Reviewer's report

Title: Investigation of the Biomechanical Effect of Variable Stiffness Shoe on External Knee Adduction Moment in Various Dynamic Exercises

Version: 1 Date: 20 January 2013

Reviewer: Peter R Worsley

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Comments to authors

This is an interesting paper with clinical relevance, which has found some results of interest. There are, however, several flaws in the paper which need to be addressed prior to publication. The most significant of which surround the review of the relevant literature and the interpretation of the results with limited relation to the known errors in the assessment techniques.

Major Revisions

1. One of the major concerns is the balance of the literature review, which has some bias towards the effects of the variable stiffness shoe. There is a body of evidence showing no significant effect which needs to be addressed. Missing key papers include;


Elizabeth M. Russell, Ross H. Miller, Brian R. Umberger, Joseph Hamill, Lateral wedges alter mediolateral load distributions at the knee joint in obese individuals, Journal of Orthopaedic Research, 2013, 31,

2. The argument that peak adduction moment is related to knee osteoarthritis progression is again a contentious issue, with literature both supporting and refuting this. Again a full balanced presentation of the literature is needed when making statements such as ‘EKAM is believed to have positive correlation with the progression of knee OA’ and ‘EKAM has been demonstrated to be a valid indicator for medial compartment loading and the severity of knee OA’

Please see literature including

Vanwanseele, F. Eckstein, R.M. Smith, A.K. Lange, N. Foroughi, M.K. Baker, R.
Shnier, M.A. Fiatarone Singh The relationship between knee adduction moment and cartilage and meniscus morphology in women with osteoarthritis Osteoarthritis and Cartilage July 2010(Vol. 18, Issue 7, Pages 894-901

Jonathan P. Walter1, Darryl D. D'Lima2, Clifford W. Colwell Jr2, Benjamin J. Fregly1,3,4,* Decreased knee adduction moment does not guarantee decreased medial contact force during gait Journal of Orthopaedic Research Volume 28, Issue 10, pages 1348–1354, October 2010

Ines Kutzner1,*, Philipp Damm1, Bernd Heinlein2, Jörn Dymke1, Friedmar Graichen1, Georg Bergmann1 The effect of laterally wedged shoes on the loading of the medial knee compartment-in vivo measurements with instrumented knee implants Journal of Orthopaedic Research Volume 29, Issue 12, pages 1910–1915, December 2011

Kim L Bennell1, Kelly-Ann Bowles1, Yuanyuan Wang2, Flavia Cicuttini2, Miranda Davies-Tuck2, Rana S Hinman1 Higher dynamic medial knee load predicts greater cartilage loss over 12 months in medial knee osteoarthritis. Ann Rheum Dis 2011;70:1770-1774

3. Throughout the literature review you have made statements with no referencing, for example;

‘knee OA is the most common type of osteoarthritis’
‘osteoarthritis is the most prevalent joint disorder in the world’
‘EKAM is a very strong predictor of knee OA progression’
‘footwear can be easily utilized…, it has become an effective non-invasive treatment to improve function as well as to delay the onset and progression of knee OA’

4. Motion Capture – why did you use a 16 marker configuration? There is a large body of evidence showing significant errors in the motion capture process, none of which have been highlighted or acknowledged in this document. There can also be large errors with kinetic and kinematic estimation with factors such as soft tissue artefact. Were any optimisation methods used, for example OLGA in Vicon. Were the kinematics filtered?


5. The moment of inertia is also very depending on the anthropometrics of the segments defined in the inverse model, for which there can be several errors with scaling. How were these defined in your analysis?


These limitations need to be highlighted in the discussion and further details of your methods to perform the inverse modeling will help the reader.

6. You can’t conclude that increasing anterior GRF could be beneficial for forward propulsion in athletes without substantive evidence (WHICH THIS PAPER DOES NOT PROVIDE)

7. Looking at your data in the figures average differences in peak EKAM range from 0.03-1.29 with large amount of deviation between your sample. If you just took the absolute values from your VSS and control shoe data (rather than percentage difference) would you still find statistical significance? Is a mean difference of 0.21%BW*Ht a clinically significant change?

Minor Revisions

8. Why did you sample at 1000Hz, I can understand getting force plate data at this frequency but I can’t see the need for motion capture data?

9. ‘All kinetic and kinematic data were averaged’ – what was the between trial variance?

10. Why pick maximum values to assess? This loses a large amount of your data and previous research (Bennell et al) have shown other parameters such as knee adduction impulse are potentially more important to assess.

11. Did you test your data for normal distribution?

12. There appears to be a bias in walking speeds, how would this affect your results?

13. When you refer to ‘anterior’ or ‘medial’ GRF are these forces or moments?

14. Why have you not presented the comfort scores?

15. Did you assess any differences in the kinematic data?

16. No recognition of variance (SD bars) on the figures

17. Mixing up time and percentage activity in the figures

**Level of interest:** An article of limited interest
Quality of written English: Needs some language corrections before being published

Statistical review: Yes, and I have assessed the statistics in my report.

Declaration of competing interests:

I declare that I have no competing interests