Author’s response to reviews

Title: Stiffness modification of two ankle-foot orthosis types to optimize gait in individuals with non-spastic calf muscle weakness - a proof-of-concept study

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Author’s response to reviews:

We thank the reviewers for their valuable feedback, which we used to improve the manuscript. By the response below, we hope to have clarified the issues raised by the reviewers.

Reviewer #1:

1. This is a well written paper emerging from a reasonably designed study. The authors have attempted to test 2 AFOs which have allowance for DF which can be adjusted. The authors seem to indicate that the effects of the AFO stiffness on gait parameters and energy expenditure is being examined. However, on reading the paper it appears that they are actually testing the AAAFO. By making it stiffer the authors are limiting DF. This needs to be clarified upfront.

Response: Indeed, in our study, we tested the effect of 2 AFOs with dorsiflexion allowance on gait by changing the ankle stiffness, thereby inherently changing ankle dorsiflexion. We assume that the reviewer means with the AAAFO ‘the Angle of the Ankle in the AFO’ [1, 2]. The AAAFO was kept constant across conditions. As suggested by the reviewer, we have made changes to the introduction section and moved some parts from the methods to the introduction to clarify the working mechanism of the AFOs upfront and more clearly (Background: Page 2, Lines 32-35, and Page 2-3, Lines 48-58).
2. One can easily argue that we don't really know the requirements of each patient (for AAAFO). The authors outline that the participants have normal knee flexion and extension (Table 1). This leads to the assumption that the authors are stating, subject A had 0 DF and 10 PF, Subject B 0 DF and 10 deg PF and subject C 40 DF and 10 PF. Also one need to assume that the last figure (60/45/0) is DF during weight bearing? The authors need to clearly state how DF was measured. It needs to be with Knee extended passively DF to resistance. In general clinical practice and in related research, the weight bearing measure is confusing because it doesn't state whether the knee is flexed. Weight bearing DF is not a true length of gastroc as the knee is flexed.

Response: The ankle joint range-of-motion (ROM) was measured passively by hand, and for DF and PF with the knee extended, as pointed out by the reviewer. Two subjects had a contracture that limited dorsiflexion and when testing passively by hand with extended knee, dorsiflexion was not reached.

The ROM was documented according to the neutral zero method [3]. For subject A, for example, the ankle ROM was 0/10/60; meaning that dorsiflexion was not possible; i.e. a contracture of 10 degrees, and plantarflexion was 60 degrees. The ROM values (last figures) in Table 1 (60/45/0) were not during weight-bearing, but tested passively in the plantarflexion direction. We made changes in the way we documented the ROM in Table 1 (Page 5) to improve readability and we made changes in the footnote of Table 1 to more clearly describe the way ROM was measured (Methods: Page 5, Table 1).

3. The results show that with shoes, the knee flexion in single stance was 5.1 deg, 2.8 deg and 16.8 respectively. One can see that the values change with stiffness, which is in effect a change in AAAFO, which affects the knee. This needs to be adequately described within the paper.

Response: We agree with the reviewer that AFO stiffness influenced knee flexion. However, the neutral ankle angle within the AFO (AAAFO) and shank-to-vertical angle were kept constant between stiffness conditions and AFO types. Consequently, the effect on the knee across the AFOs did not result from differences in alignment of the ankle angle within the AFO, but was due to the stiffness dependent dorsiflexion restriction that limited the forward movement of the tibia and thereby reduced flexion of the knee. Furthermore, knee extension was also the effect of an adequate knee extension moment that resulted from forward CoP progression [4, 5].

We added information about the ankle alignment in the AFO (Methods: Page 5, Table 1, Page 9 Lines 184-185), the casting position of the AFOs (Methods: Page 6, Lines 123-127) and processing of the ankle angle data (Methods: Page 8-9, Lines 182-185).
4. Overall, this is a good study which shows that stiffness of the AFO effects gait. However, the discussion should clearly outline that the stiffness is mimicking AAAFO.

Response: Please see the response at point 4. As suggested, we made changes in the discussion to address more clearly stiffness affected ankle and knee kinematics (Discussion: Page 14, lines 325-329).

5. In addition, the authors should attempt to get the details on passive knee extension which can help the readers to make sense of the data and make the paper clinically relevant.

Response: As indicated in Table 1, the passive ROM of the knee was normal for all three subjects, meaning that they could extend their knee to 0 degrees and flex the knee fully.

Reviewer #2:

A small but well executed and reported study. The authors report that there are benefits to be gained by tuning AFO stiffness whilst simultaneously demonstrating the complex nature of the task and the apparently unique response of each subject.

1. When reporting ankle angles, authors may consider changing their terminology from high/low angles to large/small angles (semantic importance only).

Response: We have changed the terminology for reported angles as suggested throughout the manuscript.

References


