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Comparison of gait in different support conditions for foot drop

Project Report: OrthoPed Ltd

The Clinical Health and Rehabilitation Team (CHaRT), part of the Physical Activity, Health and Rehabilitation Research Group

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7. Summary and Researchers' Comments

Barefoot

For the clinical gait measures, the barefoot condition resulted in the second best six minute walk performance (behind the OrthoPed splint, very similar balance and Timed Up and Go performance to the Lycra sock and OrthoPed conditions and the worst GAIT score; however, none of the differences were statistically significant. For the Six Minute Walk, balance and Timed Up and Go tests, the Barefoot condition also had the most consistency in performance across different participants. The consistency of results across participants was also high in the barefoot condition for step characteristics and many joint angle results for the affected side, when compared with the other support conditions. The lower variability for these measures suggests that the barefoot condition is more of a 'leveller' between participants with their walking gait diverging to a more similar pattern in this condition. During walking the barefoot condition resulted in significantly less peak knee flexion for the non-affected side than the AFO and Lycra sock conditions.

Ankle Foot Orthosis

The AFO resulted in the worst performance of the six minute walk test and timed up and go and best performance in the single leg balance and GAIT score. Whilst these differences were not statistically significant, they indicate that the device may inhibit functional walking performance but provide greater stability than the other support conditions and when barefoot. The high variability for the single leg balance and timed up and go tests indicate that participants responded differently to the AFO in terms of their performance in these tests, which supports the findings of previous studies into AFO use (Vasiliauskaite et al., 2021). During biomechanical testing, the AFO condition led to the slowest walking speed (closely behind barefoot); however, these differences were not statistically significant. For joint angles, the AFO led to significantly less plantarflexion at touchdown, peak plantarflexion and range of motion at the ankle joint during the gait cycle than the Lycra sock and OrthoPed conditions, which supports previous findings into ankle kinematics during AFO use (Mulroy et al., 2010) . Feedback through the user questionnaire indicated that the AFO was easier to use but was less comfortable and was not as easy to wear with shoes than the other devices.

Lycra Sock

The Lycra sock had the highest variability for the six minute walk and GAIT scores, indicating a wider range of individual responses to wearing the device than other devices tested. Walking speed was highest (although not statistically significant) for the Lycra sock condition. Plantarflexion at touchdown, peak plantarflexion and ankle range of motion were highest for the Lycra sock condition compared with the other support conditions. Considering useability, the Lycra sock scored significantly lower than the other devices for ease of use and ease of removing the device, reflecting the difficulty in using Lycra support garments previously reported (Rennie et al., 2000). The device was scored highly by participants for comfort and for benefitting walking performance.

OrthoPed Splint

The OrthoPed splint had the best performance in the six minute walk and second best in the GAIT assessment, after the AFO. Walking speed was very similar in the OrthoPed splint to the Lycra sock, both faster than the other two support conditions. Plantarflexion at touchdown, peak plantarflexion and ankle range of motion were significantly higher for the OrthoPed condition compared with the AFO, with range of motion also being significantly less than the Lycra sock condition. Regarding useability, the OrthoPed scored significantly better than the Lycra sock for two questions around ease of use and better than the AFO for four questions around comfort, use with shoes and walking performance. The OrthoPed splint scored consistently highly for the questions comparing it with users' usual device, suggesting that they preferred the device for comfort, better support and fit. User feedback on the OrthoPed device from the parents of six participants highlight that the device can be put on by 3/6 participants without assistance and that 5/6 participants would be "quite likely" or "very likely" to wear the device frequently and that they were keen on the appearance of the device, particularly due to it being discrete and versatile to wear with different shoes. Five out of six parents reported that the OrthoPed helped their child to walk more easily. User comfort and satisfaction have previously been identified as positively impacting submaximal walking performance (Morais et al., 2022).

8. Conclusions

First, considering the feasibility of conducting a wider definitive trial. This study did not recruit the initial target of 20 participants with many of the eligible participants declining to take part due to the additional time commitment and travel required for the study. However, all participants recruited to the study complete all parts of testing, demonstrating good compliance with the testing protocol. To facilitate greater participant recruitment for a future study, it is recommended to increase the number of research sites for biomechanical and clinical data collection and to establish data collection sites within hospital facilities where participants would be attending ongoing treatment appointments.

Whilst many results were not statistically significant in this feasibility study, the trend of results suggests that the AFO may provide better stability than the other devices but inhibit walking function more. The AFO was scored poorly by users and parents for comfort, and use with shoes, suggesting that AFO use may negatively impact on quality of living and adherence to device usage.

There were statistically significant differences reported in walking gait kinematics, with largest differences being between the AFO and other support conditions. These results suggest that the OrthoPed splint performs similarly, and in some cases with slightly more support against plantarflexion, to the Lycra sock, with the AFO restricting ankle joint motion the most. There were no detrimental effects of the OrthoPed splint that were apparent in this feasibility trial. User and parent feedback on the OrthoPed device were very positive, particularly around its ease of use, comfort and practicality, such as being more discrete and able to be worn with more every-day shoes than the other devices. The positive user and parent feedback in the OrthoPed splint indicates that it is favourable as a device compared with the AFO and Lycra sock, with further benefits of being lower cost to produce and, not requiring individual fitting and manufacture, is available more quickly with fewer clinical appointments than the other two devices.