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MEETING ABSTRACT

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# Association between foot types defined by static and dynamic measures, and the centre of pressure during gait

Su Liao<sup>1</sup>, Hannah L Javis<sup>2</sup>, Anmin Liu<sup>2</sup>, Christopher J Nester<sup>2\*</sup>, Peter P Bowden<sup>2</sup>, Richard K Jones<sup>2</sup>, Kaiyu Xiong<sup>1</sup>

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## Background

Foot types (e.g. pronated, supinated foot) are used for clinical reasoning [1] and widely assumed to be related to centre of pressure (COP) patterns [2,3]. Specifically, a pronated foot will demonstrate a medially deviated COP. It follows that COP could be a measure of foot type and inferences about function extrapolated from it. The purpose of this study was to investigate whether COP parameters differ between foot types.

## Methods

Static foot posture, foot kinematics and COP data were collected on 90 healthy subjects during walking (Figure 1). The subjects were classified as pronated, supinated, and neutral groups using three static and four dynamic methods (table 1). COP lateral and medial excursion area, COP lateral medial difference (COP\_LMD), and COP index (COP\_I) were calculated for different phases of stance [4-6]. Independent T test and correlations were calculated among the different groups.

## Results

*Pronated feet* (based on FPI) demonstrated more medial excursion of the COP from heel strike to heel off ( $p < 0.05$ ). Pronated feet classified by NCSP-RCSP demonstrated higher COP\_I during HO-TO ( $p < 0.05$ ).

*Supinated feet* classified by NCSP-RCSP and RRE had more medial excursion of the COP (COP-ME) during HO-TO ( $p < 0.05$ ). Feet classified as supinated by TPRES resulted in a greater COP-LMD in a stance ( $p < 0.05$ ) and their COP\_I was statistically significantly higher. Feet classified as supinated by RRE showed higher COP-LMD

value during HO-TO ( $p < 0.05$ ). The statistical results showed a weak relationship between COP parameters of different foot types ( $r < 0.27$ ). Dynamic measures of foot type showed a slightly stronger association to COP measures than static measures of foot type.

## Conclusion

Over all, whilst there were some differences between foot types in some COP measures, the meaning of the observed differences does not support the hypothesis that COP parameters are strongly indicative of specific

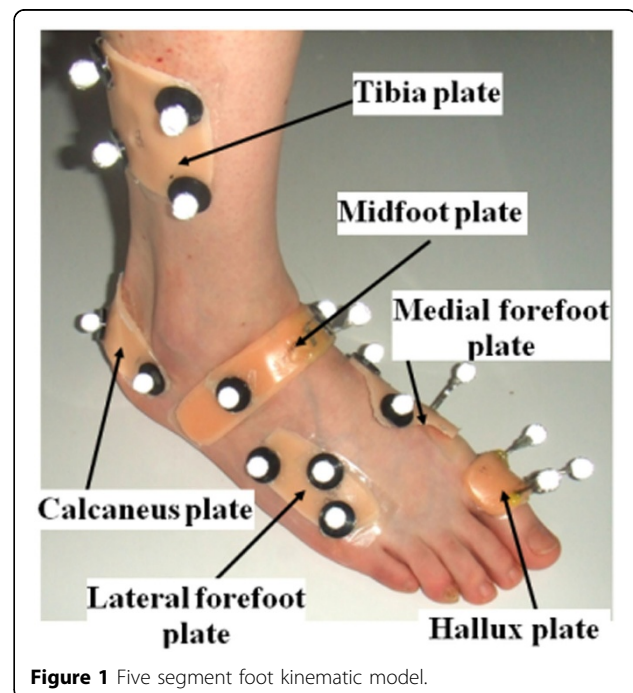


Figure 1 Five segment foot kinematic model.

\* Correspondence: cj.nester@salford.ac.uk

<sup>2</sup>School of Health Sciences, University of Salford, Salford, M6 6PU, UK  
Full list of author information is available at the end of the article

**Table 1**

Classification method	Pronators	Supinators
Foot Posture Index(FPI)	$\geq 7$	$\leq -1$
Resting Calcaneal Stance Position (RCSP)	$\leq -2^\circ$	$\geq 3^\circ$
Difference between NCSP* and RCSP	$\geq 8^\circ$	$\leq 4^\circ$
Peak Rearfoot Eversion(PRE)	$\leq -6.1^\circ$	$\geq -1.1^\circ$
Time of Peak Rear foot Eversion (TPRE)	$\geq 38\%$	$\leq 26\%$
Range of Rearfoot Eversion (RRE)	$\geq 16.3^\circ$	$\leq 10.5^\circ$
Maximum Mid Foot Dorsiflexion	$\geq 6.4^\circ$	$\leq 1.1^\circ$

\*NCSP:neutral calcaneal stance position

foot types. Thus, COP measures should not be used to infer foot kinematic nor foot function.

#### Authors' details

<sup>1</sup>Sport Science College, Beijing Sport University, Beijing, 100084, China.

<sup>2</sup>School of Health Sciences, University of Salford, Salford, M6 6PU, UK.

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#### References

1. Rao Smita, Riskowski L Jody, Hannan T Marian: **Musculoskeletal conditions of the foot and ankle: Assessments and treatment options.** *Review Article Best Practice & Research Clinical Rheumatology* 2012, **26**(3):345-368.
2. Dixon SJ: **Application of Centre-of-Pressure Data to Indicate Rear foot Inversion-Eversion in Shod Running.** *Journal of the American Podiatric Medical Association* 2006, **96**(4):305-12.
3. Han TR, Paik NJ, Im MS: **Quantification of the path of centre of pressure (COP) using an F-scan in-shoe transducer.** 1999, **10**:248-54.
4. Redmond AC, Crane1 YZ, Menz HB: **Normative values for the Foot Posture Index.** *Journal of Foot and Ankle Research* 2008, **1**(6).
5. Sobel Ellen, et al: **Re-evaluation of the Relaxed Calcaneal Stance Position-Reliability and Normal Values in Children and Adults.** *J Am Podiatric Med. Assoc* 1999, **89**(5):258-64.
6. Landorf K, Keenan AM, Rushworth RL: **Foot Orthosis Prescription Habits of Australian and New Zealand Podiatric Physicians.** *J Am Podiatric Med. Assoc* 2001, **91**(4):174-83.

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