Author's response to reviews

Title: A protocol for classifying normal- and flat-arched foot posture for research studies using clinical and radiographic measurements

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Author's response to reviews: see over
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Dr Alan Borthwick  
Deputy Editor (UK)  
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Dear Editor,

Thankyou for providing the comments from your Editorial Board. We are grateful for the comments raised by the reviewers and have revised the manuscript with these in mind - we have responded on a point-by-point basis below. Each text-box contains the specific suggestion or query made by the reviewer.

Yours truly,

George Murley
RESPONSE TO REVIEWERS COMMENTS

Reviewer #1

1. Table 3 typo - Anterior-posterior view TSMA. Do you mean T2MA?

1. Authors’ response
Yes this is a typo and should read: T2MA. This has been corrected.

2. The secondary aim of the study was “to explore relationships between clinical and radiographic measures of foot posture”. I feel this was not clearly represented in the results section “Scatter plots showing the distribution of all participants’ clinical and radiological measurements are shown in figure 5”.

The graphs in figure 5 are not referred to in the results and I am unsure why the authors chose to illustrate the association between radiographic outcomes 5b 5c and between clinical outcomes 5a, rather than between the clinical and radiographic outcomes as stated in the aim. Whereas, the results in table 3 shows some interesting associations between the clinical and radiographic outcomes that if graphical may be more relevant to the reader and more applicable to the secondary aim.

2. Authors’ response
We agree with this comment. Figure 5 has been replaced with scatter plots showing relationships between clinical and radiographic measurements.

3. The association between clinical and radiographic outcomes in Table 3 and are discussed in the results section but the authors have highlighted data that is inconsistent with table 3:

"The strongest association between clinical and radiological measures occurred for the normalised navicular height and calcaneal inclination angle." - In table 3 this is 0.60**, however NNHt and CIMA is 0.70** Please can you clarify which is the strongest association?
3. Authors’ response
The table is correct with a correlation of 0.70 between NNHt and C1MA. The text should read calcaneal first metatarsal angle and not calcaneal inclination angle. This has now been corrected.

4. Can the authors be clear about the inclusion of this association: “For the clinical measures, arch index and normalised navicular height displayed a significant negative correlation to each other (r = -0.58).” The authors have not referred to these results in the discussion I am unsure of it’s value to the paper. Particularly as in the graph 5a these 2 clinical measures appear to have no relationship in the normal group.

4. Authors’ response
We believe the correlation between the two clinical measures is worth including. By presenting the correlation between the two clinical tests, the reader can see that the relationship is only moderate. This means that when screening participants’ foot posture for research, one cannot expect a high-level of agreement between these measurements in deciding whether to pursue further examination using radiographs. This explains why the screening algorithm (Figure 6) depicts that using either of the clinical measurements is appropriate when deciding to refer for radiographic examination.

5. Can the authors add in a little more information about the sample used to test the relationship between clinical and radiographic measure in paragraph 3 page 11 opening sentence: E.G The relationships among clinical and radiographic measures (for the entire group n=91) are shown in table 3.

5. Authors’ response
Further information has been added to this sentence – it now reads:
The relationships among clinical and radiographic measures (for the entire group n=91) are shown in table 3.

6. The data is well controlled; however the reporting of one statistical measure is of some concern. Pearson’s correlation was applied as a test of association between clinical and radiographic measures, however, an association of 0.24 and 0.25 although significant are not substantive and could be handled in a more balanced manner.
6. Authors’ response
We agree that correlations of 0.24 and 0.25 are relatively weak and this should be made clearer. The following sentence has been added to the results section.

*The clinical measurements displayed only a weak to moderate relationship with radiographic measurement from the antero-posterior view, with r values ranging from 0.24 to 0.56.*

**Reviewer #2**

1. Overall, the methods are well described. It would be helpful if the authors could provide rationale for selection of their arch index measurement versus other ‘arch’ measurements such as the arch height or arch ratio. Correlation between the arch index measures used in this study, as proposed by Cavanagh and Rodgers, have not been shown to have strong correlation with foot function during gait. (See additional comments below).

Additionally, what is the rationale for not including a high-arched foot group in this study? It is interesting that strongest correlations were found for ‘non qualifiers’ in Table 5c - and based on calcaneal inclination and calc-1st met angles, these subjects look very much like a high-arch group!

1. Authors’ response
The reviewer has raised two points that require discussion. In relation to the first, ‘further justification for selecting the arch index over other arch measurements is required’: the following paragraph has been added to the Methods section to provide further clarification (pg 6, last paragraph):

*Although the arch index and normalised navicular height measurements have comparable reliability to other measures of arch height, these were selected because of their ease of use and demonstrated validity with skeletal alignment measured via radiographs (Menz and Munteanu, 2006). Additionally, the arch index is sensitive to age-related changes in foot posture (Scott et al., 2007) and is strongly associated with both maximum force and peak pressure in the midfoot during walking (Menz and Morris, 2006).*

The second point raised was that we ‘did not include a high-arch foot group in this study and that some data in figure 5 would appear to resemble characteristics of participants with high-arch feet’. We did not aim to prospectively recruit participants with high-arched feet because although high-arched feet are susceptible to injury and warrant greater research (Burns et al.,
2. The data appear to be sound and well controlled. Elaboration of details regarding the radiographic measurements (eg. were examiners blinded to the foot types, were there repeated trials, were the marks erased between measurements, etc) should be included in the section under Reliability of Clinical and Radiological Measures (p 9).

2. Authors’ response
We agree that elaboration of details about the radiographic measurements is required. The following paragraph has now been added to the section titled: Reliability of Clinical and Radiographic Measurements (page 8, second paragraph):

The x-ray measurements were marked onto clear-plastic overhead transparencies placed over the x-ray using a permanent fine-point marker. For intra-tester reliability, the tester was blinded from the initial measurements when they performed their re-test session approximately two-weeks later. For inter-tester reliability, the examiners evaluated the x-rays independently, were blinded to each other’s assessment and the data for each angle was recorded from single measurements. Testers were not blinded from the participants’ anthropometric measurements (e.g. clinical measures of foot posture) for either the intra-tester or intra-tester components of the study.

3. The discussion and conclusions are appropriate for the data assessed and not overstated. Two limitations that have not been addressed but should be included in this section include 1) the homogeneity of the group that limits generalization of the findings to a young adult population; and 2) the lack of any correlation between these findings and dynamic foot function during gait.
3. Authors’ response
We agree with the first comment that the homogeneity of our participants needs to be highlighted. Accordingly, the following comment has been added to the limitations section (page 16, second paragraph):

*The homogeneity of the participant group in this investigation limits the generalization of our findings to a young adult population.*

The reviewer’s second point regarding ‘a lack of correlation between these findings and dynamic foot function during gait’ is already addressed at the end of the discussion (pg 15, last paragraph):

*Further research is required to provide validation of radiographic measures of foot posture by investigating whether the radiographic angles are related to functional differences during gait.*

It should also be noted that rationale for designing this screening protocol was to recruit participants to a series of lab-based gait studies with the aim of determining whether variations in foot postures are related to dynamic function, in this case via electromyography.

4. In the abstract, it may be helpful to the reader to explain what is meant by the statement “28 participants being ‘not suitable’.”

4. Authors’ response
We agree that this sentence could be made clearer for the reader. The following text (underlined) has been added to this sentence:

28 participants had neither normal- or flat-arched feet and were not suitable for either study

5. Background

P 4 para 2 As stated previously, it would be helpful for the authors to elaborate on the choice to use the arch index measurement versus the other arch measurements. Definition of each of these measures may be helpful in this section.

5. Authors’ response
We acknowledge that some justification of these measurements is required. To address this, the following sentence has been added to the methods section (page 7, 2nd paragraph):

*Although the arch index and normalised navicular height measurements have comparable reliability to other measures of arch height, these were selected because of their ease of use*
and demonstrated validity with skeletal alignment measured via radiographs (Menz and Munteanu, 2006)

6. P 5 para 2 It appears that the authors have the data to delineate between normal-arch and high arch feet. Any reason why not including the ‘upper end’ group?

6. Authors’ response
Please refer to author response #1. Additionally, we did not collect data to delineate between normal-arch and high-arch feet. The scatter plots show that for some radiographic angles, there were some non-qualifying participants that may have high-arched feet. However, these participants often had another joint angle that was normal or slightly pronated, and as such, would not classified as having a high-arched foot.

7. Methods
P 7 para 1 Please indicate the location on the navicular where this measurement is taken.

7. Authors’ response
The following sentence has been added that describing the location on the navicular where the measurement was taken. (page 7, 3rd paragraph)
Navicular height is the distance measured from the most medial prominence of the navicular tuberosity to the supporting surface.

8. Results
P 10 para 2 Please elaborate on why subjects were not suitable for either foot group.

8. Authors’ response
We agree that this sentence could be made clearer for the reader. The following text (underlined) has been added to this sentence:
28 participants were classified as having neither normal- or flat-arched feet and were not suitable for either study.

9. P 11 para 3 It may be worth noting here that although significant, the correlations were not strong between the AP radiographs and clinical measurements. (Further elaboration needs to be included in the Discussion on the poorer reliability and higher variability of these AP measurements that account for the poor to moderate correlations).
9. Authors’ response
The following additional information regarding specific correlations between clinical and radiographic measure has been added to the results section (page 12, second paragraph):

The clinical measurements displayed a moderate to strong relationship with radiographic measurement from the lateral view, with r values ranging from 0.59 to 0.70. However, the clinical measurements displayed only a weak to moderate relationship with radiographic measurement from the antero-posterior view, with r values ranging from 0.24 to 0.56. The strongest association between clinical and radiological measures occurred for the normalised navicular height and calcaneal first metatarsal inclination angle (r = 0.70).

To address the second point that: ‘Further elaboration needs to be included in the Discussion on the poorer reliability and higher variability of these AP measurements that account for the poor to moderate correlations’. Whilst we agree that the AP measurements appear to be more variable and less reliable than measurements from the lateral view, it is unclear how these factors influence correlations with clinical measurements. The following paragraph has been added to the limitations section of the discussion highlighting the reliability (page 16, second paragraph).

This foot screening protocol needs to be viewed in light of some limitations. The intra- and inter-tester reliability of the talus-second metatarsal angle ranged from moderate to excellent with ICCs between 0.68 and 0.91 and limits of agreement ranging from 5.6° to 12.1°, respectively.

10. Discussion
See comment #5 above.

10. Authors’ response
Please refer to the response above (i.e. Author’s response #5)

11. Table 1
Legend indicates “Statistically significant findings” but for what comparisons?

11. Authors’ response
The statistically significant findings correspond to the comparisons below this line in the manuscript. We can see that this is unclear so we have changed the sentence to:

Statistically significant findings for the comparisons listed below (p < 0.001):


12. Authors’ response

Yes the axis labels were accidently reversed. However, these scatter plots have now been replaced (in response to the reviewer 1’s comment #2) with new scatter plots showing the relationship between clinical and radiographic measurements.

REFERENCES:


