

Foot Disorders Associated with Over-Pronated and Over-Supinated Foot Types: The Johnston County Osteoarthritis Project

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Disclosures

- No relevant commercial relationships



Evidence-based Medicine

- Nix SE, Vicenzino BT, Collins NJ, Smith MD. **Characteristics of foot structure and footwear associated with hallux valgus: a systematic review.** Osteoarthritis Cartilage. 2012; 20(10): 1059-74.
- Wearing SC, Smeathers JE, Urry SR, Hennig EM, Hills AP. **The pathomechanics of plantar fasciitis.** Sports Med. 2006; 36(7): 585-611.
- Ledoux WR, Shofer JB, Smith DG, Sullivan K, Hayes SG, Assal M, Reiber GE. **Relationship between foot type, foot deformity, and ulcer occurrence in the high-risk diabetic foot.** J Rehabil Res Dev. 2005; 42(5):665-72.



Background

- Pronated (flat arch) foot type
 - Hallux valgus? (Nix et al 2012, Ledoux et al 2005)
 - Plantar fasciitis? (Wearing et al 2006)
- Supinated (high arch) foot type
 - Hammer toes? (Ledoux 2005)
 - Plantar fasciitis? (Wearing et al 2006)



<http://vahealth.com/services/childrens-hospital/conditions-treatments/96021>

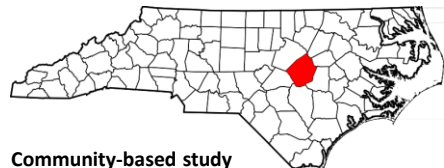


Purpose

- To determine whether **specific foot disorders** were associated with **over-pronated and over-supinated foot types** in a large, bi-racial community-based cohort



Johnston County Osteoarthritis Project



Community-based study

African American & Caucasian men and women
Third-wave of data collection (2006-2010)
50+ years old



Foot Disorders

- **Foot Assessment Clinical Tool**

- Presence / absence:

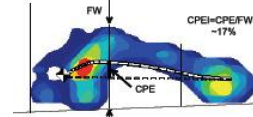
- Hallux valgus (15+ degrees)
 - Overlapping toes
 - Hammer toes
 - Claw toes
 - Tailor's bunion
 - Morton's neuroma
 - Plantar fasciitis



Foot Type

- **Foot pressure scans of both feet**

- Normal pace walking over a Tekscan Matscan system (Tekscan Inc., Boston, MA)

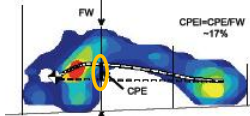


center of pressure excursion (CPE) = center of pressure excursion index (CPEI) foot width (FW) at CPE

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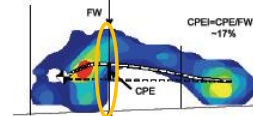


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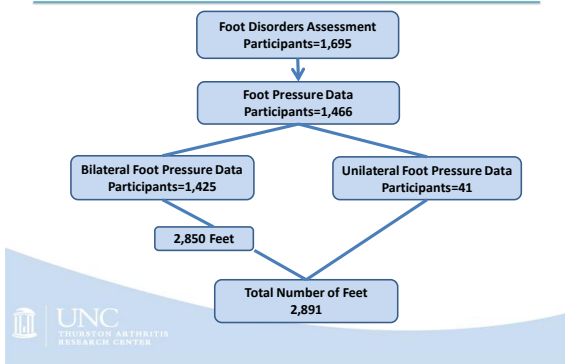


Over-Supinated $\geq 21.0\%$ Referent $>7.3\%$ to $<21.0\%$ Over-Pronated $\leq 7.3\%$

Analysis

- Unit of analysis = Foot
- Foot type and each foot disorder
 - Separate multivariate logistic regression models
 - Generalized estimating equations
 - Adjust for age, body mass index (BMI), gender, race
- Effect modification
 - Foot type and age, BMI, gender, or race
 - $p < 0.10$ considered statistically significant

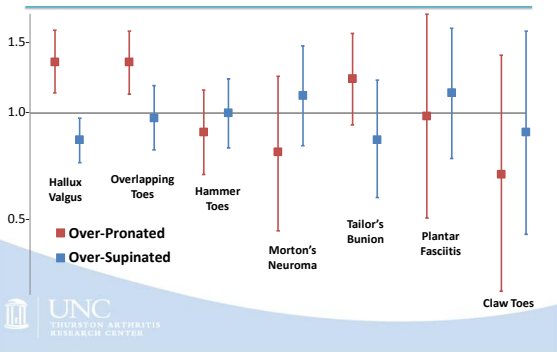
Available Data



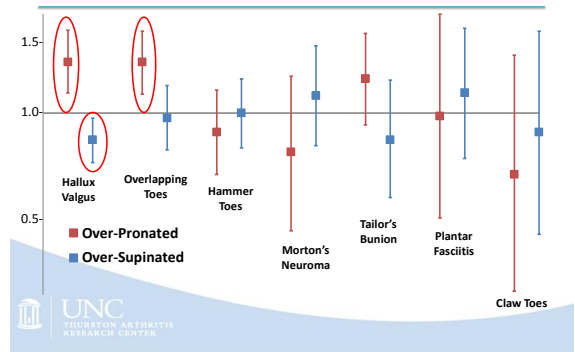
Study Sample

Participants (N=1,466)	Mean Age (SD)	68.5 (8.9) years
	Mean BMI (SD)	31.2 (6.8) kg/m ²
	Women	67.2%
	African American	29.5%
Feet (N=2,891)	Over-Pronated Foot Type	13.9%
	Over-Supinated Foot Type	19.7%
	Hallux Valgus	57.1%
	Overlapping Toes	27.1%
	Hammer Toes	25.9%
	Morton's Neuroma	6.0%
	Tailor's Bunion	5.4%
	Plantar Fasciitis	3.4%
	Claw Toes	2.1%

Foot Disorder by Foot Type: Adjusted Odds Ratios (95% CI)



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Conclusion

Hallux valgus and overlapping toes were only foot disorders strongly related to foot type



<http://www.foothealthcare.com/shop/images/articles/editor/overlappingtoes.PNG>

Limitations

- CPEI categories & clinical definitions of foot type
- Cross-sectional



Future Investigations

- Stratify by BMI categories
 - normal, overweight, obese
- Stratify by race
- Combinations of foot disorders
 - Example: hallux valgus + overlapping toes
- Longitudinal association between foot types and foot disorders
- Examine shoe and orthotic interventions for specific foot types



Acknowledgements

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- **Johnston County Osteoarthritis Project team**
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 - Marian Hannan, Alyssa Dufour, Tom Hagedorn
- **Hospital for Special Surgery team**
 - Howard Hillstrom, Jocelyn Hafer, Mark Lenhoff



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