# WALKING PROPULSION IN MULTIPLE SCLEROSIS: THE INFLUENCE OF ASSITIVE DEVICES

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## INTRODUCTION

Walking is a key activity for healthy daily living. Unfortunately, individuals with multiple sclerosis (MS) walk with difficulty due to muscle weakness, impaired coordination and poor balance. In fact, falling is more frequent in these individuals [1]. There are two medical devices commonly prescribed for MS gait assistance, the ankle-foot orthosis and the Odstock Dropped Foot Stimulator (ODFS, Odstock Medical, Salisbury, UK). These devices aid in foot clearance during swing, but little is known about their effects during stance, specifically whether they induce changes in propulsive impulse during walking which could be a sign of stable walking. The purpose of this study was to determine whether propulsive impulse changed while wearing an assitive device in a group of individuals with MS.

## METHODS

Five subjects with MS were recruited to perform a series of walking trials on a motorized treadmill (ADAL3D-F-COP-Mz , HEF Medical Development, France). The subjects signed a VA Research Consent Form, approved by the Institutional Review Board of the Louis Stokes Cleveland Department of Veteran's Affairs Medical Center, Cleveland, OH, USA. Mean body mass of the subjects was 71.9 kg $\pm$ 15.6 and mean height was 1.74m $\pm$ 0.06 m. The subjects were instructed to complete three, 3-minute walking trials at their self-selected speed without a device, with an AFO and with an ODFS. Condition order was balanced between subjects. Ground reaction forces were collected at 100 Hz for the right and left sides during each trial. Force data were filtered with a fourth-order low pass recursive Butterworth filter at 20Hz. Between five and 15 steps were extracted from the trials during both the first and last 30 s of walking to determine differences between the device conditions and over the walking duration. Propulsion was quantified by computing the time integral of the positive anteroposterior ground reaction forces and averaging across trials. Statistical analysis was accomplished with a 2-factor ANOVA (Device, Time; GLM, Minitab) with significance set at $p<0.05$.

## RESULTS AND DISCUSSION

The propulsive impulse increased on the affected side with both devices ($p=0.013$) although the ODFS elicited the greatest change. Both devices may have allowed the users greater stability during stance to propel their center of mass forward even while walking at a constant, self-selected speed.. It is possible that the devices facilitated plantarflexor activity during the last half of stance because these are the primary muscles contributing to the propulsive impulse during normal, unimpaired walking. Enhancing propulsion will enable those with MS to attain a functional walking speed as has been shown for those with hemiparesis [2].

Other results showed that propulsion increased from the beginning to the end of the walking bout on both the affected and non-affected sides ($p=0.022$ and 0.002). This was an unexpected result although it likely reflects compensatory adjustments on unaffected side due to possible affected side fatigue.

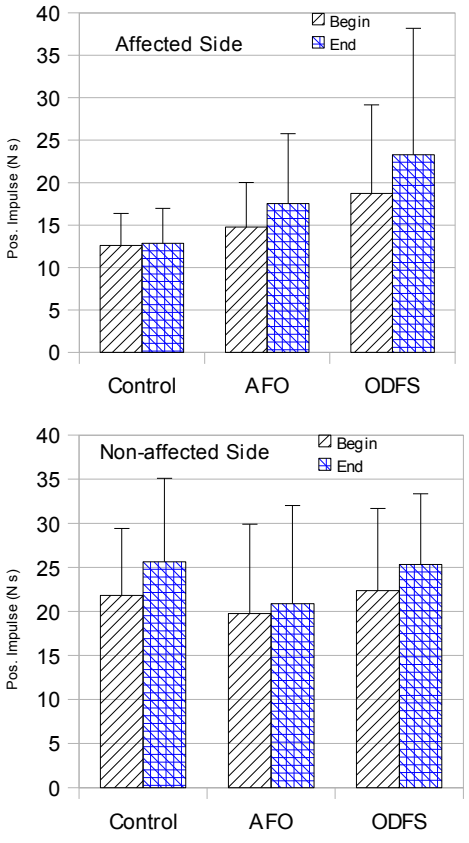


***Figure 1. Propulsive impulse during walking without a device (Control) and with an AFO and ODFS. Light shading shows data from the beginning of the three minute walk while dark shading shows data from the end.***

This study is limited in that these results pertain to treadmill walking and may not transfer to overground walking.

## REFERENCES

1. Stolze H, et al., *J Neurol.* **251**:79-84, 2004.
2. Bowden, MG et al., *Stroke*, **37**:872–876, 2006.