
Altra.com


Vivobarefoot.com

## Running Shoes: Minimalist, maximalist or standard shoe prescription?

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## Disclosures

**I have no product endorsements or other financial relationships to disclose**

## Outline

Running shoe prescription: What's the evidence?

Does minimalism reduce injury rates in runners?

Does maximalism reduce injury rates in runners?

What should we tell our patients?

## What do runners perceive as causes of running injuries?

Saragiotto 2014

Most frequently cited:

Not stretching

Excessive training

Wrong running shoes for foot type

Inadequate/unbalanced diet

Foot type changes

"not respecting (my) body's limits"

Not warming up


goGriz.com

## Assigning shoes based on foot type: Knapik et al., 2009, 2010a,b, 2014

Runnersworld.com

n=1955 Air Force Cadets Knapik 2010

Experimental group (n=1042)

Control group (n=913)

Sportspodiatryinfo.com

Assigning shoes based on arch type lacked support

Shoe brand had no bearing on injury rate Knapik 2014

Original article

Foot pronation is not associated with increased injury risk in novice runners wearing a neutral shoe: a 1-year prospective cohort study

Rasmus Oestergaard Nielsen,[1,2] Ida Buist,[3] Erik Thorlund Parner,[4] Ellen Aagaard Nohr,[5] Henrik Sørensen,[1] Martin Lind,[6] Sten Rasmussen[2]

British Journal of Sports Medicine

*Br J Sports Med* (2013)

927 runners: Tracked running volume via GPS for 12-months

Foot posture index measured

- Highly supinated (n=53)
- Supinated (n=369)
- Pronated (n=122)
- Highly pronated (n=18)

Runners classified as "pronators": *Lowest* injury rate per 1000 km

252 sustained injury

Injury risk in runners using standard or motion control shoes: a randomised controlled trial with participant and assessor blinding

Laurent Malisoux,[1] Nicolas Chambon,[2] Nicolas Delattre,[2] Nils Gueguen,[2] Axel Urhausen,[1,3] Daniel Theisen[1]

British Journal of Sports Medicine

*Br J Sports Med* (2016)

**Randomized 364 runners,**
18-65 years of age, regular running for 6 mo's, >12 months without interruption due to injury

**Foot posture index**

**Standard shoe** (n=191) → **Injured: 32.5%** 60/185

**Motion control** (n= 195) → **Injured: 17.6%** 33/187

**Injury rates only different in pronated runners**

**Tracked for 6 months running**

**Pronated: Motion control 66% lower risk**
**Standard shoe 80% higher risk**

## So, why the difference between Nielsen 2013 and Malisoux 2016?

**Nielsen 2013**

Pronated foot reduced risk

- Novice runners
- Foot Posture Index
- Received neutral shoe
- Tracked for 6 mo's
- Injury: Interruption for 1 wk

**Malisoux 2016**

Motion control shoe reduced risk

Standard shoe increased risk

- Experienced runners
- Foot Posture Index
- Neutral or motion control shoe
- Tracked for 6 mo's
- Injury: Interruption for 1 day

Change of shoes for pronators may be the cause

Since the advent of the modern running shoe in 1972…
"…injury rates have not declined in 30 years even as major advances seem to have been made in running shoe technology over that time."

-Daniel Lieberman, PhD, *40th Annual Sports Medicine Symposium, Boston Marahon*

Nike.com

Asics.com

## Minimalist vs. Maximalist Shoes

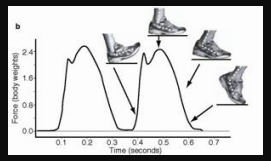
Agresta 2018

**MINimalist shoe**: "..minimal interference with natural movement of the foot due to high flexibility, low heel to toe drop, weight & stack height, & absence of motion control & stability devices"
Esculier 2015, *J Foot & Ankle Res*.

**MAXimalist shoe**: Um, pretty much the opposite

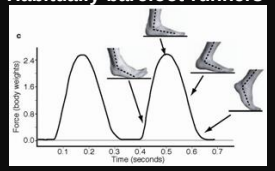
## Lieberman et al., 2010 *Nature*

**Habitually shod runners**




75% runners are heelstrikers Hasagewa 2007

**Habitually barefoot runners**




Dramatically lower impact loads


Lieberman, 2010

## Nike Free 3.0 (2005)

www.Runnersworld.com forums, accessed 1/09/2015

"Hi, I am doing my first marathon Saturday.."

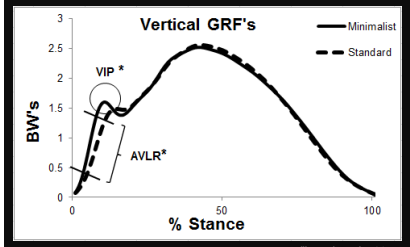
"I have been running in my Nike Pegasus.."

"I just finished reading 'Born to Run'…"

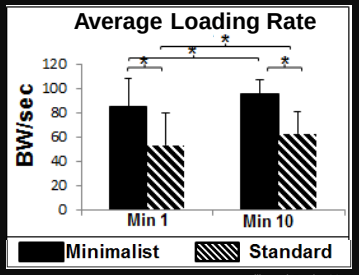
"What do you guys think, take a chance on the Nike Frees to bring me the distance… and get over the niggles at the start?"

## Nike Free 3.0 vs. Nike Pegasus

**Willy and Davis 2014, *MSSE***




Willy and Davis, 2014




Willy and Davis, 2014

**Loading rates were 62% higher in the minimalist shoe!**

**Longer follow-ups: Similar findings** Willson 2014, Agresta 2018

**Body Mass and Weekly Training Distance Influence the Pain and Injuries Experienced by Runners Using Minimalist Shoes**

A Randomized Controlled Trial

Fuller et al. 2015, *AJSM*

**Healthy runners (n=61)**

**Minimalist shoe (n=31)**
Asics Piranha, MI: 88%

**Standard shoe (n=30)**
Asics Cumulus, MI: 16%


26 Wks Transition

**a) Neither shoe was protective against injury**
**b) Minimalist runners w/ body mass >85.7 kg HR: 2.00 (95% CI: 1.10-3.66)**

## What about zero-drop shoes?

**Brooks Launch**

27 mm heel
17 mm forefoot
} 10 mm drop

**Altra Torin**

32 mm heel
32 mm forefoot
} 0 mm drop

Zero drop shoes (Altrarunning.com) :
Encourage "natural, more efficient running"
"aligns the feet, back and body posture for less impact"

## Does shoe drop affect injury rates?

Malisoux 2016

**Randomized 577 runners,**
18-65 years of age, >12 months without interruption due to injury

| 10 cm Drop Shoe (n=190) | 6 cm Drop Shoe (n=194) | Zero Drop Shoe (n=193) |
|---|---|---|
| Injury incidence: 21.6% | Injury incidence: 27.4% | Injury incidence: 24.6% |

Tracked for 6 months running

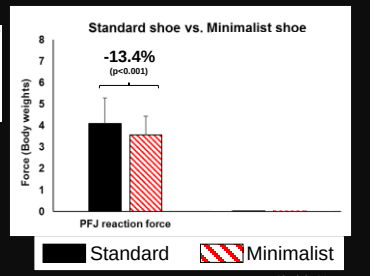
**No difference in injury rate**
10.33 injuries per 1000 hours of running

**No meaningful change in running biomechanics** Malisoux 2017

## Minimalist shoes to reduce knee loads?

Saucony Progrid guide
MI: 36%

Inov-8 Evoskin
MI: 96%



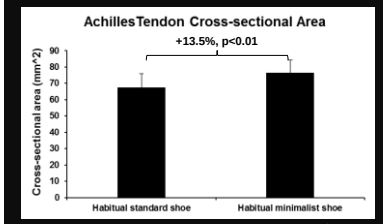

Sinclair 2014

62% higher vertical loading rates in minimalist shoes Willy and Davis 2014

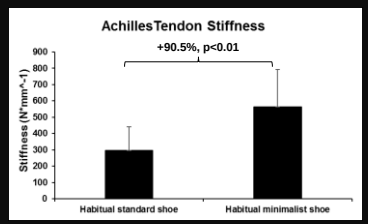
28.7% greater 5th metatarsal strains in minimalist shoes Firminger 2017

Is the reduction in knee loads worth the injury risk?

## "But wait! Minimalism inc.'s Achilles tendon properties!"




Histen 2016




Histen 2016

Cross-sectional study: Prone to Survivor Bias

Heavy, slow resistance training: best way to improve AT properties
Bohm 2015

## Google trends query conducted 2/18/2018

## Maximalist shoe: The current trend

Hoka.com

**Men's Best Selling Road Running Shoes – Q4 2017**

| Rank | Model | Colors Offered |
|---|---|---|
| 1 | Nike Zoom Fly | 5 |
| 2 | HOKA ONE ONE Clifton 4 | 6 |
| 3 | HOKA ONE ONE Arahi | 6 |
| 4 | HOKA ONE ONE Bondi 5 | 5 |
| 5 | Altra Escalante | 6 |
| 6 | Saucony Kinvara 8 | 9 |
| 7 | Brooks Ghost 10 | 9 |
| 8 | Nike Zoom Pegasus 34 | 8 |
| 9 | ASICS Gel Kayano 24 | 9 |
| 10 | adidas adizero Boston 6 | 3 |

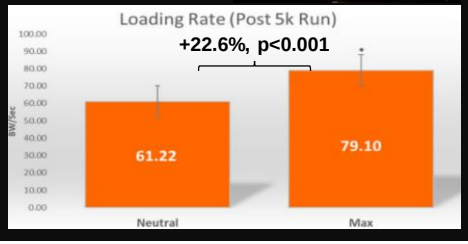
Runningwarehouse.com

## Influence of Maximal Running Shoes on Biomechanics Before and After a 5K Run

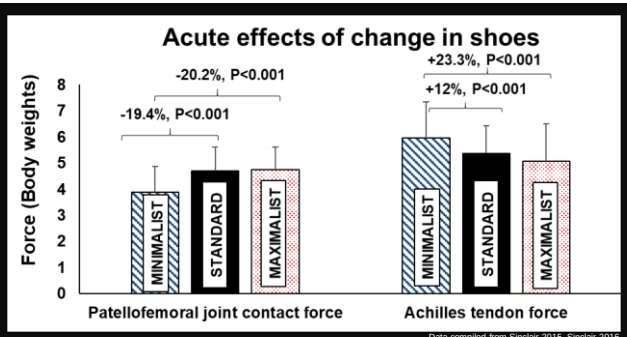
Christine D. Pollard,*† PhD, PT, Justin A. Ter Har,†‡ BS, J.J. Hannigan,† PhD, ATC, and Marc F. Norcross,‡ PhD, ATC

Orthopaedic Journal of Sports Medicine

*OJSM* 2018




## Acute effects of change in shoes




Data compiled from Sinclair 2015, Sinclair 2016

Minimalist: Greater Achilles tendon loads, reduced PFJ loads

Maximalist: No real differences at PFJ or Achilles tendon

Vs. Standard Shoes

## Immediate and short-term adaptations to maximalist and minimalist running shoes

Cristine Agresta[a]*, Sarah Kessler[a], Emily Southern[a], Grant C Goulet[a], Ronald Zernicke[b] and Jessica Deneweth Zendler[a]

*Footwear Science, 2018*

**Randomized 30 standard shoe wearers**

18-45 years of age, regular running for 6 mo's & >10 mi/week, >6 months without injury

**Tracked for 4 weeks**

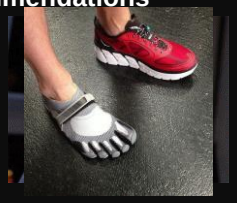
**Reduced step length, Vertical loading rates & lower leg shock higher**

**Injured: 47%**
**7/15**

**No change in impact mechanics**

**Injured: 0%**
**0/14**

## Shoe fitting recommendations

No evidence for shoe prescription Knapik 2010, 2014, 2015 Ryan 2011

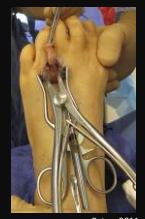
Rotating shoes: 39% reduced risk of running injury (n=264) Malisoux 2015

Pick a shoe that is comfortable, most likely optimal Nigg 2015

"Pick a shoe that needs no break-in *for you*. Then, find another one"

## So, shoes don't seem to matter…. Until they do!

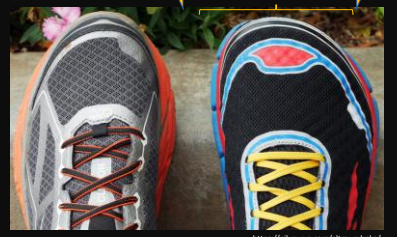
5th metatarsal stress fx



Peters 2011

Interdigital neuroma

Wide toe box



https://oilygurus.com/altra-vs-hoka/

## What's the point of this shoe stuff anyway?

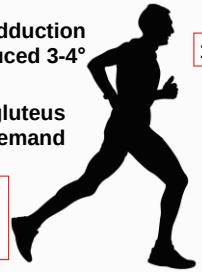
## Oh, right… to lower loads!

## 5-10% Increase in cadence/step rate

Peak hip adduction reduced 3-4°

9-11% Lower gluteus medius & max demand

3.6% Lower Achilles tendon force



10-15% Reduced PFJ loads

7.5-11% Reduction in tibiofemoral contact forces

18-22% Reduction in vertical GRF load rates

10% Reduction in plantar loads

Neal 2018, Bowersock 2017, Heiderscheit 2011, Hobara 2014, Lenhart 2014 & 2015, Willson 2015, Willy 2016, 2017, Wellenkotter 2015, Lyght 2016

## What message can we take back to our patients?

- We don't do well with rapid changes. Shoes are no exception
- Traditional shoe prescription doesn't work
- Minimalist shoes: Inc. Achilles loads, lower PFJ loads,
  Increase risk of injury in short-, medium-term (6-months)
- Maximalist shoes: Probably not really different than regular shoes
- Choose shoe comfortable *for you &* fits. Buy another similar one.


## Acknowledgements

LaTrobe LASEM

Co-presenters

Collaborators: John Willson, PT, PHD; Stacey Meardon, PT, PhD; Paul DeVita, PhD, Ryan Mizner, PT, PhD, Christian Barton, PT, PhD



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## Summary

Running shoes:

Lack evidence for reduction of running related injuries

Minimalist shoes: Require transition (6 months) to do so safely

Is it worth the risk?

Gait retraining:

Used to ease graded return to running.

Must be targeted and requires sufficient practice

Not a stand alone treatment