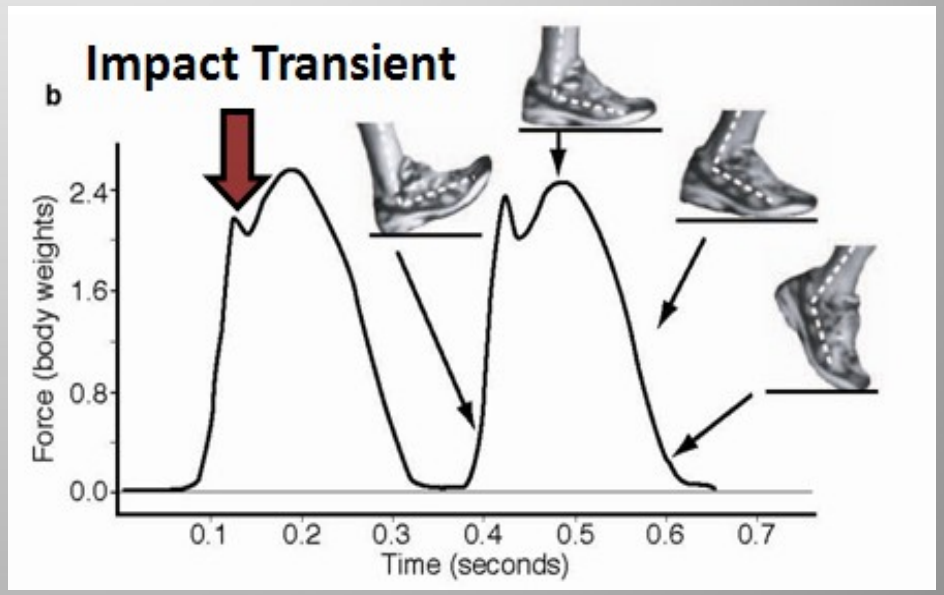


Lieberman et al. 2010. Foot Strike Patterns And Collision Forces In Habitually Barefoot Versus Shod Runners. Nature 463: 531-5.

Lieberman – Comparison

- Steel Rod: Drop it on an angle or straight down





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A New Wave of Running

Sports Medicine & Performance

Proposed Benefits

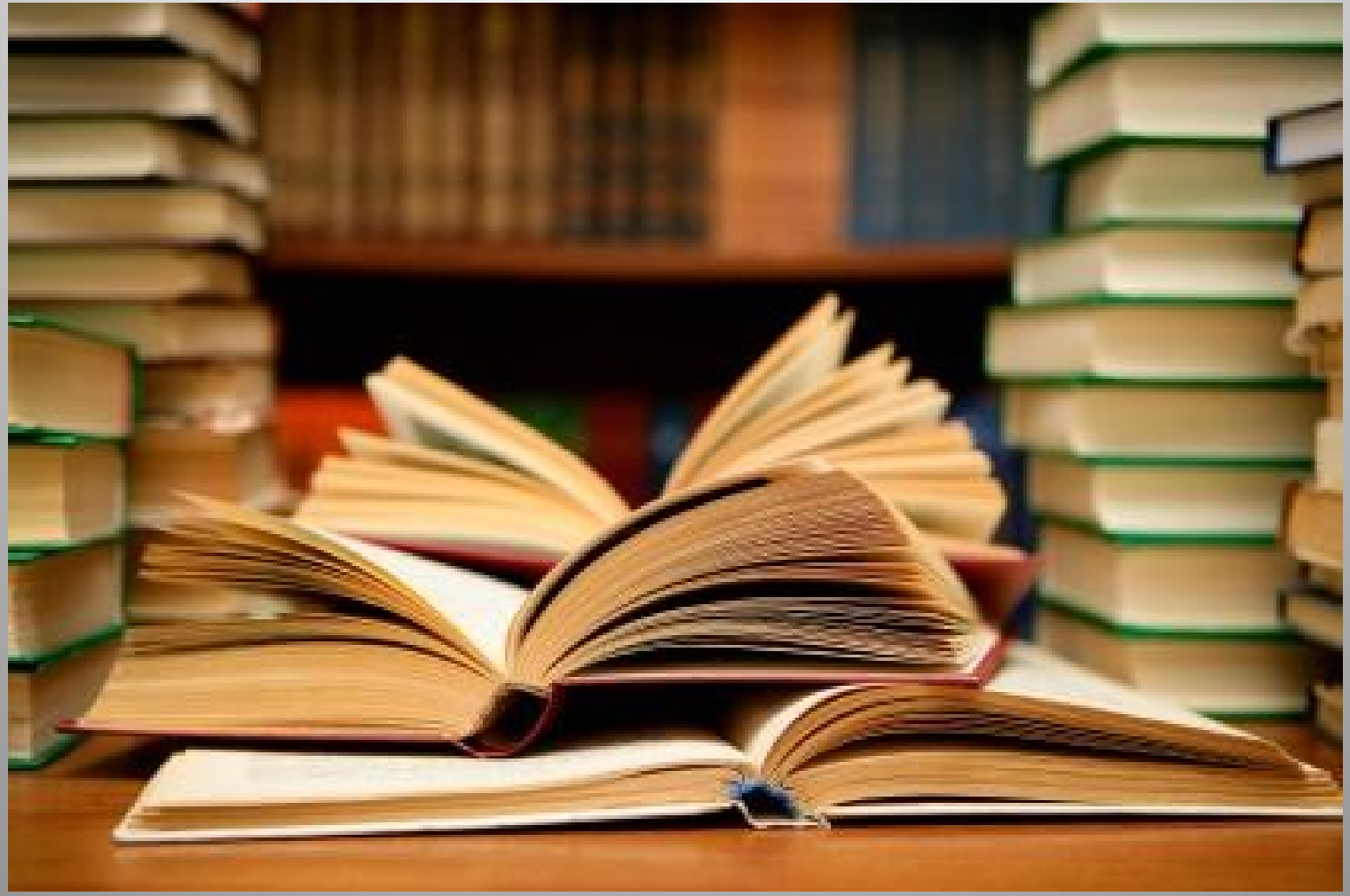
- Shoes splint and cast your foot
- Strengthens muscles of the foot
- Decreased Injury Rate & Increased Awareness
- Increased bone density
- Energy Cost:
  - Forefoot strike uses natural springs in foot and calf
  - Running barefoot or in minimal means there is less mass to accelerate
    - 5% less energy than shod (Divert et al., 2005)

Exposing barefoot runners for the nutters that they are

Barefoot Running is Bad

Sports Medicine & Performance

What does the research say?

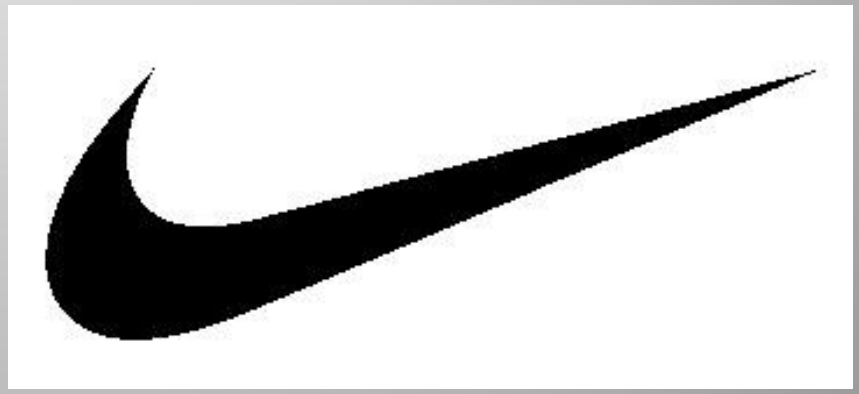


Less is More

Potthast W, Niehoff BB, Goldmann J, Heinrich K, Brüggemann. Changes in morphology and function of toe flexor muscles are related to training footwear. Institute for Biomechanics and Orthopaedics, German Sport University Cologne.

- Evaluate effect on foot and shank muscles
- 100 active people
- Both groups: 20-30 min of exercise 4x week
- Increase flexor strength & Cross-sectional area
- Stiffening of the MPJ can enhance performance

- Study Funded by Nike



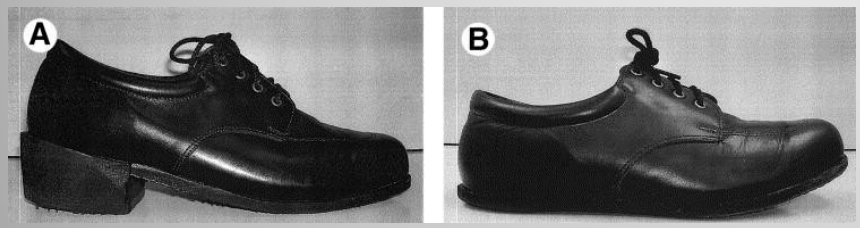
Less is More

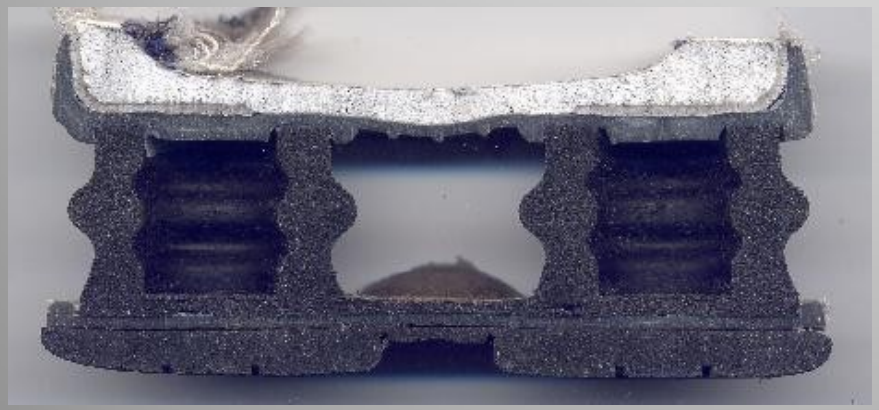
Shakoor N, Block JA. Walking barefoot decreases loading on the lower extremity joints in knee osteoarthritis. *Arthritis and Rheumatism*. 2006; 54(9): 2923-2927.

- 75 subjects with knee OA – shoes/ barefoot
- Peak Jt loads at hips and knees decreased with BF
- Previous studies of lateral wedge orthotics = 5-7% decrease in medial compartment
- BF reduced relative load of 12% at knee
- Conclusion: shoes may increase loads on LE joints.

Less is More

Kerrigan DC, Johansson JL, Bryant MG, Boxer JA, Della Croce U, Riley PO. Moderate-heeled shoes and knee joint torques relevant to the development and progression of knee osteoarthritis. Arch Phys Med Rehabil 2005;86:871-5.

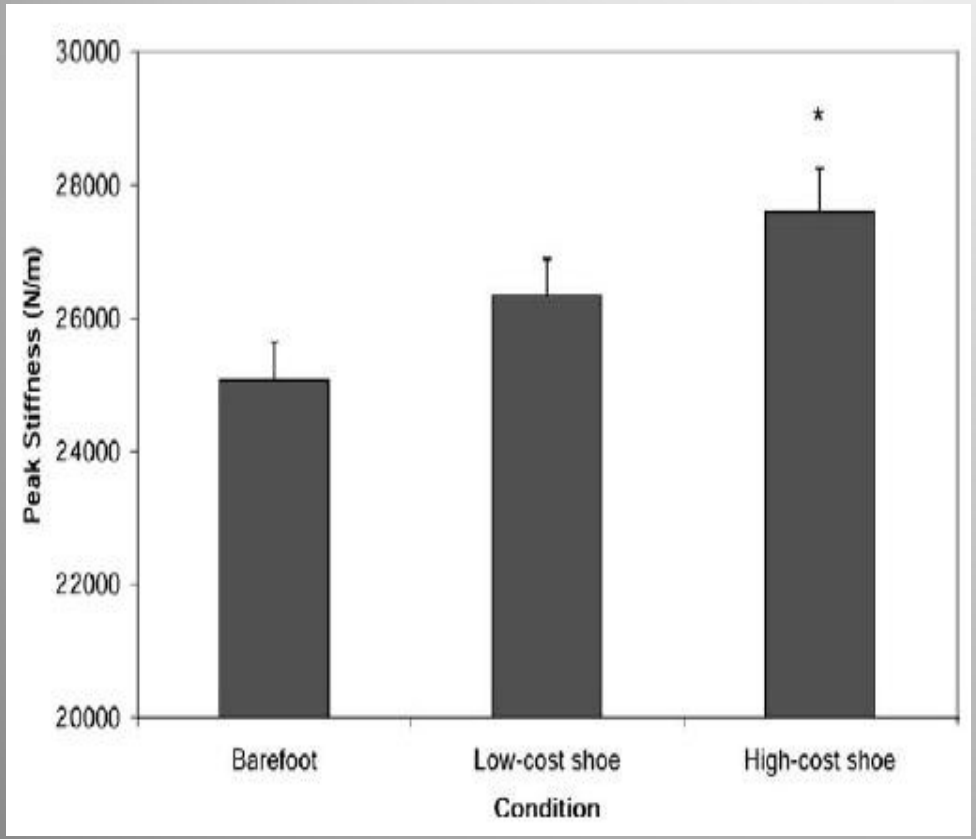




- 30 healthy young and 20 elderly women
- Does 1.5” heels = progression of knee OA?
- Exp shoes significantly increased knee torques thought to be relevant in the develop/progression of knee OA
- Women, with OA should be advised against wearing heeled shoes

Less is More

Bishop et al (2006). Athletic Footwear, Leg Stiffness, and Running Kinematics. Athl Train. 2006; 41(4): 387–392.



- Nine healthy adults
- Subjects hopped in place on force plate and ran at two different speeds under three conditions: barefoot, low-cost footwear and high-cost footwear
- High-cost shoes were described as, “Lightweight Cushioned Trainers for the High-Mileage Runner.”
- Peak limb stiffness increased when wearing shoes and significantly with high-cost shoe.
- Similar to study by Robbins and Waked.

Shoe Problems

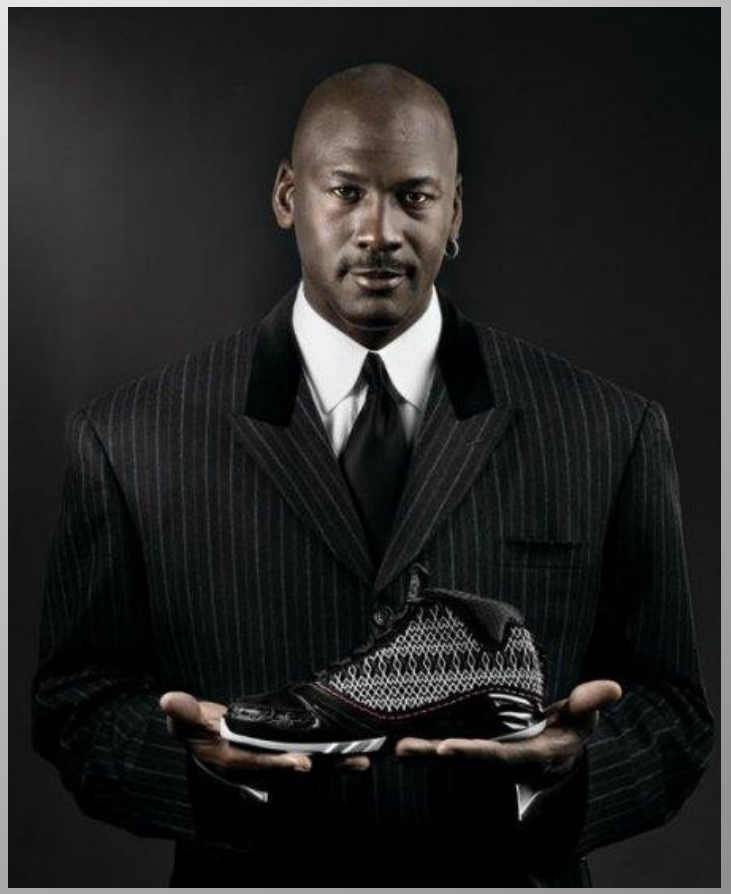
Robbins S, Waked E. Hazard of deceptive advertising of athletic footwear. *Br. J Sports Med.*1997;31:299-303.

- 15 men confronted 4 surfaces
- Advertising messages:
- Deceptive, (Advanced Technology)
- Warning (frequent injuries)
- & Neutral (impossible to predict)
- Results: impact varied with message
- Impact greatest with Deceptive
- Impact lowest with Warning

Shoe Problems

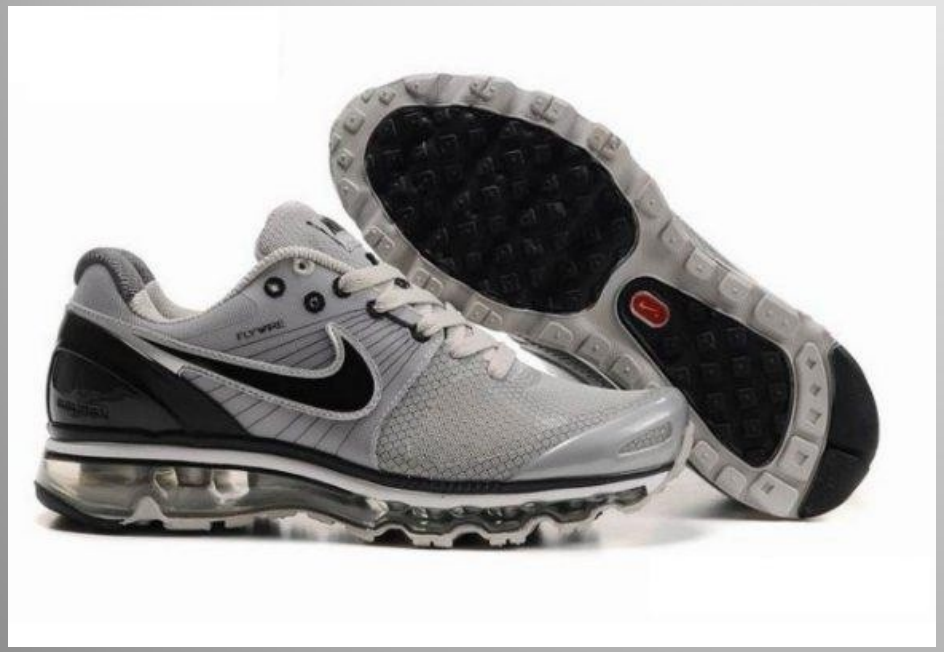
Marti B. Relationship between running injuries and running shoes – Results of a study of 5000 participants of a 16-km run – The May 1984 Berne "Grand Prix". In: Segesser B, Pforringer W, eds. *The shoe in sport.* Chicago: Year Book Medical Publishers, 1989: 256-65.

- Questionnaire to over 5000 runners
- Expensive shoes accounted for 123% greater injury frequency than lowest cost models
- Incidence of injury in shoes over $95 were twice as much costing less than $40



Shoe Problems

McKay GD, Goldie PA, Payne WR, Oakes BW. Ankle injuries in basketball: injury rate and risk factors. *Br J Sports Medicine*. 2001;35:103-108.



- Over 10000 participants observed

1. Previous Ankle Sprain – 5x more likely to sprain again
2. Air Cells in Heel – 4.3 x more likely
3. No stretch = 2.6x more likely

* Relation between calf tightness and ankle injuries . Tight calf = supinated foot

Where am I?

Magnusson M, Enbom H, Johansson R, Pyykko I. Significance of pressor input from the human feet in anterior-posterior postural control. The effect of hypothermia on vibration-induced body-sway. *Acta Otolaryngol* (Stockh) 1990;110: 182-188.

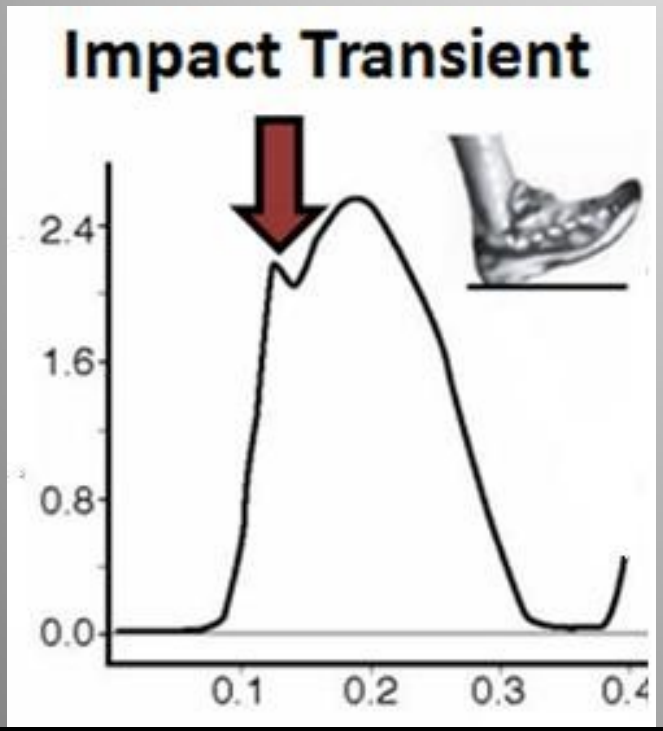
- Study significance of mechanoreceptors in soles of feet
- 13 healthy subjects
- Force Platform – cold/control
- Posture perturbed by vibratory stimulation
- Body-sway velocity significantly greater with cold feet (eyes open and closed)
- Results suggest mechanoreceptors of the soles contribute **significantly** to postural control

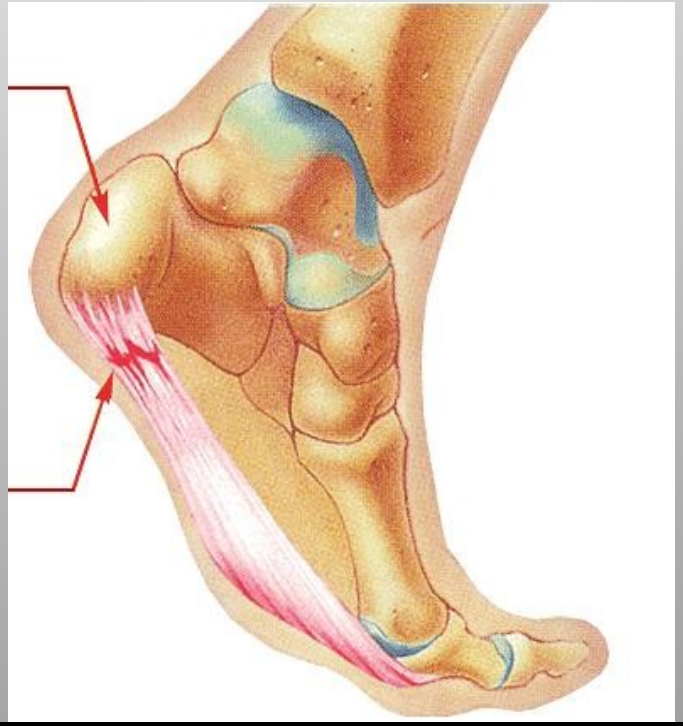
Ouch!

Milner et al., (2006). Biomechanical Factors Associated with Tibial Stress Fracture in Female Runners. Medicine & Science in Sports & Exercise. 38(2)323-328.

Pohl et al., (2010). Biomechanical and Anatomic Factors Associated with a History of Plantar Fasciitis in Female Runners. Clin. J. Sports Med, 19(5):372-376.

Bowser et al (2010). A prospective study of loading variables in female runners who develop plantar fasciitis. American Society of Biomechanics, State College, PA.





The magic is not in the medicine but in the patient's body – in the vis medicatrix nature, the recuperative of self-corrective energy of nature. What the treatment does is to stimulate natural functions or to remove what hinders them.

– Miracles, C.S. Lewis 1940

Is Barefoot Running For You?

- Evaluation
- Screening
- Training Area
- Training Rules
- Implementing Strategies in Sports Medicine
- Implementing Strategies in Strength & Conditioning

Screening – It's Not For Everyone

- Previous injury (van Gent et al, 2007)
- Stress fracture or previous surgery
- Excessively high arches
- Athletes or Patients with Sensory Loss
- Whole Body Movement Limitations

FMS™ Functional Movement Systems

SFMA™ Selective Functional Movement Assessment

Training Area

- Turf, Field Turf or Carpet
- Surface clear of debris, glass, rocks or other danger
- No to Ceramic tile & Wood Floors
  - slipping
- Socks vs. barefoot
- Risk vs. Reward

Training Rules

- Soreness vs Pain
- Pain elsewhere – knee, hip and back
- SAID principle
- If in doubt, start small
- 2-3 week intervals – achieve success and progress
- Listen to your feet
- 10% Rule

Implementing Strategies in SM

- Shoes off on the table
- ROM and stretching
- Modalities
- Gait Analysis
- **Therapeutic exercises**
  - **Balance**
  - **Strength**

Evaluation

Implementing Strategies in S&C

- Soft tissue time
- Prep work
- Movement/Mobility
- Ladders /Agility time
- Hopping and Jumping
- Platform
- Running/Cool down

Implementing Strategies in S&C

Week 4-6(April 19-May 7)	*Day 1- April 19th*	*Day 2 - April 20th*
Cold Stretch	PF rolls, T-spine Twist & Tilt 5x 5	table stretch: hip rotator, hamstring
	Lateral Band Rack Stretch/Wall OH reach -sit	Foam Roll: ITB/Lat Quad, Distal Groin
Foam Roller	total body as directed by coach	Modified partner stretch
Movement Prep	barefoot - linear as directed by coach	barefoot - lateral as directed by coach
Agility Ladder	barefoot - linear as directed by coach	barefoot - lateral as directed by coach
	SL Anterior Reach	Stick Series -Split squat, hip hinges
Movement/Mobility Circuit	airplane x 15 touches	Kneeling hip flexor with tricep pull
	cross-over lunge	Bowler squat x 10 each
	lateral lunge , T- Push up	Achilles Matrix / Clock Jumps eyes closed
Activation / Core	Lateral X Band Walk 2x 10 yards Standing Cable Press 2x 10 reps each Stir the Pot 2x 15 reps each	SL hip lift with ball trap kneeling upward cable stick chop Kneeling PB roll out

Progression: Strength & Conditioning

- Week One
  - Patient Education, **Barefoot** for Cold Stretch, Foam Rolling & **Movement**
  - Nike Free or minimal shoe during remainder of lift & ADL's
- Week Two
  - **Barefoot** for Cold Stretch/Foam Rolling, Movement and **Agility Ladders**
- Week Three
  - **Barefoot** for above including **Mobility Circuits, Activation** and **Core Work**
  - Add **Kettle Bell** and **Traditional Lifts** prn

Cold Stretch

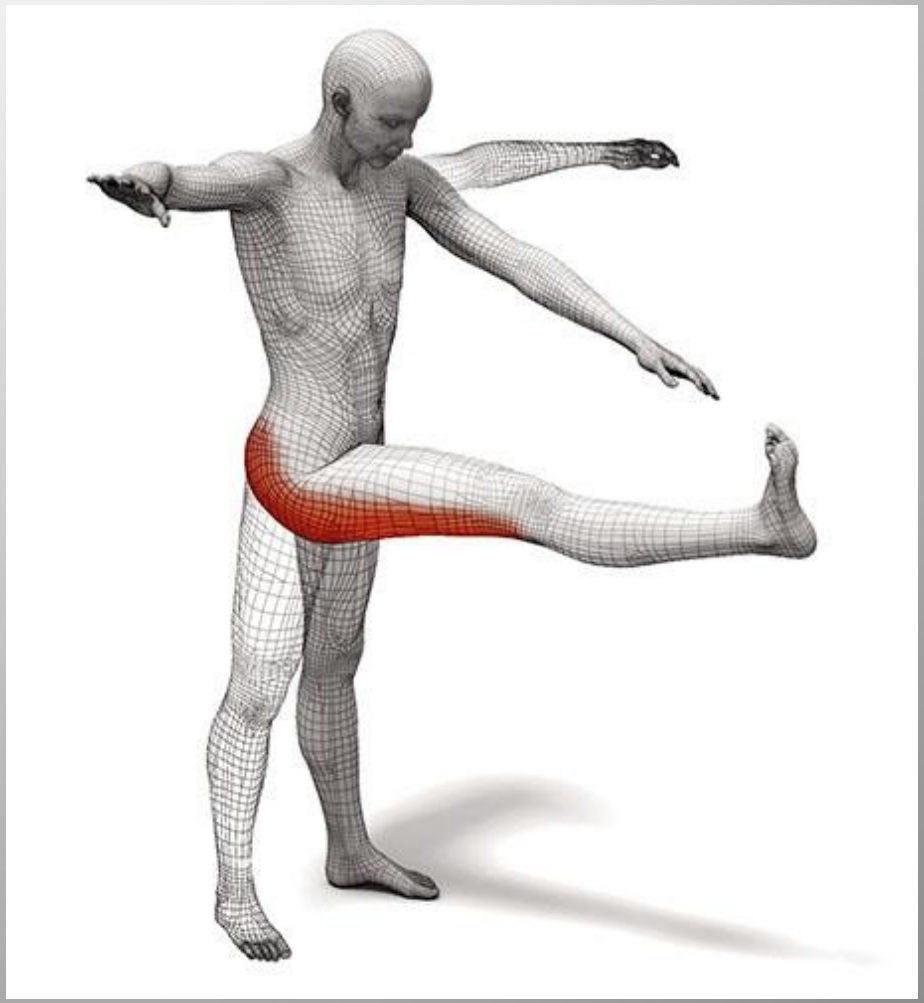
- Strap stretch
- Partner stretch
- Table stretching
- Yoga Poses

Soft Tissue Work

- Plantar fascia rolls
- Foam rolling
- Gastroc/soleus stretching

Movement Prep

- Butt Kicks
- Skips
- Toe Kicks
- Marching
- Inchworm
- Spiderman/World's Greatest Stretch



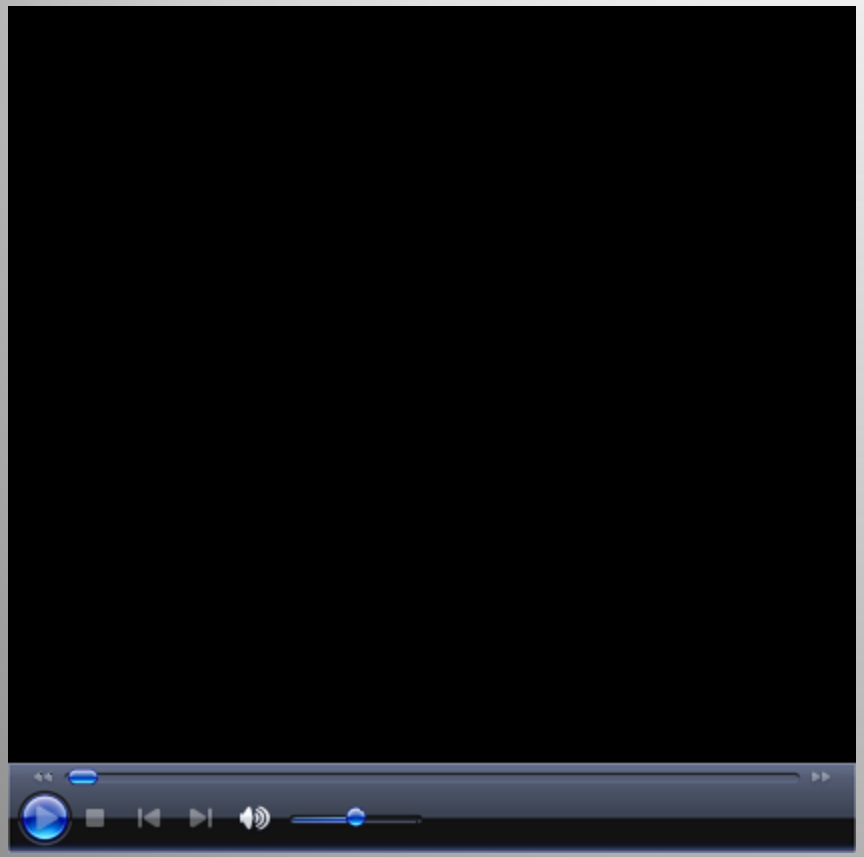
Agility Work

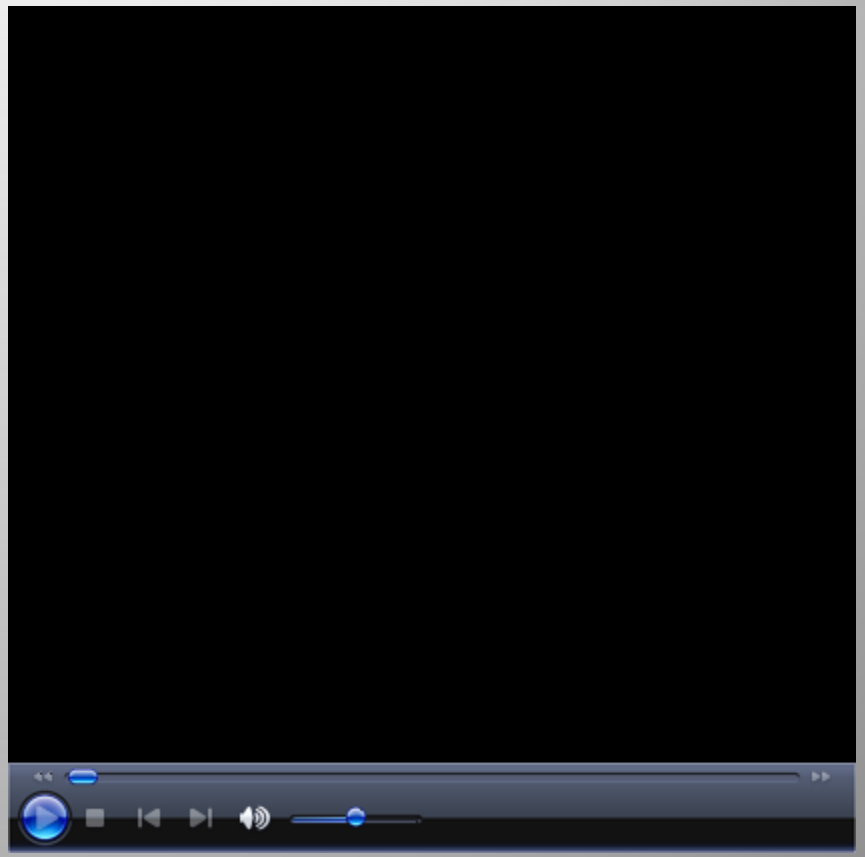
Agility Work

Lunge Series

Squat Series

Hops, Jumps, and Balance





Hops, Jumps, and Balance

Hops, Jumps, and Balance

Traditional Lifts

- Kettlebell
- Squat
- Dead Lift

Kettlebell Work

Traditional Lifts – Squat

Traditional Lifts – Deadlift

Sports Medicine & Performance

In the Perfect World

1. Start with Nike Free in day time
2. Nike Free to train and move
3. Decreased or Neutral heel lift (New Balance)
4. Vibram to walk around, train and move
5. Vibram as a part of your running progression

- Negative: costs with each shoe - $100

Take Home

- Safety First : Evaluate and Educate
- It’s not for everyone
- Protect your feet : Minimal Shoes to start
- Slow and Steady wins the race (10% rule)
- Get Fit To Run, Don’ t Run To Get Fit
- Eliminate the high heels
- Be nice to your kids : wide toe boxes
- If you’re not injured, don’t change

Thank you

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