Reviewer’s report

Title: Dynamic 3D Foot Reconstruction for Orthotic Design: The Way Forward

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Reviewer: Stephen Urry

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Dynamic 3D Foot Reconstruction for Orthotic Design: The Way Forwards

This manuscript requires significant reorganization, enhancement and refinement before it can be considered for publication, particularly since publication is sought in a journal where the readership population includes a substantial proportion of clinicians.

The intention of the paper is far from clear. The title emphasizes foot orthoses but the research content is only indirectly appropriate to foot orthoses – that is, none of the work included in this submission involved a single orthosis. The title must, therefore, reflect the actual content and not mislead prospective readers that there is some factual content regarding foot orthoses and orthotic therapy.

A more appropriate title would be something like:
Dynamic 3D shape of the plantar surface of the foot using coded structured light: An initial technical report.

The key content of the manuscript is of a technical nature, relating to the use of coded structured light as a method for measuring the dynamic 3D shape of the plantar surface of the foot. This content could be better suited to a technical journal (optics/vision science/engineering etc) or should be considered as a “Short Technical Report” (as will be found in journals such as Gait and Posture). That the manuscript is more in the form of a Technical Report is evidenced further by the cited literature; of the forty references given twenty-five (nos 14-38) relate purely to technical method and have no immediate clinical relevance.

Further consideration of the references reveals that several papers, which may be considered of key importance in this field at the present time, are absent (see list below). The literature review is, therefore, incomplete and skewed.

These comments, regarding the intention of the report, are reflected in the poor structure and content of the Background/Commercial Technology/Research Systems sections – in essence these sections simply convey the following points:

1. Orthoses are important therapeutic interventions for many foot disorders
2. More and more commonly, orthoses are prescribed using digital data acquired with scanners
3. There are a variety of scanning technologies available
4. Scans of the foot in a static posture may be sub-optimal for some clinical applications, but this is speculative at this time

5. Dynamic approaches have been demonstrated by previous researchers (see references in this report, below) and an alternative is described in this paper

These five points can easily and clearly be covered in a few paragraphs, at most. The current version wanders and needs to be heavily edited to provide a more focused introduction. It needs to be reorganized and amended to include the references regarding dynamic scanning.

Comments regarding the section: Clinical Repeatability

The authors have initiated their investigation of clinical repeatability and present some useful data. However, the results are poorly presented, and incompletely discussed.

The authors make use of the ICP algorithm as the key to repeatability, but they fail to describe, in simple terms for non-technical readers, what the ICP is and how it was applied. Without this information it is impossible to properly assess their comments and conclusions. The authors then emphasize the average differences but omit to comment regarding the equally important maximum differences – their graphs, figures 9 and 10, but particularly figure 10. Dynamic Repeatability, indicate errors as large as 5, 6 and 7 (units not given but presumably mm?). A foot scanning error of 7mm is massive and needs to be more fully explored to determine the behavior of this system. Furthermore, the graphs are inadequately labeled; the Error has no unit of measurement (presumably mm?) and the title gives no explanation to help the reader.

Comments regarding the section: Accuracy and Repeatability

The authors argue that, because the errors are smaller than variations in foot length, then they are acceptable for orthotic design. This is a poor argument. Foot length is a linear measure not a curvilinear measure, and is only used to determine size. Curvilinear measures such as girth, and the contours associated with the 3D shape would be far more appropriate as evidence to support their contention that dynamic scanning offers improvement over static shape. This evidence is not provided.

Comments regarding the section: Clinical Repeatability

The authors report that “Nonetheless, errors in comparison are small”, however, these relate to averages and they omit to discuss maximum errors, which may be important. Thus, this simple conclusion is overly optimistic with the evidence provided.

Comments regarding the section: Conclusion

On the basis of the evidence provided, the authors should confine their conclusions to:

1. The design and technical details of the system have been presented
2. Early indications of repeatability are encouraging and suggest that the work should continue
3. Further work to validate appropriate measures of 3D morphology, especially curvilinear measures derived with this system, are required
4. The clinical usefulness of the system for either dynamic analysis of the foot or to aid in the design of therapeutic interventions such as orthoses remains unknown and will only be determined by subsequent appropriate clinical studies.

The reference list will require substantial amendment; depending on the focus (intention) the authors wish to place on a revised manuscript.

Overview
1. Does the manuscript adhere to the relevant standards for reporting and data deposition? NO
2. Are the discussion and conclusions well balanced and adequately supported by the data? NO
3. Do the title and abstract accurately convey what has been found? NO
4. Is the writing acceptable? Needs improvement

ALL MAJOR COMPULSORY REVISIONS

References which relate to dynamic 3D foot scanning that must be included in any future manuscript


**Level of interest:** An article whose findings are important to those with closely related research interests

**Quality of written English:** Needs some language corrections before being published

**Statistical review:** No, the manuscript does not need to be seen by a statistician.

**Declaration of competing interests:**

I declare that I have no competing interest