Author's response to reviews

Title: Clinical Correlates Between Foot Posture Index and Dynamic Rearfoot Motion

Authors:

Vivienne H Chuter (Vivienne.Chuter@newcastle.edu.au)

Version: 2 Date: 2 December 2009

Author's response to reviews: see over
To the Editors,

Please find attached a point by point description of the amendments made in response to the reviewers' comments for the manuscript MS: 7308267053128373.

Regards,

Vivienne Chuter
Senior Lecturer
Faculty of Health

Tel: + 61 2 43494424
Fax: + 61 2 43494538

Vivienne.Chuter@newcastle.edu.au
Reviewer 1: Keith Rome

1. Title re-wording completed as suggested
   New title: **Relationships between foot type and dynamic rearfoot frontal plane motion**

2. Validity of the FPI?
   The FPI has been validated as per:
   

   The article text reads as:

   The six item Foot Posture Index uses a validated criterion based observational measurement of the forefoot and rearfoot in a static position (Redmond, Crosbie et al. 2006). Reference added to paragraph relating to video gait analysis and statements relating to electromagnetic tracking

3. Further information about inclusion/exclusion issues required.
   Amended text now reads:

   Inclusion criteria for the study required a pronated or neutral foot type as determined by Foot Posture Index score when applied by an experienced clinician. Subjects who had a negative FPI score indicating a pes cavus foot type were excluded from the study. Any subjects with history of major lower limb or back trauma or surgery were excluded from the study. Any subjects with current lower limb of back pathology were excluded from the study.

4. Sampling is further explained, it is assumed sampling refers to the patient sample
   20 male and 20 female subjects were recruited from the University of Sydney student population for participation in this study, mean age 32.4 yrs (SD ±4.7 yrs), mean height 171 cm (SD ±8.9 cm) and mean weight 69.5 kg (SD ±4.1 kg).

5. Further information re marker placement
   The following information has been included
   Markers were applied to the hallux, head of the fifth metatarsal and navicular for the forefoot segment. The rearfoot and shank consisted of medial, lateral and posterior calcaneal markers and medial and lateral malleolar and upper and lower tibial makers.

6. No an independent observer was not used to place markers
7. The statistical analysis section has been reworded:

Linear correlations were performed to identify strength of relationship between maximum dynamic rearfoot eversion and total FPI score with in the entire population and within pronated and normal groups.

8. a) Linear correlations using r values need to be explained in terms of strong and weak.

The author was unsure as to what was required. General rules applying to correlation strengths were included as per the wording below:

Pearson’s r values above 0.8 were considered very strong, between 0.6 and 0.8 strong and 0.3 and 0.6 moderate. Correlation coefficient values below 0.3 were considered weak due to the relatively small sample size (Minichiello, Sullivan et al. 1999).

b) Referencing was added to the planar dominance philosophy.

A possible relationship between evidence of frontal plane dominance of the subtalar joint, and maximum rearfoot eversion and was also examined (Payne and Chuter 2001).

9. Descriptive information to be added to the results the results

I am unsure as to what is required. The following table of descriptive statistics has been included:

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Minimum (°)</th>
<th>Maximum(°)</th>
<th>Mean (°)</th>
<th>Std. Deviation (°)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal Group FPI=0 to +5</td>
<td>20</td>
<td>3</td>
<td>7</td>
<td>4.95</td>
<td>1.16</td>
</tr>
<tr>
<td>Pronated Group FPI=+6 to +9</td>
<td>20</td>
<td>7</td>
<td>14</td>
<td>10.71</td>
<td>1.42</td>
</tr>
</tbody>
</table>
10. Significant and non significant relationships have been included.

11. Correlation results added as per below:

Correlations of total FPI score and maximum rearfoot eversion angle for both a pronated and normal foot type demonstrated a significant positive relationship ($r=0.79$ & $r=0.73$ respectively) with linear regression suggesting strong predictive capacity for the FPI with frontal plane motion of the rearfoot ($r^2=0.91$, $p<0.001$).

12. Relationship between frontal plane FPI score and frontal plane motion

13. Statistics are now quoted in this section.

14. This study was part of a larger study for which pronated and neutral foot types only were recruited. It is suggested that in future studies an analysis of all foot types is undertaken

15. Linear regression results explained in full

Linear regression analysis suggests strong predictive capacity for the FPI for frontal plane motion of the rearfoot ($r^2=0.91$, $p<0.001$) with the FPI predicting 91% of the variation in maximum eversion angle.

16. Why was analysis restricted to the frontal plane?

The following has been added to study limitations

Analysis was restricted to the frontal plane due to frontal plane motion of the rearfoot being adequately demonstrated by calcaneal motion. Components of the FPI related to the static transverse plane and assessed assessment of talar head position which cannot be measured with skin mounted markers and calcaneal transverse plane motion would have to be used with is potentially highly erroneous. There is no component of sagittal plane position included in the rearfoot FPI scoring system therefore this could not be included.

17. Expansion of the discussion of planar dominance

Investigation of the relationship between FPI frontal plane score of the rearfoot and maximum eversion angle demonstrated a strong significant relationship between the two variables for both a pronated foot type and a normal foot type. The pronated group demonstrated the stronger correlation with rearfoot motion, most likely due to greater range
of pronation providing measureable differences in the individual planar components of rearfoot pronation. The presence of a positive relationship in a relatively small cohort suggests that further investigations are required particularly relating to a highly pronated foot type (FPI 10+) which is more likely to demonstrate significant differences across the three planes of motion making up subtalar pronation. Correct identification of dominant planar components of rearfoot motion potentially may assist with orthotic prescription, specifically in relation to position of point of correction and style of the device with frontal plane dominance suggesting increased calcaneal motion control is required.
Reviewer 2: Anthony Redmond

Major compulsory

Was data assessed for suitability for linear regression?

Data were assessed for normality of distribution via scatter plots and homogeneity of variance using Levene’s test to determine suitability for linear regression analysis. Ordinal FPI data were converted to Rasch transformed scores allowing the data to be analysed as interval data (Keenan, Redmond et al. 2007)

Minor essential

1. Abstract methods – specify the method used to derive correlations

Reworded as:

Linear correlations were performed between components of total FPI scores measuring frontal plane rearfoot position and maximum rearfoot eversion. The capacity of the total FPI score to predict maximum frontal plane motion of the rearfoot was investigated using linear regression analysis.

2. Abstract results

A typographic error was also noted for pronated foot type scores should have read +6 to +9

All references to FPI scores change to convention FPI=+6 to +9

3. Please report FPI range used to define normal group

Correlation performed on data subsets demonstrated the pronated foot type (FPI =6 to +9) and maximum rearfoot eversion angle was more strongly positively correlated (r=0.79) than the normal foot type (FPI=0 to +5) and maximum rearfoot eversion (r=0.73).

4. Amended to

via video gait analysis and electromagnetic motion tracking.
5. Capture area replaced with capture volume

The cameras were arranged around a central 15m walkway, creating a capture volume approximately 2.5m long, 1.5m high and 1m wide, varying slightly according to the height and leg length of the subject.

6. Amended to:

Five acceptable walking trials were

7. Detail the statistical test used to identify linear correlations

Wording amended to:

Linear correlations were performed to identify strength of relationship between maximum dynamic rearfoot eversion and total FPI score with in the entire population and within pronated and normal groups. Pearson’s correlation coefficient was calculated due to the ranked directional nature of the FPI ordinal data set (Cohen 2001).

8. Paragraph reworded as advised:

Correlations between FPI score and maximum rearfoot angle were performed on data subsets representing a pronated foot group (FPI = +6 to+9) and a normal foot group (FPI = 0 to +5). The relationship between FPI score and maximum rearfoot angle was stronger in the pronated group (r=0.79) than in the normal group (r=0.73).

9. Typo corrected

however were less strong

10. Reworded as recommended.

This is in contrast to initial investigations of the relationship between FPI and dynamic foot function which demonstrate a weaker relationship between both dynamic midfoot and ankle joint complex motion and static FPI
11. Paragraph reworded as recommended

One previous study evaluated ankle joint complex motion and FPI score in manipulated positions (Redmond, Crosbie et al. 2006). The method of measuring maximum rearfoot eversion in unmodified gait and in a larger sample may explain the increased strength of relationship found in this study. Furthermore, in this study FPI scores were correlated with maximum rearfoot eversion whenever this occurred during stance phase allowing for an inter-relationship between the midfoot and forefoot to be included. This allowed for delayed or prolonged rearfoot eversion, both recently identified as distinct patterns of rearfoot motion (Cornwall and McPoil 2009), to be included in the statistical tests.

12. Reworded to

Modern three dimensional motion analysis techniques used for collection of rearfoot data from subjects in this study

Reworded as suggested

The ability of a static postural measurement to be able to predict dynamic midfoot function may be reduced where movement occurs across multiple joints simultaneously with individual axes of motion and the weighting of midfoot measurements toward medially located structures (talo-navicular congruence and medial arch height).

13. Wording amended as suggested to:

The ability of a static postural measurement to be able to predict dynamic midfoot function may be reduced where movement occurs....

14. Paragraph deleted as suggested

15. Wording amended as suggested to:

A supinated foot type classified by a score -5 to 0 on the FPI scale, was not included.
16. Wording amended as suggested to:

“directional, it may suggest that the predictive capacity of the FPI”

17. Paragraph reworded as follows

In this study the investigation of the effect of planar dominance identified by a breakdown FPI scores assumed the measurement of curvature above and below the lateral malleolus to be a frontal plane measurement. In reality, the FPI scoring system identifies this as a combination of frontal and transverse plane position (Redmond, Crosbie et al. 2006). Therefore this study potentially overestimates the strength of the relationship between dynamic frontal plane motion of the rearfoot and frontal plane dominance in FPI score.

18. All use of the word planal has been changed to planar.

19-22

Typos corrected

23. Figures have all been removed as per reviewer 1 (Keith Rome’s comments)

Discretionary

1. Parentheses added as suggested

Measures have included frontal plane calcaneal angle, (frequently referred to as rearfoot angle), medial arch angle, and arch height however....

2. Reworded as suggested to:

....determine the discrete variable (maximum eversion) to be entered into the statistical analysis.