AOASM 2026

Allen Jacobs Memorial Lecture

'The Agony of "De Feet"'

Biomechanical contributions of the foot to lower extremity dysfunctions and running injures

ACSM Exchange Lecture

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Greetings from ACSM!

A College where basic science, exercise science, athletic training, physical therapy, sports medicine, medicine and orthopedics

Incredible diversity of program, where connections are made

ACSM
AMERICAN COLLEGE OF SPORTS MEDICINE

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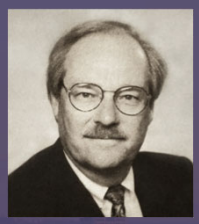
Allen W. Jacobs, DO, PhD

Dr Jacobs was a Kirksville trained DO and PhD Anatomist. He integrated the study of anatomy with his clinical sports medicine practice. He served as team physician for Michigan State's baseball & women's gymnastics team as well as serving as Team Doctor for East Lansing High School and Lansing Lugnuts, then a minor league affiliate of the Chicago Cubs.



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Disclosures

- I do not have any financial disclosures
- All medications discussed will be on label

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Learning Objectives

- At the end of this session, participants will be able to:
- Discuss the anatomy of the foot, the location of functional arches and the insertion of the musculature and its role in the maintenance of force transfer and normal gait
- Recognize common injury patterns that arise at the foot and ankle and their implications for alterations of gait at the ankle, knee and more proximally
- Understand basic foot orthosis and their role in altering gait, force transfer and correction of common biomechanical dysfunctions.
- Diagnose common biomechanical dysfunctions of the foot and ankle and apply osteopathic techniques to correct.

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Overview

- Discuss foot and ankle anatomy and the key components for the foundation of this talk
- Discuss gait mechanics and force transfer across the foot and their contribution to issues at the knee & more proximally in the kinetic chain
- Review exam & treatment techniques for specific dysfunctions and the role of orthotic use for control of motion, force and gait

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The Agony of Defeat
Vinko Bogataj & ABC Wide World of Sports

https://www

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Running & Gait

- Impact forces from ground transmitted through foot to body
- Repetitive impact leads to injury
  - MTSS & stress fractures of LE
  - Patellofemoral syndrome
  - Achilles tendinosis
  - Plantar fasciosis
- Usually unilateral ?!
- What clues does gait and anatomy offer?

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The Hindfoot – Static Principles

- Talus and Calcaneus
- Subtalar joint
  - "Shock absorber joint" [4]
  - Hindfoot strikers impact here
  - Forces distributed proximally & distally during gait

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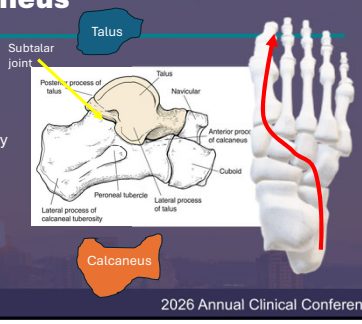
Talus and Calcaneus

- Subtalar joint
  - Synovial Joint
  - Oblique axis "declines posteriorly and laterally"
  - Distributes force proximally & distally at foot strike through push off.
  - A dynamic event



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The Forefoot

- Phalanges
  - Reciprocal motion with metatarsal heads
- Metatarsal heads
  - Area of dysfunction
  - Fascial distortions
  - Callous formation
- Lisfranc joints

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The Midfoot

- Medial, middle and lateral cuneiforms
- Strong ligament & muscle connections
- Specific shape of articular surface facilitates force direction/transfer.
- Important areas of dysfunction for arches

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The Midfoot

- Navicular & cuboid
  - Essential force transmission distally from heel strike
    - Navicular via talus
    - Cuboid via calcaneus
  - Each can become dysfunctional and contribute to altered gait mechanics

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Functional Arches

- Medial Longitudinal Arch
  - Essential for force transmission
  - Often a target for intervention
- Medial and lateral components
  - Bony articular facets
  - Interosseous ligaments
  - Fascial sheaths
  - Plantar ligaments
  - Functional musculature (later)

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Functional Arches

- Transverse arches
  - Proximal transverse arch is cuboid and navicular
  - Common source of dysfunctions
  - Distal is metatarsal heads, but dysfunctions can cause MTs to drop, altering mechanics and leading to plantar callous

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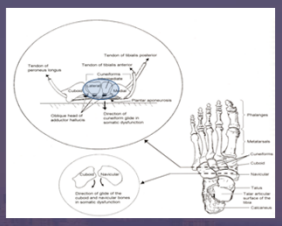
Functional Arches

- Proximal transverse arch
  - Articulation/bone shape and muscle/ligamentous attachments produce specific rotation of cuboid & navicular
  - Common somatic dysfunctions
  - Associated with widening of plantar fascia & increased tension on calcaneal insertion



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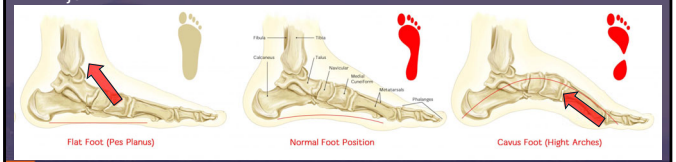
Foot Arch Structure

- Pes Planus
- Increased force transmission to tibia and patellofemoral joint
- Pes Cavus
- Increased force transmission to MT



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Foot Arch Structure

Talar & calcaneal positioning influences navicular & cuboid…

- Pes Planus
- Plantarflexed talus & calcaneus
- Pes Cavus
- Dorsiflexed talus & calcaneus

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Dynamic Considerations – Muscles

- Posterior tibialis
  - Inserts on 6/7 tarsal bones (not the talus) mainly inferior medial cuneiform
  - Originates from interosseous membrane, proximal tibia and fibula
  - Plantar flexes, inverts foot and maintains medial longitudinal arch

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Dynamic Considerations – Muscles

- Peroneus (fibularis) longus
  - Inserts on plantar proximal 1st MT and plantar aspect medial cuneiform
  - Originates Fibular head and superior 2/3 of the fibula
  - Pronates the foot, (eversion & abduction), brevis also plantarflexes

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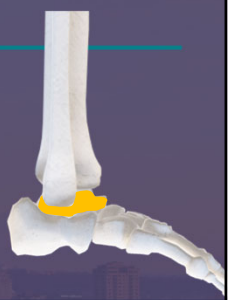
Functional Biomechanics

- Traditionally, fibular motion and talar motion are coupled via ATF and PTF ligaments
- Motion occurs at talus, which influence tibial & fibular position, calcaneal position and transmission of forces into navicular & cuboid



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Functional Biomechanics

- Plantarflexion
  - Requires talus to glide anteriorly and rotate plantar-ward
  - Fibula glides forward under tension of ATF ligament
  - Talus minor rotation about lateral & downward (coronal plane) and posteriorly & lateral (transverse plane)
  - Tibia *externally rotates/anterior medial glide*
  - Kuchera (among others) suggests minor motions important in OMM

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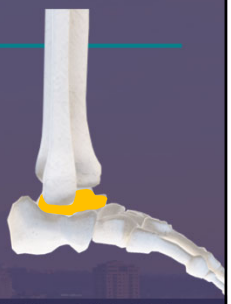
Functional Biomechanics

- Dorsiflexion
  - Requires talus to glide posteriorly and rotate dorsally
  - Fibula base slides posterior/slight lateral to accommodate wider anterior talus
  - Tibia: opposite rotation & glide
    - Interosseus membrane & mechanical advantage of compartments



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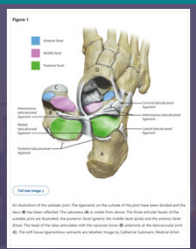
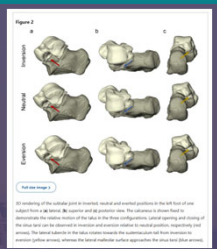
Subtalar Joint & Talus[5]





Fernández MP et al. Sci Rep 10, 1035 (2020)

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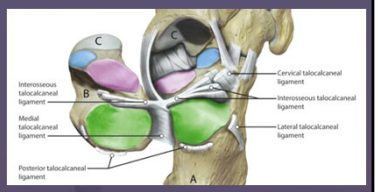
Subtalar Joint & Talus[5]

- Weight-bearing Inversion & Eversion
  - Talus rotates & glides
  - Motion controlled by talo-calcaneal ligaments



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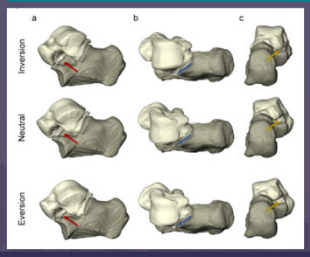

- With Calcaneus Fixed
  - Talus rotates & glides
  - Lateral sinus tarsi opens (inversion) & closes (eversion) (red arrows).
  - Lateral Talar tubercle rotates towards the sustentaculum tali from inversion to eversion (yellow arrows),
  - Lateral malleolar surface approaches the sinus tarsi (blue arrows).
  - Motions key to force transfer distally *and* proximally
  - *Kuchera (among others) suggests minor motions important in OMM*

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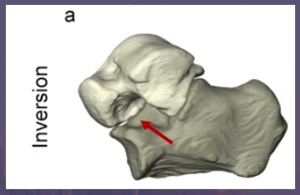
Subtalar Joint & Talus[5]



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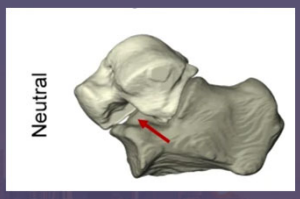

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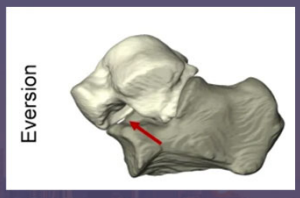

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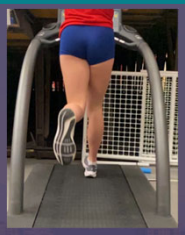
Gait Analysis

Applying basic science to actual movement

- Seeing anatomic motions within gait
- Forces across ankle with impact
- Vertical
- Eversion/Inversion moments
  - Eversion is expected & normal[14]
  - Too much eversion pathologic
- Effects up the chain
  - Hip drop
  - Knee abduction/rotation moments



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Gait Analysis

- Forces across ankle with impact
- Vertical
- Eversion Inversion moments
- Effects up the chain

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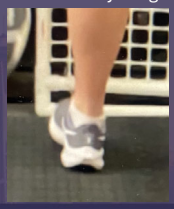
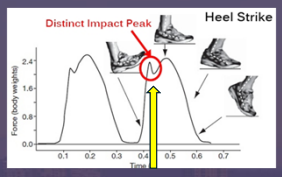
Ground Reactive Force

- Forces across ankle: Vertical; foot slight aDDucted, supination
- Force is 2.5-3x body weight across joint; peak vertical loading rate





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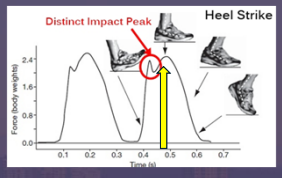
Ground Reactive Force

- Forces across ankle: Vertical
- Transition to subtalar neutral – foot is everting



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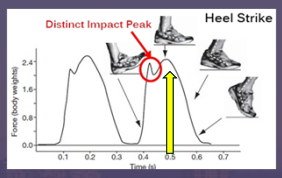
Ground Reactive Force

- Forces across ankle: Peak Ankle Eversion Velocity (AEV), Peak Ankle Eversion Angle (AEA)



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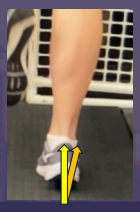
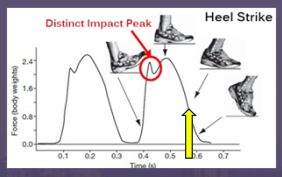
Ground Reactive Force

- Push off phase – activation of posterior muscles and supination





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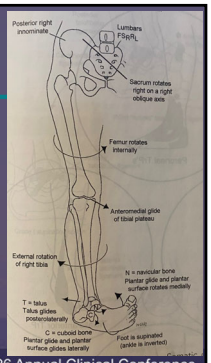
Coordinated Motions of Foot Ankle & Lower Extremity

- Foot supinates, ankle inverts
  - Alters talus and calcaneus position
- Alters Cuboid, Navicular position
- Fibular head moves backward; base forward
- Tibial articulation externally rotates * tibial plateau glides antero-medially
- Femur internally rotates
- Innominate rotates posteriorly and sacrum moves into right on right position.



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Applying Biomechanics of the Foot & Ankle to Running Injuries

Overuse Injury	Associated Risk Factors
• MTSS & stress fractures of LE	• Peak eversion angle/velocity[6]
• Patellofemoral syndrome	• Knee abduction angular impulse[8], greater peak dorsiflexion[9], greater eversion angles[10]
• Plantar fasciosis	• Elevated peak vertical loading rates[7]
• Achilles tendinosis	• Lower peak ankle inversion moment, a lower peak ankle external rotation angle; greater running volume[9]

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MTSS/Shin Splints

- Muscle fatigue increases load to bone
- Overuse leads to accelerated bone remodeling;
- Interventional goal is to lower bone stress therefore preventing bone remodeling

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Shoe Type Prescription

Why we run: Because it feels so good when we stop…

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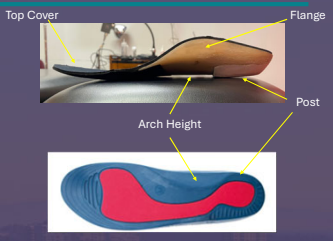
Orthotics – Components of fabrication

- Cushion
- "Arch Supports"
  - Arch height
  - Flange
- Sole
  - Prefabricated rigidity
  - Custom - material rigidity
- Posting
  - Hindfoot control leads to force transfer control



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Interventions for MTSS

- Altered NM firing patterns; gait change
- Shoe Types
  - Increased cushioning
- Orthotics

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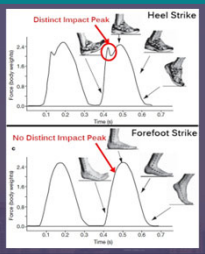
MTSS Targets for Intervention

Goal: decrease force load on tibia

- "Non-modifiable" risk factors
  - Sex, bone density & skeletal alignment
- Modifiable risk factors[3]
  - Training volume, intensity
  - Equipment & surfaces
  - Alter running technique[20] & biomechanics
  - Gait retraining for midfoot strike[20], speed, cadence, stride width
- Footwear
- Orthotics



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Footwear in MTSS
Effect of footware on tibial load

- Running barefoot ↑ tibia load [25]
- Minimalist shoe ↑ tibial load [23-25]
- Cushioned shoes – No effect [26]
- Motion control shoe 'small' ↑ in tibial load [22, 23]
- High cut shoes; controlled ankle motion ↓ tibial loading [21]
-

Image for educational purposes only modified from https://www.runnersvault.com/blogs/running-blog/

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Orthotics in MTSS

- OTC cushioned insoles ↓ VLRs[12]
- No effect on Tibial Loading[3]
  - Cushioned insole
  - Soft insole
  - Semi-rigid insole
  - Rigid insole
  - Arch taping
- Decreased muscle activation[29]
  - Textured orthotic footbed

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Interventions for Patellofemoral Pain

- Goal is to ↓ risk factors:
  - ↑ Knee abduction angular impulse[8], ↑ peak dorsiflexion[9], ↑ eversion angles[10]
  - Reduction of Internal rotation of knee/femur reduces lateral facet load [31, 32]
- Stride/gait change
- Shoe type
- Orthotics

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Interventions for Patellofemoral Pain

- Goal is to ↓ risk factors:
  - ↑ Knee abduction angular impulse[8], ↑ peak dorsiflexion[9], ↑ eversion angles[10]
  - Reduction of Internal rotation of knee/femur reduces lateral facet load [31, 32]
- Runners with PFPS demonstrated:
  - ↓ gait velocity, stride length, & cadence [1]
  - ↓ knee flexion angles & knee extension moments [1, 19]
  - ↑ contralateral pelvic drop [1]
  - Females (not males) with PFP have ↑ hip flexion & rearfoot eversion [1]
  - ↑ contralateral pelvic drop occurs during running [1]

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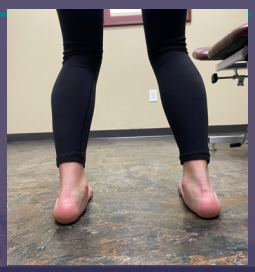
Orthotic use in PFPS

- Correct hindfoot valgus & eversion
  - Medial posting, arch & flange
- Improve knee alignment[18]
  - ↓ knee internal rotation moment
  - With pronation; Internal rotation at tibia equates to external rotation at femur
  - ↓ lateral patellar facet load by ↓ valgus rate & angle at knee



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Orthotic Use in PFPS

- Correct hindfoot valgus & eversion
  - Medial posting, arch & flange [15,16]
- Improve knee alignment
  - ↓ lateral patellar facet load [15]
- Greater hindfoot valgus & eversion predicts orthotic success in PFPS [29]
- Anecdotal Evidence
  - Use of OMT prior to fabrication
  - Goal – optimize foot alignment; orthotic supports normal motion & allows ligament remodeling

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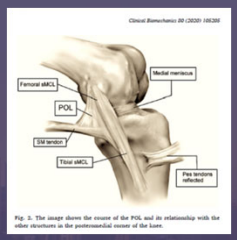
Posterior Oblique Ligament
AKA the posterior-medial capsule



- With pronation, tibia rotates medially; tibial plateau glides posterior & medially
- POL Main stabilizer to prevent internal rotation of tibia at 0-30° flexion
- Resisting posterior translation of tibia (esp. in PCL deficient knee)
- Resists external rotation

Ambrosi RD, et al Clin Biomechanics. 2020; 80: 105205

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Testing Rotation

- Knee at 90° flexion, rotate distal tibia/ankle & observe external/internal rotation at joint line
- Limited internal rotation indicates dysfunction

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Testing POL
Anteromedial Rotatory Instability Test

- **Knee at 30° flexion, externally rotate distal tibia/ankle & apply valgus force**
- Laxity or pain suggests injury to the POL

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Interventions for Achilles Tendinosis

Predictors of Achilles tendinopathy [9]
- ↓ lower peak ankle inversion moment
- ↓ peak ankle external rotation angle
- "Split" role for Achilles – leads to shear
  - Part pulling into inversion; part pulling into external rotation
  - Larger role: contraction for push-off phase
- Motion control with shoes, orthotics, OMT
- ↑ running volume – education

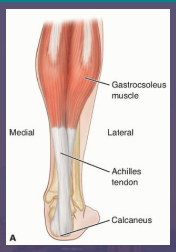

Image modified for educational purposes only from https://musculoskeletalkey.com/wp-content/uploads/2016/07/C118-FF1-1.gif

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Contributions to Plantar Fasciosis

Runners with PF had:
- Significantly ↑ maximum instantaneous load rate vertical GRF [6,7]
- ↑ ankle dorsiflexion ROM[7]
- ↓ medial & transverse arch index compared with control[7]
- No difference in rearfoot kinematics or hindfoot alignment[7,12]

- Orthotics and osteopathic manipulation

Pohl MB et al. Clin J Sport Med 2009;19:372–376.
Messier SP, etal Med Sci Sports Exerc. 1988;20:501–505.

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Biomechanical interventions

- Orthotics to control foot motion & forces
  - OTC insoles ↓ VLRs[12]
  - No consistent effect on AEVs, AEAs, or KAAIs [12]
- In runners with excessive pronation [15]
  - Medial post ↓ ankle eversion
  - ↓ ankle inversion moment
  - ↑ amount & rate of knee motion during transition strike to stance
- Alters arch, weight transfer, dorsiflexion angle & rate in flatfooted runners[16]

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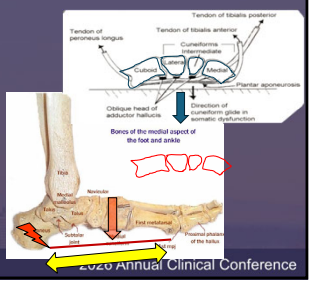
Biomechanical Principals

What contributes to plantar fascia tightness?

- Proximal transverse arch flattens
- Cuneiforms collapse & widen and flatten transverse arch
- Stretch of medial longitudinal arch
- Calcaneus dorsiflexed relative to talus – results in tight Achilles
- Leads to strain on plantar fascia at insertion



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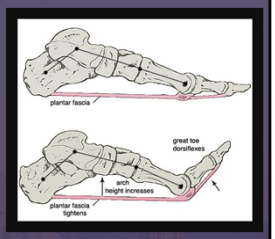
Muscle Energy for Cuneiforms

- Muscle energy for middle/lateral cuneiforms
  - Variation of windlass maneuver
  - Using toes indirectly
  - Can also use tibialis anterior to raise cuneiforms
  - Must gap to allow proximal arch to form



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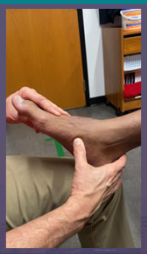
Osteopathic Approach to Midfoot Dysfunctions

- Assess motion
  - Talus-navicular
  - Navicular-medial cuneiform
  - Medial cuneiform – 1st MT



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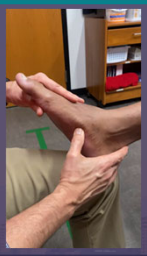
Treatment of Navicular/Medial Cuneiform Dysfunctions

- Muscle energy
  - Posterior tibial/Fibularis Longus
  - Moving medial cuneiform
  - Video shows fibularis longus moving first ray and medial cuneiform relative to navicular
- Facilitated Positional Release
- Balanced Ligamentous Tension



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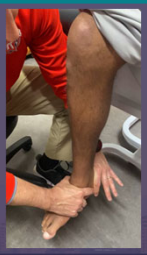
Assessment & Treatment of Talar and Subtalar Joints

- Kuchera (among others) suggests *minor motions important* in OMM
- Address:
  - dorsi-/plantarflexion
  - Inversion/eversion
  - AB-/AD-duction
- Muscle Energy, FPR, BLT or HVLA from this position



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Additions for Plantar Fasciosis

- Muscle energy to the middle and lateral cuneiforms
- Address cuboid
  - Muscle energy using fibularis brevis, chalking or HVLA
- Treat TP at PF insertion at medial distal calcaneus with SCS
- FDM techniques also helpful
- Address dysfunction prior to orthotic mold/production

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Summary

- The anatomy and biomechanics of the foot & ankle greatly contribute to dysfunction & injury more proximally
- Combining anatomic and biomechanical knowledge allows a potent lens for reviewing an applying the literature to clinical practice
- Osteopathic techniques are at least adjuvant to other treatments in correcting deficits that contribute to injury

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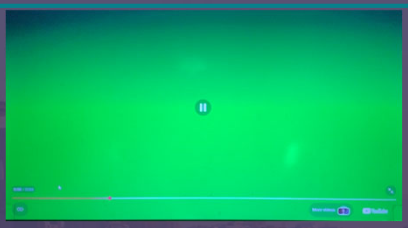
Questions?



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References

1. Bazzett Jones_DM et al Kinematic and Kinetic Gait Characteristics in People with Patellofemoral Pain. Sports Medicine 2023: 519-547.
2. Kayll_SA_et al Do biomechanical foot-based interventions reduce patellofemoral joint loads in adults with and without patellofemoral pain or osteoarthritis. Br J Sports Med 2023; 57:872-881.
3. Keast et al Acute effects of gait interventions on tibial loads during running Sports Med 2022; 52:2483-2509.
4. Nack JD, Phillips RD. Shock absorption. Clin Podiatr Med Surg. 1990; 7(2):391-397.
5. Fernández MP, Hoxha D, Chan O, Mordecai S, Blunn GW, Tozzi G, Goldberg A. Centre of Rotation of the Human Subtalar Joint Using Weight-Bearing Clinical Computed Tomography. Sci Rep 10, 1035 (2020). https://doi.org/10.1038/s41598-020-57912-z
6. Messier SP, Pittala KA. Etiologic factors associated with selected running injuries. Med Sci Sports Exerc. 1988;20:501–505.
7. Pohl MB, Hamill J, Davis IS. Biomechanical and anatomic factors associated with a history of plantar fasciitis in female runners. Clin J Sport Med. 2009;19:372–376.
8. Jandacka D, Skypala J, Plesek J, Urbaczka J, Golian M, Burda M, Šustek J, Zahradnik D, Elavsky S, Jandackova VK, Selbie S, Silvernail JF, Hamill J. Biomechanical insights into Achilles tendinopathy risk and protection in runners: a large prospective study 4HAIE. Br J Sports Med. 2026 Feb 11;60(3):186-197. doi: 10.1136/bjsports-2025-110260. PMID: 41672607; PMCID: PMC13018850.

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References

8. Stefanyshyn DJ, Stergiou P, Lun VM, et al. Knee angular impulse as a predictor of patellofemoral pain in runners. Am J Sports Med. 2006;34:1844–1851
9. Jandacka D, Skypala J, Plesek J, Urbaczka J, Golian M, Burda M, Šustek J, Zahradnik D, Elavsky S, Jandackova VK, Selbie S, Silvernail JF, Hamill J. Biomechanical insights into Achilles tendinopathy risk and protection in runners: a large prospective study 4HAIE. Br J Sports Med. 2026 Feb 11;60(3):186-197. doi: 10.1136/bjsports-2025-110260. PMID: 41672607; PMCID: PMC13018850.
10. Arazpour M, Bahramian F, Abutorabi A, et al. The effect of patellofemoral pain syndrome on gait parameters: a literature review, Arch Bone Jt Surg 4 (4) (2016) 298–306 https://www.ncbi.nlm.nih.gov/pubmed/ 27847840.
11. Barton CJ, Levinger P, Webster KE, Menz HB, Walking kinematics in individuals with patellofemoral pain syndrome: a case-control study, Gait Posture 33(2) (2011) 286–291 https://www.ncbi.nlm.nih.gov/pubmed/21194952.
12. Lewinson RT, Stefanyshyn DJ. Effect of a commercially available footwear insole on biomechanical variables associated with common running injuries. Clin J Sport Med 2019;29:341–343.
13. Ferber R, BA H. A comparison of different over-the-counter foot orthotic devices on multi-segment foot biomechanics. Prosthet Orthot Int. 2016; 40:675–681.

65

References

14. Novacheck TF. The biomechanics of running, Gait Posture 7 (1998) 77–95. https://doi.org/10.1016/S0966-6362(97)00038-6.
15. Braga UM, Mendonçaa LD, Mascarenhasa RO, Alvesb COA, Filhoa RGT, Renan A. Resendeb RA. Effects of medially wedged insoles on the biomechanics of the lower limbs of runners with excessive foot pronation and foot varus alignment Gait & Posture 74 (2019) 242–249
16. Chen H, Zhang Q, Bíró I. Effects of arch support pads and insoles on gait parameters and plantar mechanics during running in adults with flatfoot. in 2024 IEEE 7th International Conference and Workshop Óbuda on Electrical and Power Engineering (CANDO-EPE),2024, 99–102, https:// doi. org/ 10. 1109/ CANDO -EPE65072. 2024.10772923.
17. Lui HL, Ye D, Yang Y, Zhang S. Effects of orthotic insoles on gait biomechanics in runners with flatfoot under different gait loads. Scandinavian Journal of Medicine & Science in Sports, 2026; 36:e70205 https://doi.org/10.1111/sms.70205
18. Hart HF, Crossley KM, Bonacci J, Ackland DC, Pandy MG, Collins NJ. Immediate effects of foot orthoses on gait biomechanics in individuals with persistent patellofemoral pain. Gait & Posture 77 (2020) 20–28.

66

References

19. Powers CM, Witvrouw E, Davis IS, Crossley KM. Evidence based framework for a pathomechanical model of patellofemoral pain: 2017 patellofemoral pain consensus statement from the 4th International Patellofemoral Pain Research Retreat, Manchester, UK: part 3. Br J Sports Med. 2017;51(24):1713–23.
20. Meardon SA, Derrick TR. Effect of step width manipulation on tibial stress during running. J Biomech. 2014;47:2738–44.
21. Sinclair J, Rooney E, Naemi R, Atkins S, Chockalingam N. Effects of footwear variations on three-dimensional kinematics and tibial accelerations of specific movements in American football. J Mech Med Biol. 2017;17:1750026
22. Butler RJ, Hamill J, Davis I. Effect of footwear on high and low arched runners. Gait Posture. 2007;26:219–25.
23. Butler RJ, Davis IS, Hamill J. Interaction of arch type and footwear on running mechanics. Am J Sports Med. 2006;34:1998–2005.
24. Sinclair J, Taylor PJ, Liles NB. Effects of running with minimal and conventional footwear in habitual and non-habitual users: a musculoskeletal simulation and statistical parametric mappingbased approach. Footwear Sci. 2020;12:25–38.

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References

25. Sinclair J, Taylor PJ, Andrews S. Influence of barefoot, barefoot inspired and conventional shoes on tibial accelerations and loading kinetics during running in natural rearfoot strikers. Comp Exerc Physiol. 2013;9:161–7.
26. Lam W-KK, Liebenberg J, Woo J, Park S-KK, Yoon S-HH, Cheung RT-HH, et al. Do running speed and shoe cushioning influence impact loading and tibial shock in basketball players? Peer J. 2018;6:e475
27. Barton CJ, Menz HB, Levinger P, Webster KE, Crossley KM. Greater peak rearfoot eversion predicts foot orthoses efficacy in individuals with patellofemoral pain syndrome. Br J Sports Med. 2011;45(9):697–701.
28. Esculier_2015_A consensus definition and rating scale for minimalist shoes
29. Robb KA, Perry SD. The suppression of lower leg electromyography when walking in textured foot orthoses. Experimental Brain Research (2024) 242:2367–2380 https://doi.org/10.1007/s00221-024-06904-w
30. Ambrosi RD, Corona, D, Guerra G, Rubino, M De Feo F. Biomechanics of the posterior oblique ligament of the knee. Clin Biomechanics. 2020; 80: 105205, ISSN 0268-0033, https://doi.org/10.1016/j.clinbiomech.2020.105205.

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References

31. Talbot S, Zordan R, Bennett K, Sasanelli F, Griffith A, Woodford N, Walter WL. Quadriceps tendon malalignment is an independent anatomical deformity which is the primary abnormality associated with lateral facet patellofemoral joint osteoarthritis.Knee Surg Sports Traumatol Arthrosc. 2023; 31 (12): 5950-5961. PMID: 37989778
32. Yazdi H. et al. The effect of tibial rotation on knee medial and lateral compartment contact pressureKnee Surg Sports Traumatol Arthrosc. 2016; 24(1):79-83.

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The ACSM Exchange Lecture

The Allen Jacobs Memorial Lecture is also the ACSM exchange lecture this year. It pays tribute to an anatomist and physician who dedicated his career to applying basic science to osteopathic principles in the practice of clinical medicine. This lecture highlights the role of the feet and foot mechanics to walking and running gait. Despite being the initial contact point for all gait, only minimal time is allocated in sports medicine curricula for gait, foot mechanics and orthotic training. Dysfunctions and injuries of the feet alter gait mechanics and have implications for injuries more proximally in the kinetic chain. This lecture looks at the functional anatomy of the foot and its contribution to gait related injuries, reviews evidence for specific interventions and clinical osteopathic evaluation and treatment.

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