Reviewer’s report

Title: Changes in multi-segment foot biomechanics for a heat-mouldable semi-custom foot orthotic device.

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Reviewer: Thomas McPoil

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General Comments:
1. The authors should be complimented on conducting a timely study to assess the effectiveness of foot orthoses on midfoot mobility. The assessment of molded versus non-molded foot orthoses on support provided to the medial longitudinal arch is also unique aspect of this paper.

2. The paper was well written and nicely organized for the reader.

Major Compulsory Revisions:

1. The authors selected a small sample of 20 healthy individuals who fell within the normal range for the AHI reported by Butler (ref 18). In reviewing the Butler, et al paper, the only information provided is the sitting and standing AHI values. Which did the authors use? Or, did the authors attempt to select their subjects based on the “change” in AHI between sitting and standing? The change in AHI, which would provide a measure of foot mobility and was reported by Butler to be approx. 3 mm (with a standard deviation of approx. 0.6 mm) for both the left and right feet as well as for men and women. Assuming the authors selected their subjects based on a 3 mm change or the standing AHI mean value, if the authors only picked subjects who fell within the normal range of movement why would they expect a significant change in arch deformation during walking? In light of the fact that the authors also performed their “standing” calibration in what appears to be “resting standing posture” and the subjects were within the normal range for the AHI, it would appear highly unlikely that the subject’s would undergo a significant amount of rearfoot or midfoot mobility during walking. Thus, the effect of the foot orthoses, molded or not molded, in comparison to the sock liner of the shoe would be minimal on midfoot and possibly rearfoot movement— which is what the authors found in their study. One could ask the clinical question – why would one expect a subject with a foot structure that most likely has minimal rearfoot or midfoot movement to demonstrate significant amounts of mobility during walking and thus benefit from the use of a foot orthoses? It is unfortunate that the authors did not have a group of subjects (with or without pathology) with “excessively mobile“ feet based on the AHI criteria as defined by Butler in comparison to a group of “healthy” subjects who fit the “normal range” for the AHI. The authors should discuss this issue (no mention of this important limitation) in their Discussion Section since it would appear to have a major
impact on the results they are reporting.

2. The authors provide no information on the type of semi-custom device use in the study. Who is the manufacturer? What was the density of the orthotics device (classification based on Shore A gauge or other device)? How was the molding process conducted – in the shoe, outside the shoe, or other method? The reviewer is under the impression that one of the several types of SOLE Inc. foot orthoses devices was used in the study based on the Acknowledgement Section of the paper. But, the authors need to provide the reader with more detailed information on the foot orthoses used in their study based on the questions asked above.

3. The fact that the PFS was significant but the MLA angles values were not is quite interesting. Since the change in position of the D1MT and MCAL markers were used to calculate the PFS and since PFS was significant (indicating a change in marker position) one must assume that the only reason the MLA angle was not significantly different amongst the three conditions studied was movement or lack of movement of the NAV marker. While the authors did discuss the issue of these three markers being removes and re-positioned (page 8), the issue of skin movement for not only the NAV but also the D1MT and MCAL markers should be discussed more fully in the paper. While the Tranberg and Karlson paper (Clin Biomech 13:71, 1998) is over 10 years old, it still provides interesting information on the amount of marker movement that occurs in the foot during walking. The authors should include a discussion of this issue in their manuscript.

Minor Essential Revisions:

Page 4; Line 1- the word “or” after efficacy I believe should be “of”. The authors should check this.

Page 4, Line 21 – the word “on” after “index (AHI) and were” does not seem to fit. The authors should check this.

Page 17, ref 18 – The pages provided for the Butler reference are incorrect – the pages should be listed as “102-106”

Discretionary Revisions:

1. The authors note on Page 10, line 21 – that future research involving custom-made orthotic devices needs to be conducted. It would beneficial for the reader if the authors discussed the findings by Kogler GF, et al (Clin Biomechanics 11:243-252, 1996). In their study, they assessed five different foot orthoses and their effect on the strain of the plantar fascia in fresh frozen cadavers. While this is not a dynamic study, such as the one conducted by the authors, the results of the Kogler study substantiates the need for further dynamic motion research with other types of foot orthoses.

2. The author’s note on Page 14, line 15 – that future research should include other types of experimental models, including finite element analysis and
fluoroscopy. Again, it would beneficial for the authors to discuss the findings of Wearing SC, et al (Med Sci Sports Exerc 36:1761, 2004), as their findings are in agreement with the results of the authors study regarding the MLA angle. Wearing et al used digital fluoroscopy to obtain 2-D dynamic lateral radiographs during walking. Again, this would be beneficial for the reader and substantiate the point the authors have made in their manuscript.

**Level of interest:** An article of importance in its field

**Quality of written English:** Acceptable

**Statistical review:** No, the manuscript does not need to be seen by a statistician.

**Declaration of competing interests:**

I declare that I have no competing interests.