

O065**A new method for evaluating ankle foot orthosis stiffness: BRUCE**

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Summary: BRUCE (Bi-Articular Reciprocating Universal Compliance Estimator) is a new device for evaluating the stiffness and neutral angles of ankle-foot orthoses (AFOs) with high reliability. **Conclusion:** BRUCE can reliably measure AFO characteristics such as stiffness and neutral angle around both the ankle joint and the forefoot joint.

Introduction: The mechanical characteristics of AFOs, such as stiffness and neutral angle around the ankle and forefoot joints, are rarely quantified. Yet, it is expected that these characteristics determine the function of the AFO in pathological gait [1,2]. Therefore, there is a need for objective measurements of the aforementioned mechanical characteristics. In this study we report on the reliability of measurements obtained with BRUCE.

Methods: BRUCE was designed to allow manually driven flex/extension of AFOs about the ankle or forefoot joints while continuously registering joint configuration and moments exerted by the AFO onto the replicated leg [Figure 1]. From this information, neutral angles and stiffnesses around the ankle and forefoot joints are determined using a linear fit. The reliability of the stiffnesses and neutral angles was studied by repeatedly measuring the mechanical characteristics of four different AFOs. The inter-session, intra-session, and inter-observer errors were evaluated using Generalizability Theory [3].



Figure 1. BRUCE.

Results: An example of the measurement results for one AFO evaluated by three different testers shows high repeatability [Figure 2]. For the four different AFOs, stiffnesses from 0.16 to 1.56 Nm/deg were found for the ankle, with neutral angles

ranging from -0.7 to 6.5° . For the forefoot joint, stiffnesses from 0.09 up to 0.53 Nm/deg were found, with neutral angles from 3.2 to 15.8° . The reliability study revealed that ankle and forefoot stiffness could be measured with very high reliability, given the Standard Errors of Measurement (SEM) of 0.02 and 0.03 Nm/deg respectively. Ankle and forefoot neutral angles showed relatively larger SEMs of 1.1 and 2.6° . Measurement error in the neutral angles could mainly be attributed to the difference in testers. With a fixed tester, SEMs of 0.3 and 0.6° were obtained.

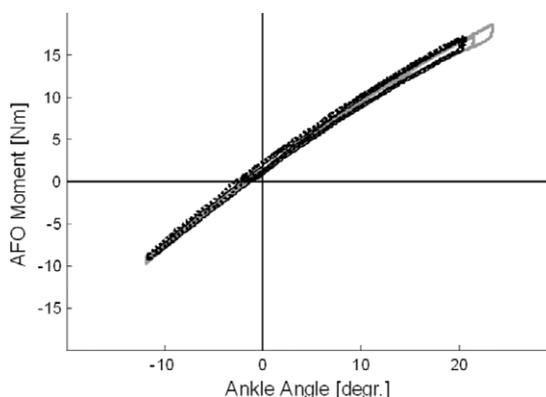


Figure 2. An example of multiple trials of an AFO show.

Discussion: The results derived using BRUCE can help gain insight into the role of the mechanical characteristics of AFOs in correcting pathological gait. In clinical practice, objective information of AFO characteristics is expected to lead to a better founded prescription of AFOs, resulting in more functional benefit for the patient. Further research on the derivation of prescription guidelines for optimal AFO-patient matching is currently underway.

References

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O066**Effects of tuning of the ankle foot orthoses footwear combination (AFO-FC) on the stance phase knee kinematics of children with cerebral palsy**

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Summary: The effects of tuning of AFO-FCs on the stance phase knee kinematics in children with CP were investigated.

Conclusions: Tuning of AFO-FC was found to be effective in improving the knee joint kinematics of children with CP. This study highlights the importance of analysing subgroups with specific gait patterns.

Introduction: The gait of children with CP can be improved by tuning, i.e. making small modifications to AFO-FCs using aids such as wedges, rockers and heels. Tuning reorients the Ground Reaction Force (GRF) with regard to knee and hip joints which can be used to optimise the gait of children with CP [1]. Children