Author's response to reviews

Title: Importance and Challenges of Measuring Intrinsic Foot Muscle Strength: Review of the literature

Authors:

Achini D Soysa (achini.d.soysa@gmail.com)
Claire Hiller (claire.hiller@sydney.edu.au)
Kathryn Refshauge (kathryn.refshauge@sydney.edu.au)
Joshua Burns (joshuab2@chw.edu.au)

Version: 2 Date: 21 August 2012

Author's response to reviews: see over
21st August 2012

Prof Hylton Menz
Editor-in-Chief
Journal of Foot and Ankle Research

Dear Prof Menz,

Ms. Ref. No.: 9344588646905632

Title: Importance and challenges of measuring intrinsic foot muscle strength: Review of the literature’

We thank the editor and reviewers for their thoughtful comments concerning our manuscript and for considering our review for publication in Journal of Foot and Ankle Research. We have carefully addressed the issues raised by the editorial team and reviewers and would like to take the opportunity to resubmit our revised manuscript.

We have provided our revised manuscript with the changes highlighted. In addition, we have provided a separate document listing the editorial and reviewer comments verbatim and our replies, point by point (with page numbers of any changes made).

As a result, we believe this revised manuscript is significantly improved in clarity and will be informative to the readership of Journal of Foot and Ankle Research.

Yours sincerely,

Achini Soysa and Associate Professor Joshua Burns, Ph.D.
on behalf of the co-authors Dr. Claire Hiller and Prof. Kathryn Refshauge
Editor's comment:

JFAR uses standard English, not US English, so please remove all unnecessary capital letters from the title, headings and subheadings. The title will need to be changed in both the submission system and the manuscript file.

Authors’ response: We acknowledge that American English was used in the manuscript. Therefore the manuscript was proof read to change all capital letters from the title, headings and subheadings. The changes were made on pages 4,5,6,7,8,11,12,25.

REFEREE 1 COMMENTS

This is a nice review of an interesting and important topic related to the measurement of intrinsic muscle strength measurement in the foot. The authors have done a good job to identify and review the existing literature on this topic.

- Major Compulsory Revisions

In the introduction, the authors state that “Strengthening intrinsic foot muscles might improve, or even prevent, these disorders”. What do the authors base this on, there is no reference available. We do not know if this is the case, and therefore I suggest being more careful with such a statement. Different wording would be more appropriate.

Authors’ response: We acknowledge this speculative comment in the introduction is inappropriate and therefore this comment was omitted in the revised manuscript. The changes were made on page 3.

Direct methods: One of the main limitations is that nearly all “direct” tests reviewed measure toe flexor strength and not toe extensor strength. In my view, this limitation has not been exposed enough in the manuscript in sections on the direct methods and in the first paragraphs of the discussion.

Authors’ response: The revised manuscript addresses this point in two sections. First, this point is expanded and explained in detail in the first paragraph under the new heading “Direct methods of assessing intrinsic/extrinsic muscle strength”. These changes were made on page 12. Second, this point is again discussed in the limitations of direct methods in the Discussion on page 24.

Discussion, paragraph 2: “Therefore further research is needed to determine whether intrinsic muscles are the main contributor to the force generated, before hand-held dynamometry can be accepted as a valid measure of intrinsic muscle strength.” What kind of research do the authors mean? Which suggestions do they have for this research?

Authors’ response: This statement has been expanded in the revised manuscript to include suggestions for future research. The main suggestion is to perform a study, where EMG is performed while using a hand-held dynamometer to measure intrinsic muscle strength. This will allow muscle activation patterns of both intrinsic and extrinsic
muscles to be assessed during hand-held dynamometry testing. This point is further discussed in the revised manuscript (Discussion-Paragraph 2). The changes were made on pages 24.

The paragraph on future research may need a separate subheading. Because the main interpretation throughout the manuscript is that proper methods to measure intrinsic muscle strength are not available and that it will definitely be a great challenge to find methods that isolate intrinsic from extrinsic muscle strength, the future research section of the paper is very important. I think the reader should not only be informed about the limitations of the methods currently available, but also about an extensive research agenda and/or methodology on how we are going to tackle this problem in the future.

Authors’ response: In the revised manuscript, the future research section has its own heading. Furthermore in the future research section, the main limitations of direct and indirect methods is stated and methods of overcoming these limitations in future studies are also discussed. The changes were made on page 26.

- Minor Essential Revisions

The abstract could be better structured to provide more specific information. For example, the authors conclude that toe dynamometry represents a promising method, but they do not mention in the results section what this is based on. And if I am correct, they mean hand-held dynamometry instead of the more general method of toe dynamometry.

Authors’ response: We acknowledge that the abstract is lacking in structure. Therefore in the revised abstract, a method section outlining how the literature was searched was added. Furthermore the conclusion and results sections in the revised abstract were modified to include further details regarding hand-held dynamometry. The changes were made on pages 1 and 2.

Furthermore, the authors could clarify more how future research should be conducted, as the main conclusion in the review is that the right methods to assess intrinsic muscle strength are not yet available.

Authors’ response: We acknowledge that the future research section in the original manuscript was brief. The revised manuscript, under the future research section, provides examples of how future research studies may be conducted to better assess intrinsic muscle strength. The changes were made on pages 25 & 26.

In the introduction, the authors refer to the publication of Bus et al, 2009 to support that intrinsic foot muscle weakness is implicated in the development of claw toe deformity. However, to the contrary, this paper suggests that this relationship may not be as straightforward as many believe it is. Therefore, it should not be referred to here, but discussed, as it is, in the section on diabetic neuropathy.
Authors’ response: We agree that the publication by Bus et al 2009 does not support the argument that intrinsic foot muscle weakness is implicated in the development of claw toe deformity. The findings of this study are discussed in further detail under the ‘Lesser toe deformity’ subheading in both the original and revised manuscript, where the point that the relationship between intrinsic muscle weakness in the development of toe deformity may not be as straightforward is discussed. The changes were made on page 10.

I am confused about the use of the wording “direct” and “indirect” methods in the paper. In fact, all the methods reported are indirect because none of the methods can measure in isolation intrinsic muscle strength since all are biased towards measuring extrinsic muscle activity as well. I suggest using different wording for this.

Authors’ response: We acknowledge the use of terms ‘direct methods’ and ‘indirect methods’ is somewhat confusing. We also agree that all direct methods are actually indirect methods of measuring intrinsic muscle strength and therefore the terms appear to be used inaccurately. Therefore a section was added to the revised manuscript, under the heading ‘Measurement of intrinsic foot muscle strength’ explaining the rationale for the use of these terms. The changes were made on pages 11 and 12:

“The next section will review the ‘direct’ and ‘indirect’ methods of measuring intrinsic muscle strength. The subheading ‘direct methods of assessing intrinsic/extrinsic muscle strength’ reviews the methods that can directly measure a unit of force or power. However, these ‘direct’ methods actually measure toe flexion strength which is a combination of intrinsic and extrinsic muscle strength. The subheading ‘indirect methods of assessing intrinsic muscle strength’ reviews methods that are unable to directly measure force but provide information regarding intrinsic muscle structure and activity.”

Paper grip test: What do the authors mean when they say that patients try and keep a business card underneath the toes? And how can the paper grip test be used in conjunction with a plantar pressure platform when the examiner needs to pull out the paper from underneath the toes. Maybe a photograph showing these tests would be helpful.

Authors’ response: Further details explaining the Paper Grip test have been added to the section under the subheading ‘Paper Grip test’. The changes were made on pages 15. We agree that photographs showing the different direct methods would be helpful.

Dynamic MRI: “An important advance in MRI is the fast-cine phase contrast (or dynamic MRI), which allows images to be acquired while the participant performs an action [58].” What is actually measured in the MRI images using Dynamic MRI? So which parameter, that could serve as a surrogate measure of muscle strength?

Authors’ response: We have amended the manuscript to explain the parameters that can be measured using dynamic MRI. The changes were made on pages 19. Currently dynamic MRI has only been used to investigate the axis of rotation in joints of the foot. However, we make the point that as technology improves, dynamic MRI may allow real-
time imaging of intrinsic muscles during different activities. A better understanding of the function of intrinsic muscles will assist with developing better methods of measuring intrinsic muscle strength.

The conclusion is very concise and does not cover all the important issues discussed in the paper. I would suggest expanding on this.

Authors’ response: We agree that the conclusion is short. Therefore in the revised manuscript further details have been added to the conclusion section to better summarise the main points of the manuscript. The changes were made on pages 26.

There are several typographical errors in the manuscript, mainly with words missing or commas missing after words like “However” or “Currently”

Authors’ response: The typographical errors in the manuscript have been corrected.

Reviewer 2: Michael J Mueller

This review addresses the important issue of measuring intrinsic muscle strength. The intrinsic foot muscles have been understudied, yet seem to have many very important functions in the foot. The topic is highly relevant to this journal and covers important and interesting topics.

However, the following substantial concerns are noted: The review seems to cover too broad a topic, and so, does not cover any of these topics in a comprehensive or authoritative manner (as required of a review by description on website). The stated purpose (page 3) indicates the paper will “provide an overview of anatomy... and evaluate the different methods used to measure intrinsic muscle strength”. However, only 1 paragraph is devoted to a very superficial listing of the 4 layers of muscles followed by a superficial review of the “Evolution of the Intrinsic Foot Muscles” that doesn’t develop either topic adequately or seem to fit with the rest of the paper. The paper then briefly discusses the role of intrinsic foot muscles in walking, arch support, and several important pathologies. Although these topics are important, they are not part of the review’s purpose statement and are not developed adequately. Any of these topics could be a full review in itself. It is not until page 9 that the authors get to the main point of the review; measuring intrinsic foot muscle strength.

Authors’ response: Reviewer 2 critiques the stated purpose of the review “Therefore the aim of this review was to provide an overview of the anatomy, role of intrinsic foot muscles and evaluate the different methods used to measure intrinsic foot muscle strength”. Reviewer 2 suggests that the anatomy section is too brief and the “Evolution of intrinsic foot muscles” section does not suit the purpose of the review. We did not intend to provide a comprehensive review of intrinsic muscle anatomy. Nevertheless, we have added to the intrinsic muscle anatomy in the revised manuscript, including the layered positioning of individual intrinsic muscles in the foot and nerve innervations on pages 4 and 5. We believe this has satisfied the purpose of the review, which is to outline the anatomy of intrinsic foot muscles. Furthermore the evolution of intrinsic
muscles is an important and novel section providing context for the role of intrinsic foot muscles, which is one of purposes of the review.

Reviewer 2 also suggests that the “Role of intrinsic foot muscles” section has not been discussed adequately and the “Implication of weakness of intrinsic foot muscles” does not fit in with the purpose of the review. The purpose of the review was to outline the different roles of intrinsic foot muscles, which have been discussed in terms of walking and arch support but also to outline the role of intrinsic muscle weakness in pathologies such as CMT, heel pain and foot deformities. The main aim of the review was to evaluate the different methods used to measure intrinsic foot muscle strength. Therefore less consideration is provided to the anatomy and roles of intrinsic muscles sections, although we believe these aims have been discussed in adequate detail.

In this reviewer’s opinion, the divisions into “direct” and “indirect” methods to measure strength are not accurate. The “direct” methods are actually quite indirect estimates of intrinsic muscle strength as they rely on many factors (i.e., joint torque through the MTPJ, placement and length of resistance arm, type of force measuring device, joint position, and involvement of the extrinsic muscles) many of which are discussed by the authors. The “indirect” measures are not measures of strength at all but estimates of muscle structure (volume or area), activity, or histochemical properties. The measures may be related to muscle force production (strength) but that remains to be seen. The review hardly mentions these important issues.

Authors’ response: Please see our response to Reviewer 1 regarding this point. We acknowledge that the use of the terms “direct” and “indirect” methods are unclear. Therefore we have added a rationale for using these terms in the section ‘Measurement of intrinsic foot muscle strength’. The changes were made on pages 11 and 12. The term “direct” actually refers to a direct measure of force or power. The term “indirect” refers to the notion that these measures cannot measure muscle force or strength. The notion that indirect methods can provide important information regarding muscle volume, activity and histochemical properties, which inturn may provide insight into the force producing capacity of the muscle is also explained in the discussion, in the revised manuscript. The changes were made on page 25.

In addition to the above major concerns, the review does not show other characteristics of a scholarly review. The authors do not indicate how the literature was reviewed or how papers were selected to include. The paper contains little primary quantitative data to support the broad statements. The paper contains many excellent references, but there is a higher reliance on abstracts for important points (i.e., refs 43, 49, 58) than would be warranted in a scholarly review.

Authors’ response: The revised manuscript now contains a thorough description of the search strategy and inclusion criteria. The changes were made on page 4. Furthermore Table 1 (on page 34) also contains the results from our full database search. In regards to the comment that the review has a high reliance on abstracts, in the revised manuscript only 4 abstracts have been used (reference 16,35,46,64) out of a total of 74 references. Furthermore the abstract studies (reference 35, 64) have been used along with other full text non-pilot studies to support key statements. In regards to the
abstracts from the studies by Ledoux et al 2008 (page 10, reference 46) and Mickle et al 2008 (page 16, reference 16), which were used as standalone references to make points regarding intrinsic foot muscle weakness and measurement; we added that these were pilot studies.

The Discussion (page 20-22) seems fairly redundant with the rest of the text.

Authors’ response: We disagree that the discussion is redundant. The discussion section of the review evaluates the strengths and limitations of both the direct and indirect methods available to measure intrinsic muscle strength and outlines future research suggestions to address the limitations discussed.

Tables 1 and 2 are a good idea to include quantitative information from the references, but most of the cells have “n/a”.

Authors’ response: The ‘n/a’ cells highlight the research gaps in our field to fill.

Reviewer 3: Karen J Mickle

Minor issues

1. P10L3: References need to be formatted. The changes were made on page 29 to 33.
2. P11L6: Correct spelling for dynamometry. The changes were made on page 1,12-14,23-24,26-27,36,46.
3. References need to be checked for consistency. The changes were made on page 29 to 33.
4. The year/page is incorrect for ref 45 (Spink), it should be 2010; The changes were made on page 14,31 and 36.
5. The ICC values for the Mickle (2006) in Table 2 are incorrect. They should be 0.93 for the hallux and 0.92 for the lesser toes. No CI was reported. The changes were made on page 37.

Authors’ response: These errors have been corrected in the revised manuscript.

Major Compulsory Revisions

1. P18: Include the following studies that have assessed the reliability of measuring intrinsic foot muscle size - (Cameron et al. 2008; Mickle et al. 2012)

Authors’ response: The manuscript has been revised to include these papers. The Cameron et al 2008 paper has been integrated into the revised manuscript on pages 20 and 39. The Mickle et al 2008 paper has been integrated into the revised manuscript on pages 20 and 40.

Minor Essential Revisions
1. Very little of the text under the heading of “Diabetic Neuropathy” (p7) does not actually relate to the diabetic foot and rather discusses lesser toe deformities. I suggest combining the information relating to the toe deformities with that under hallux valgus under the heading of Toe Deformities, or, Hallux Valgus and Lesser Toe Deformities. There are several other papers that could be mentioned under the diabetic neuropathy section (van Schie et al. 2004; Greenman et al. 2005; Andreassen et al. 2009)
   Authors’ response: This heading has been changed in the revised manuscript. Further, the manuscript has been revised to include the papers by Greenman et al 2005 and Andreassen et al 2009.

2. Insert appropriate reference numbers into the tables.
   Authors’ response: The manuscript has been adjusted to include the reference numbers into the tables. The changes were made on page 36-40.

Discretionary Revisions
1. P19: The opening paragraph describing EMG, is not related to the review and adds unnecessary text. I suggest adding the recent paper by Kelly et al.(2012) who conducted indwelling EMG on 3 of the intrinsic muscles to the discussion.
   Authors’ response: The opening paragraph describing EMG has been modified. The changes were made on page 20. Furthermore the paper by Kelly et al 2012 has been included in the revised manuscript. The changes were made on page 21 and 22.