Author’s response to reviews

Title: Reliability of doming and toe flexion testing to quantify foot muscle strength

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Author’s response to reviews:

Thank you to both reviewers for your detailed and thoughtful reviews of our paper. The points raised in your reviews were very helpful. We believe that we have addressed your concerns in this revision and, as such, resubmit a much improved paper.

The highlighted version of the manuscript shows the changes we made using “Track Changes”. Below, I will summarize changes made in regard to each comment from each of the reviewers.

Reviewer 1

In order to address your points made under General Considerations, point 1, we made changes throughout the paper to reflect the fact that we were measuring foot muscle strength, not necessarily isolating the intrinsics. We changed the names of the tests to reflect the movement performed. In addition, we discussed which muscles may be involved in each movement in more detail in the introduction and the discussion.

Regarding General Considerations, point 2, we addressed the relevance of the types of movement performed during our testing to movement during daily activities in the discussion and limitations.

Specific comments:

1. Abstract Line 44 - "lesser toes" may be more appropriate than "lateral toes".
2. Introduction P3 Line 77 - please change "may contribute to" to "has been associated with"

3. Introduction P3 Line 83-84 - The final sentence "if the intrinsic muscles of the feet are ineffective" is very vague. Could the authors please be more specific, or remove the sentence.

4. Introduction P4 Line 98 & 99 - please change "was" to "is"

5. Introduction P4 Line 100 & 102 - please change "drawback" to "limitation"

6. Introduction P4 Line 106-111 - Please re-focus this paragraph to be less certain that are measuring intrinsic foot muscle strength in isolation.

7. Introduction P5 Line 116-117 - The authors may wish to provide further justification for why they believe their measures are likely to be more reliable than others. Is there something in the experimental set-up that is likely to increase the ability of participant to consistently replicate the task?

Addressed in text (Lines 121-123).

8. Methods P5 Line 125. Please add a statement regarding the declaration of Helsinki, if this was adhered to.
Added

9. Methods P6 Line 142. The authors should be less definitive about the role of the intrinsic foot muscles in producing force in isolation during this test. They may wish to mention the long toe flexors, TA and TP here too.

Removed IFM in this sentence. Also addressed throughout discussion

10. Methods P6 Line 142. Can the authors be certain that the metatarsal heads were not raised of the surface of the Brannock device during the doming task? Inversion of the rear-foot, via tibialis anterior and tibialis posterior activation may also produce an upward directed force.

Added statement re: visualizing the movement of the metatarsal heads (Lines 172-173)

11. Methods P7 Line 1162-166. The toe flexion task descriptions do not seem as they as they are encouraging the participant to activate the intrinsic foot muscles in isolation. This idea is supported by the images in figures 3A and 3B where it is apparent that there is substantial amounts of distal IP joint flexion occurring in all toes. Distal IP joint flexion is most likely produced by the long digital flexors (FHL and FDL).

We have changed the focus throughout the paper to reflect the fact that we are testing functional groups of muscles and not isolating the intrinsic foot muscles.

12. Discussion P10 Line 228 - Please alter reference to intrinsic foot muscle strength, as discussed earlier

Changed throughout

13. Discussion - The authors may wish to discuss the potential contribution of different muscles to these tasks. The authors may also like to comment on the functional relevance of toe flexion and doming in terms of gait biomechanics in the discussion.

Changed throughout (ex. Lines 252-255)
Reviewer 2

Major Essential Revisions

As indicated above, we have removed many of the statements regarding measurement of the intrinsic foot muscles, specifically. We have changed the title of the paper to reflect that as well. We have addressed the contribution of the extrinsic muscles throughout the introduction, methods, and discussion sections of the paper.

Minor Essential Revisions

1) Please provide an indication as to why this study should be considered appropriately powered. Is n=21 enough?

We are unaware of a power analysis that applies specifically to ICCs. Our sample size is in line with previous studies reporting the reliability of measurements of foot structure (Ex. Pohl, et al, 2000 – n=20, Hartmann, et al, 2009 – n=24)

2) Abstract, Methods: The term 'strength tests' and 'exercises' are used. I recommend using the most appropriate term consistently.

Changed exercises to strength tests throughout.

3) Abstract, Methods: I recommend the authors consider using the word 'between' instead of 'across' to describe the different testing sessions.

Changed across to between.

4) Abstract: Change '1 - 5 days' to 'one to five days'.

Changed

5) Background, paragraph 2: It appears that most of these references found associations between IFM weakness rather than 'contribution' which implies an element of causation. Please revisit this paragraph to ensure that what you are reporting is indeed supported by the references.
Changed “may contribute” to “has been associated with”. Checked references.

6) Background, paragraph 2: Consider referring to Saeki et al Ankle and toe muscle strength characteristics in runners with a history of medial tibial stress syndrome JFAR 2017
https://jfootankleres.biomedcentral.com/articles/10.1186/s13047-017-0197-2 for a more contemporary reference regarding foot strength and MTSS.

Added reference and noted altered activation due to difficulty in isolating intrinsic and extrinsic foot muscle activity

7) Background, paragraph 2, final sentence: Please consider rewriting this sentence as I'm not certain if readers will understand what 'ineffective' intrinsic foot muscles mean? Does this refer to weakness, atrophy, poor activation, etc.?

Removed

8) Background, lines 112-117: This sound more like methods than background. Please either change it into an aim/hypothesis or shift the content to the methods (or remove).

Removed. This information was already stated in methods.

9) Methods, participants. Please only state that the participants are healthy once. I suggest you remove 'healthy' from line 122.

Removed.

10) Methods, participants. Consider changing 'one week and at least 24 hours apart' to 'one to five days'.

Changed

11) Methods, participants. Please remove spacing between the +/- so it is consistent throughout the manuscript.

Changed
12) I recommend providing an image of the short foot/doming exercise for readers who are unfamiliar with it.

Added in a new figure (Figure 2) showing the foot relaxed and “domed”.

13) Please indicate if the equipment used to measure strength is valid and reliable. Provide references to support.

Added sentence re: calibration and included $r^2$ (Lines 165-166)

14) Line 187: Spacing issue prior to 'inter-session'.

Fixed.

15) Table 1: Provide a '0' at the beginning of each 95% CI and change the hyphen with 'to'. For example, change ".899 - .950" to "0.899 to 0.950".

Changed

16) Discussion: The testing was performed in a set order. Is this likely to have a sequencing effect on the results? Please discuss.

Added to limitations (Lines 337-339)

17) Discussion: It is worth discussing that the potential validity issues relating to the strength tests explored in this manuscript.

Discussed isometric measurements vs. movement through typical range of motion during activity in the limitations

18) Discussion: I recommend the authors discuss the reliability of the tests explored in this study compared to alternative foot strength tests.

Added statements in discussion (Lines 298-299, 306-308)
19) Line 244: Many professions are likely to use 'doming' (not just physical therapists) so please replace 'physical therapists' with a broader term that encompasses these many professions. Changed to “healthcare professionals”

20) Line 243: Put 'and' before 'pes planus'. Added.

21) Discussion: I'm not convinced ABDH requires an abbreviation as it is sparingly used in the manuscript. Changed.

22) Line 278: Sentence fragmented - please rewrite. Fixed.

23) Discussion, limitations. I feel more limitations need to be discussed. Do these measures reflect muscle activity during gait, max. strength v muscle endurance, and does it reflect what may be observed when fatigued/exerted, etc.? Added statements in limitations regarding muscle activity during other activities (Lines 332-339).