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The Influence of Carbon Composite and Plastic Ankle Foot Orthoses on Balance and Gait in Individuals with Multiple Sclerosis: A Pilot Study

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Background and Purpose

Multiple sclerosis (MS) can cause lower extremity weakness which may impair balance and gait. Ankle-foot orthoses (AFOs) are frequently prescribed to reduce the effects of these impairments. Despite numerous recent advances in the design and materials used for AFOs, there is a lack of evidence to guide clinicians in effective AFO prescription. The purpose of this research was to compare the effects of an anterior shell carbon AFO with a traditional plastic AFO on measures of balance and gait performance.

Subjects

10 individuals (mean age = 56 ± 21) with MS and mild to moderate disability (mean EDSS = 4.4 ± 2.4) who had not used an AFO previously.

Table 1. Subject Characteristics

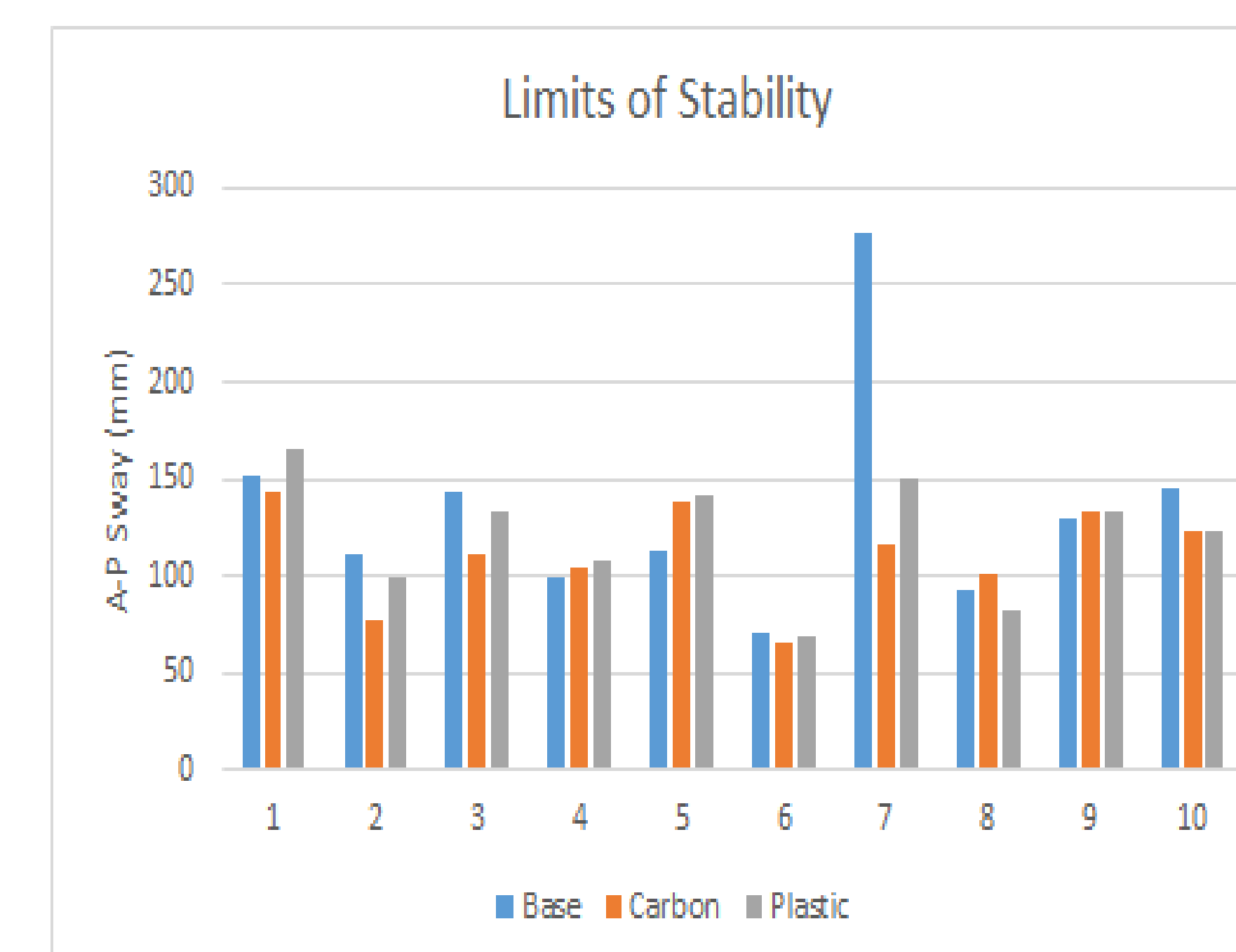
Subject Number	Age	BMI	EDSS	Years with MS	Normalized DF Strength	AFO Preference
1	51	22.07	2.5	6	1.27	Carbon
2	35	18.43	4.5	3	0.52	Carbon
3	62	39.39	6	15	0.70	Plastic
4	68	21.75	6.5	29	0.62	Carbon
5	62	27.26	3.5	30	0.63	Carbon
6	53	23.78	6.5	13	0.30	Plastic
7	62	27.46	3	22	0.63	Carbon
8	63	23.70	3.5	27	0.80	Plastic
9	45	30.89	6	15	0.85	Carbon
10	61	40.27	2	25	0.21	Plastic

Methods

Participants gait and balance were tested at approximately the same time of day on three separate occasions under the following AFO conditions: 1) no AFO, 2) carbon AFO, 3) plastic AFO. Balance was assessed using a force plate during quiet standing under manipulated sensory conditions and during a limits of stability (LOS) assessment. Gait quality and speed were assessed using wireless body worn sensors during a 10-meter walk and gait endurance was assessed using the 6-minute walk test (6MWT) distance and physiological cost index.

Results

No significant differences were identified between the AFO conditions (no AFO, carbon, plastic) for any of the outcome measures. However, individual participants demonstrated both positive and negative responses to the different brace conditions that could influence appropriate AFO prescription. Participants subjectively preferred the carbon AFO to the plastic AFO by a margin of 6 to 4.



Conclusion

There were no differences in a variety of balance and gait measures between the carbon and plastic AFO conditions. However, individual responses to the AFO conditions were varied and should be considered during the prescription process. The majority of the participants subjectively preferred the carbon AFO.

These findings support an individualized approach to effective AFO prescription for persons with MS. The use of instrumented measures of gait and balance, combined with clinical expertise and patient preferences, may help to optimize individual outcomes.



Figure 1. Carbon AFO

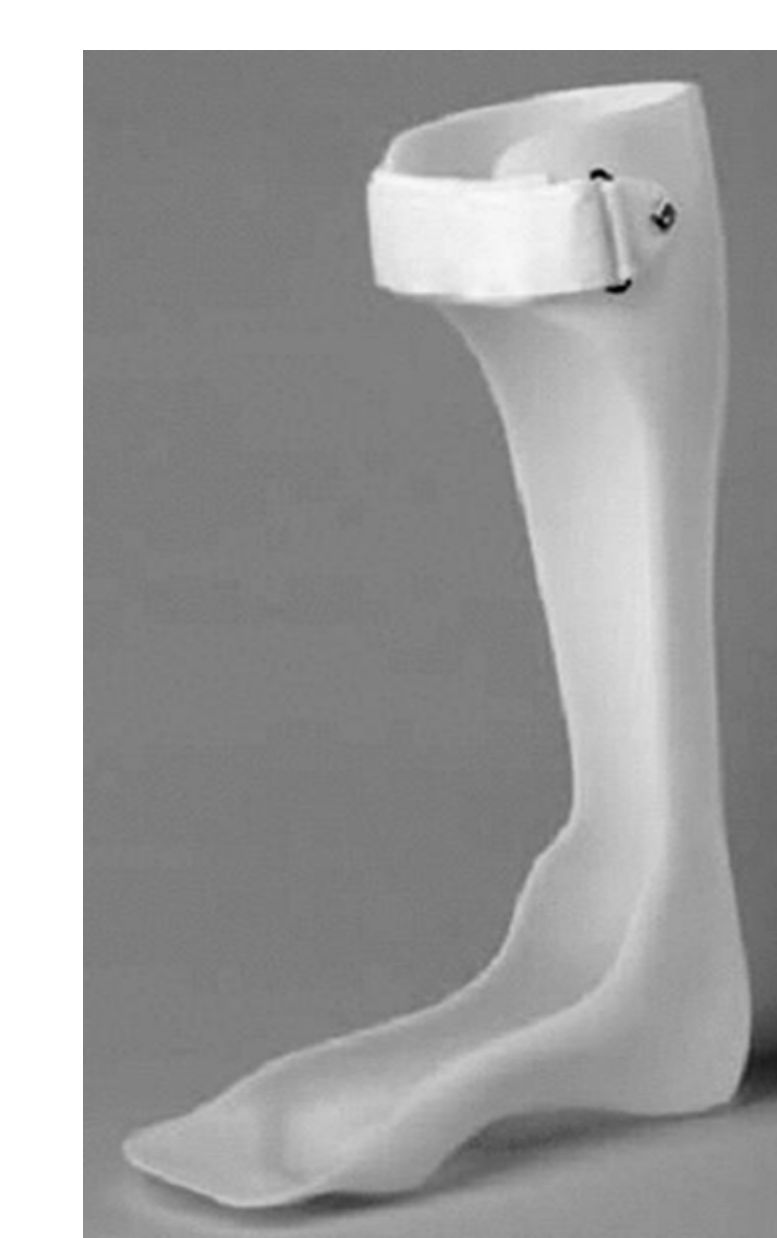


Figure 2. Plastic AFO