Running Footwear: What the Rehab Professional Needs to Know

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Goals of This Presentation

- The Anatomy of Running Shoes
- Types of Running Shoes
- How Shoe Parts Can Affect the Foot and LE
- Shoe Prescription for Your Patient(s)
- How to Fend Off Confusing Advertising

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Brief History of the Running Shoe

- 1960 – NB Trackster 1st Massed Produced Running Shoe
- 1974 – Nike Waffle Trainer Released
- 1976 – First Women's Running Shoes
- 1977 – First Mass Produced Running Shoe w/ EVA Cushioning and Varus Wedge Device for Pronation control (Brooks Vantage)
- 1979 – First Nike Air Shoe Released (First Proprietary Cushioning System)
- 1982 – First $100 Shoe (NB 990)
- 2004- First Nike Free Model
- 2005- Original Vibram FiveFingers released
- 2009 – First Maximalist Shoe Designed Shoe (Hoka) released
- 2012 – Re-introduction of TPU midsoles – Adidas Boost

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Running Shoe Brands

MAIN

- Adidas
- Asics
- Brooks
- Hoka
- Mizuno
- New Balance
- Nike
- Saucony

Additional

- Altra
- Inov8
- On
- Reebok
- Skechers
- 361
- Newton
- Salomon

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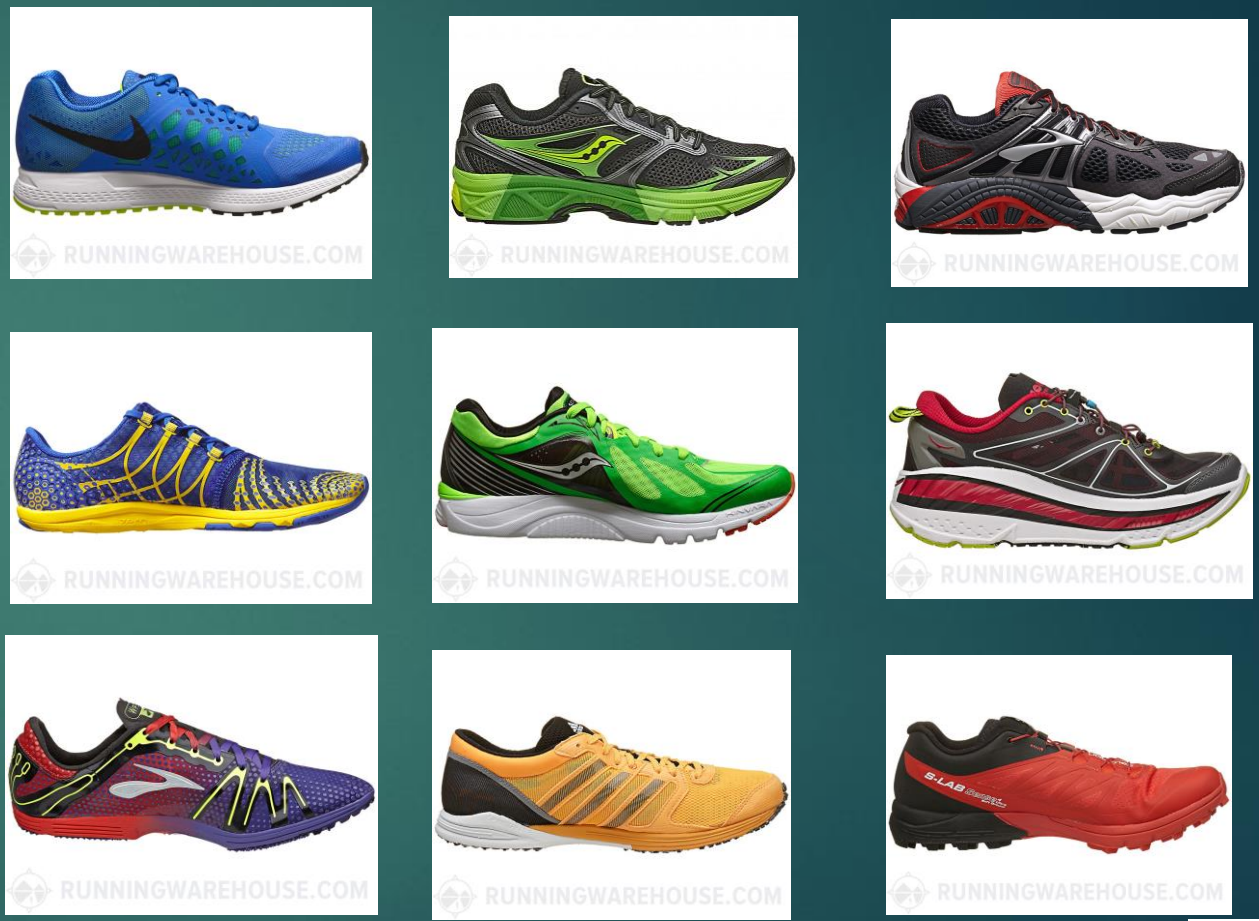
TYPES OF SHOES

- General Training Shoes
  - Neutral
  - Stability
  - Motion Control
  - (lines are blurred now)
- Specialized
  - Minimalist Shoes
  - Transitional Shoes
  - Oversized Shoes
  - Track/XC Spikes
  - Racing Flats
  - Trail Shoes



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ANATOMY

- Upper
  - Heel/ Heel Counter
  - Heel Collar
  - Sockliner
  - Tongue
  - Midfoot Wrap
  - Laces / Eyelets
  - Overlays
  - Toe Box
  - Toe Guard
- Last

- Foot Orientation
  - Heel
  - Midfoot
  - Forefoot
- Sole
  - Insole
  - Midsole
    - Posting
  - Outsole
    - Tread

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Shoe Last

- Shoe Shape (“Foot Print”)
- Straight, Semi-Curved, Curved
  - Stability, Neutral, Racing
  - Curved last may resist Supination
  - Wide or Straight Last - More Stable Base
- Based on different people’s feet
- Find the one closest to you!

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UPPER

- Material On Top of Shoe
- Locks Foot Onto Sole
- Many Variations & Components
  - Midfoot Saddles
  - Heel Counters
  - Overlays
  - Toe Guard
  - Laces
  - Mesh Uppers vs Stiff Uppers

MIDSOLE

- Cushioning
  - Soft/Firm
- Stack Height
- Medial Support
  - Posting/Wedge
- Heel Drop
- Flexibility
  - Flex Grooves
- Flare
  - ↑ Surface Area, ↑ Stability
- Plates, Trussic Systems

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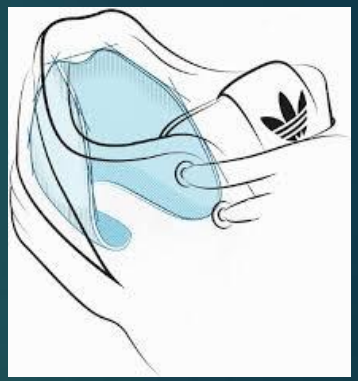
OUTSOLE

- Bottom of Shoe
- Grip / Flexibility
  - Flex Grooves
  - Traction / Grip
- Full or Split Contact
  - Full Ground Contact – More stable
- Sometimes not present (Nike Free)
- Wear Patterns (NOT VALID TEST)

Key Points for the Rehab Professional

- Support / Stability
- Sole Flare
- Flex Grooves
- Heel Bevel
- Toe Spring
- Rocker Shoes
- Cushioning
- Heel Counter
- Fit
- Heel Toe Drop
- Plates



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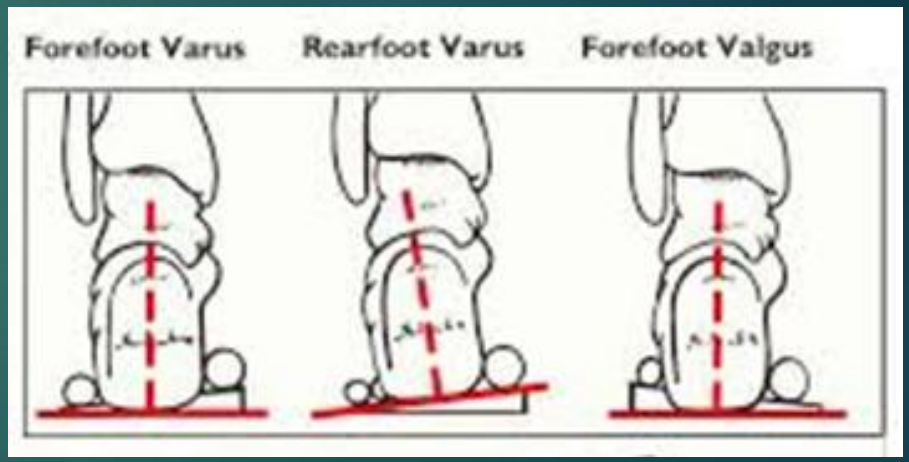
MEDIAL SUPPORT

- **Posting**
  - Most common
  - **SLOWS** Pronation
  - Midfoot, Heel or Both
  - Forefoot VERY Rare
- **Wedging**
  - Not as common
  - Varus Deformities
  - Bring the Ground UP



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Research: Prescribing Support in Shoes

- Based on:
  - Plantar shape: No influence on injury risk (Knapik et al., 2010)
  - Foot Shape: No influence on pain or injury risk (Ryan et al., 2010)
- Summary: Wet Paper and Static Tests (Dr. Scholl Scan)
  - **POOR TESTS, NOT RELIABLE OR VALID**
- Different People react differently to arch support/inserts
  - Nigg et al., 2003.
- **Preferred Motion Path & Comfort Filter**
  - **Nigg et al., 2015**
- **NEED TO LOOK AT DYNAMIC MOTION**
  - **Consider Navicular Drop Test**

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Sole Flare

- ↑ Surface Area, ↑ Stability
  - Wider Shoe, More Stable
- It's All About **TORQUE**
- Posterior, Lateral or Medial
  - Posterior: Premature Initial Contact
  - Lateral: Support for Supinators
    - Greater torque through Pronation
      - Forefoot AND Heel Strikers
  - Medial: Support for Pronators

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Flex Grooves

- Grooves in Midsole/Outsole
- Usually in Forefoot
- Enhance Flexibility
- May Facilitate Motion
- Few points of true Foot Sagittal movement
- Flex grooves should line up with MTP Joints

HEEL COUNTERS

- Firm
  - Calcaneal stabilization
  - Holds Heel in Place
  - More “Support”
- Soft/Unstructured
  - Hagland Deformities
  - Heel Bumps
  - Achilles Tendon Insertion Pain
  - Less “Support”

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Heel Bevel

- Curved Heel
  - Smooth Initial Contact
  - Can be used to influence landing
    - Posterior Lateral Position
- Similar to curve of Calcaneus
  - Facilitate Heel Rocker
  - Maintain Forward Momentum
- Lack of Heel Bevel
  - Posterior Flare
  - Rigid Heel
  - Shin Splint

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TOE SPRING

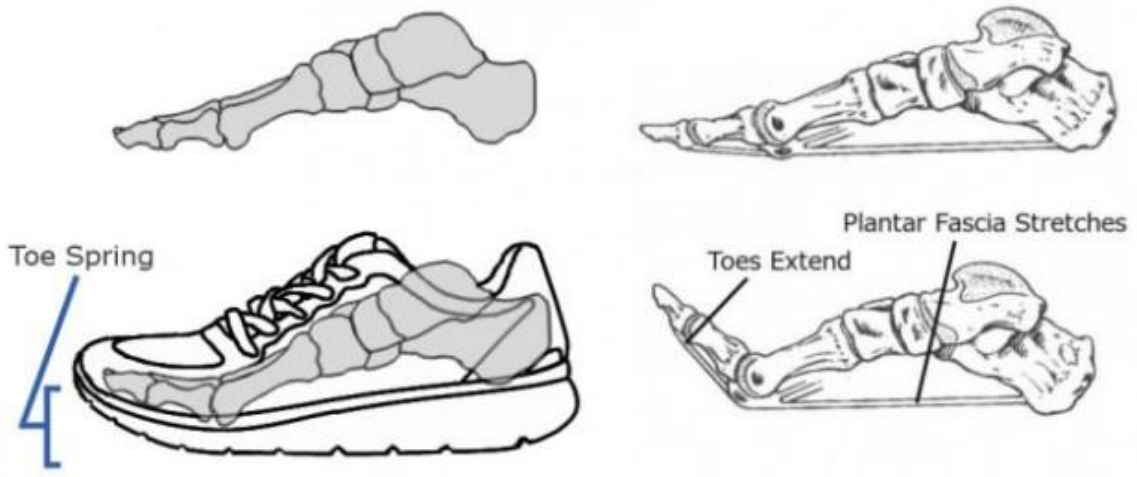
Elevation of Toes

Some Degree Present in All Shoes
(15° Standard)

Replaces Forefoot Rocker

Good for Certain Pathologies

May lead to Muscle Imbalances, Hammer Toes in Wrong Population



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ROCKER SHOES

- Replacement of Foot Rocker Systems
- Reduced Ankle PF Moment
  - Sobhani et al ., 2013
- Altered Plantar Pressures
  - Decrease IF Full Rocker Sole
- Change in Running Economy
  - Uses Different Muscles
  - Sobhani et al., 2013

FIT

- Toe Spread → Normal Foot Fx
  - Shock Absorption
  - Don't Crunch the Toes!
    - Neuromas?
- Comfort Filter
  - Nigg et al. 2015
  - Individual Preference
- Upper: Work With Foot Motion
  - Not Against
  - Overlays
  - Toe Guard

Abnormal Fit and Consequences

- **Patient may report numbness!**
  - Nerve symptoms
  - Shoes are too narrow!
- **Bunions** (Exacerbation)
  - Lateral Deviation of Hallux
  - Tight Calves Make Worse
- **Blisters**
- **Hammertoes**
  - Shoes too Short
  - Excess Toe Spring
- **Plantar Fasciitis**
- **Neuromas** (Exacerbation)

HEEL TOE DROP

- Height Difference B/W Heel & Forefoot
  - 0-12mm
  - 8-12mm standard
  - Static Number (Changes w/ Movement)

- LITTLE EVIDENCE ON BEST HEIGHT
  - Very strong opinions though...
  - Lack in general differences? (Chambon et al, 2013)

- Influences Subtalar Joint
  - Changes Axis

- HIGHLY INDIVIDUAL
  - Ankle ROM, Calf Length
  - KINEMATIC CHAIN

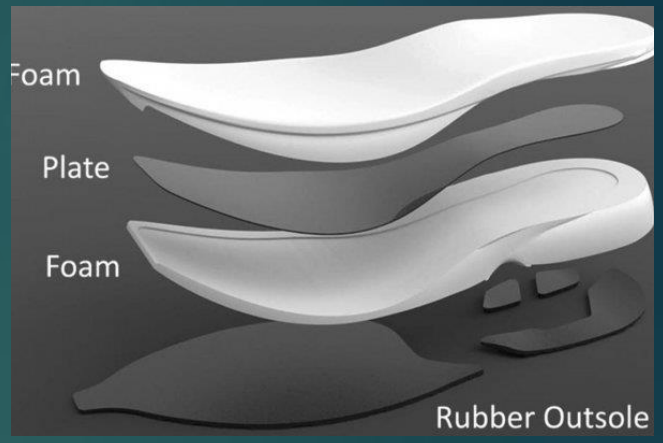
CUSHIONING

- FIRM Cushioning: More Stable
  - **MORE** joint motion (Attenuate Force)
  - Minimalist, Racing Shoes, Firm Midsoles
- SOFT Cushioning: More Unstable
  - **LESS** joint motion (muscle stabilization)
  - Maximalist Shoes, Highly Cushioned Shoes
- Research: “Midsole hardness of modern cushioned running shoes DOES NOT seem to influence running related injury risk”

  -Theisen et al, 2013 & Withnall et al, 2006

Plates

- Propulsive
  - Racing Shoes
- Stability
  - Change midsole stiffness
  - Imitate Plantar Fascia
  - MTP Joints
- Cushioning
  - Mizuno
- Different Locations
  - Heel, Midfoot, Forefoot



Shoe MODIFICATIONS

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Shoe Prescription

- **Stability**
  - **Multiple Sources**
  - Where does Pronation Occur?
    - Overuse of Subtalar Joint
    - Hindfoot, Midfoot, Forefoot
  - Do they really need it?
- **Cushioning**
  - Stiff vs Loose Joints
- **Fit**
  - Wide vs Narrow
  - Width in the right spots (forefoot)
  - Watch lacing/overlays for pressure points
  - Male vs Female (Avoid companies that “Shrink It And Pink It”)

- **Heel Drop**
  - Calf Flexibility
  - Calf + Intrinsic Stretch
- **Rockers**
  - **Forefoot, Ankle, Heel**
  - Hip Shock Absorbing Abilities

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How Long Do Running Shoes Last?

- 300-500 miles
  - Little Research
  - May break down as soon as 100
  - Body Compensates (Kong et al., 2008)
  - 3-6 months
- May break down sooner
  - Depends on the Person!
- All Shoes Degrade at similar rates!
  - Depends on Endurance of Compensation

http://www.backfixer1.com/wp-content/uploads/2013/02/worn-running-shoes.jpg

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The Best Shoe For Your Patient (or You).

- THERE IS NO SINGLE BEST SHOE
- Match Biomechanics & Comfort
- Different shoes for different people
- “No shoe has ever been shown to protect against injury.” –Noakes, 2003.
  - The Wrong Shoe can cause an injury though!
- Muscular Strength/Endurance and Biomechanics MOST IMPORTANT!
  - In regards to injuries

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SUMMARY

- Many Types of Shoes
- Stability from Multiple Places
  - Heel Counter, Posting/Wedging, Sole Flare, Firm Sole
- Evaluate the Patient Dynamically!
  - Pronation is a movement, not a position
  - Pronation is also NOT the only thing to look for!
- Every Person is Unique
  - Comfort is Best
- Don’t Squash those Toes!
- Keep Shoes Up to Date!

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Thank You!

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