Reviewer’s report

Title: Foot orthoses alter lower limb biomechanics but not jump performance in basketball players with and without flat feet

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Reviewer: John Arnold

Reviewer's report:

This study investigated the effect of foot posture and prefabricated foot orthoses on countermovement (CMJ) and standing broad jump (SBJ) performance in 26 adult male basketball players. No differences in jump height were found between flat and normal-arched adults, nor between no orthoses and orthoses conditions. Selected biomechanical variables displayed differences between foot types; namely peak hip angular velocity and peak horizontal GRF were reduced in the flat-arched group. Foot orthoses reduced ankle eversion, peak horizontal GRF and coronal plane ankle moment. Differences were small and their practical importance were not contextualised, although no differences between groups or with orthoses on the performance measures suggests they are negligible. This paper is generally well-written, and will be of interest to readers with interests in court sports, footwear biomechanics and foot orthoses. However, there are some areas of concern detailed below:

1. The rationale for why and how arch structure and foot orthoses may impact on jump performance in the Introduction is not convincing. Many of the terms and concepts introduced are imprecise (i.e. 'effective push-off', 'supinate effectively', 'jump efficiently'). I feel revision of the introduction (paragraph 1) is required to improve the depth and accuracy of the biomechanical rationale underpinning the study.

2. A large number of outcome variables were investigated in this study (34), leading to an even larger number of statistical comparisons (I stopped counting at 90 p-values in the Tables). I think part of the issue relates to the general hypothesis 'flat-footed athletes wearing orthoses would have better jump performance and take-off biomechanics'). Was any consideration given to targeting the investigation to specific variables likely to have meaningful relationships to jump performance?

3. Stemming from this is a strong emphasis on p-values in the manuscript, with no attention in the results to the magnitude of the differences (some of them are tiny). Information on the size of the differences would be valuable (either unstandardised or standardised, i.e. effect sizes). Therefore although some p-values were <0.05, the likelihood of type 2 error with such a large number of statistical comparisons is guaranteed. Can the authors consider adding more information in the Abstract and Results regarding (a) the size of the differences and (b) their meaningfulness in the context of jump performance?

4. There is a lack of detail on the biomechanical modelling in the Methods section. More information is required, such as:
- Data interpolation
- Detail in the manuscript on the kinematic model used
- Method of joint angle computation and joint moment computation. Body segment parameter information (de Leva?)
- Resolution and expression frames for moments and angles
- Order of rotations for joint angle computations
- Joint moment and power normalization procedures

Specific comments:

Abstract

- 'restore normal foot function' - suggested rewording to be more precise
- Should mention orthoses were prefabricated
- 'slower' peak hip velocity - suggest rewording
- Only p-values are mentioned in the abstract. Please consider adding in details on size of differences.
- Velocity/power - suggesting stating either or both as '/' infers the same
- The final sentence is very strong and should be tempered for a small study.

Background

- References 8 and 9 are book chapters and don't seem to provide strong support for the statements. i.e.

- Reference 10 is a book chapter with only anecdote that supports '50% of basketball players use medial arch-support insoles'. Some players do wear foot orthoses but likely much less than this figure. Suggest revising this sentence.
- Hypothesis 2: in comparison to the no-orthoses condition?

Methods

- I am not familiar with this protocol for classifying foot posture. Has it been published before? Has it been validated against radiographic measures?
- I assume because navicular drop was taken then navicular height was measured? If so, navicular height normalised to foot length could be reported and then compared to values from Murley (2009): Murley, G.S., Menz, H.B. and Landorf, K.B., 2009. A protocol for classifying normal-and flat-arched foot posture for research studies using clinical and radiographic measurements. Journal of foot and ankle research, 2(1), p.22.
- Please provide further details on the materials and design for the Li Ning basketball shoe (density, mass, heel-forefoot differential, etc).
- What's the original citation for the marker set?
- How was the start of the propulsion phase determined?
Results
- Where are the results for the joint kinetics and GRFs in Figure form? These should be presented.
- Figure 2 is not referenced in text.
- 'Statistically significant' should be used in preference for 'significant'
- The sentence on line 52 repeats the group 'flat-footed'. Needs revising.
- Line 57: compared to?

Discussion
- 'better spring mechanism' - the discussion surrounding this point could be improved as there is a lot of literature on this topic.

Conclusion
- '…in CMJ,' - at take-off?
- '…and ankle moment in SBJ' - what one?
- The final two sentences should be tempered and fit more closely with CMJ and SBJ.

Tables
- Please indicate what plane the joint powers refer to.

Figure 1.
C- what size are these specifications for?

Figure 2.
The sagittal plane knee kinematic curve is perturbed for the control condition in the countermovement jump. Are there some trials causing an issue with this? 'board' should be 'broad'

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Please indicate how interesting you found the manuscript:

An article whose findings are important to those with closely related research interests

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