Assistive Shoe for Foot Drop

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Background

- **Foot drop** is a neurological condition marked by the inability of the leg muscles to flex the foot upwards
- As the leg swings forward, the toes scuff/drag on the ground making walking a deliberate and strenuous task
- Common in those with cerebral palsy, strokes, multiple sclerosis, and ALS

Overview

- **Current Treatments:** Orthotic inserts, surgery, physical therapy, electrical nerve stimulation
- **The Problem:** Available solutions are cost prohibitive, uncomfortable/painful, obtrusive, or not sufficiently effective

Our Solution

Figure 1 *Final prototype of a shoe to aid with foot drop.*

Two Features to Minimize Scuff Forces:

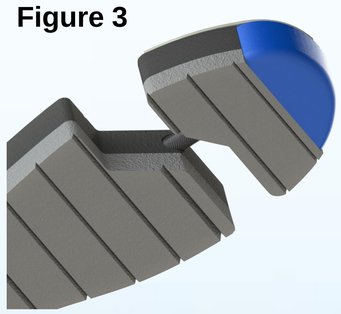
- For significant scuffs and rough walking surfaces, the platform under the front of the shoe will be pushed backwards as the toes scuff, in order to limit body interaction forces with the ground.
- For minor scuffs and smooth walking surfaces, a low friction front edge of the shoe slides across the ground making the scuff less noticeable.

Cadence

Figure 2 *Rendering of the final shoe prototype.*

Key Components

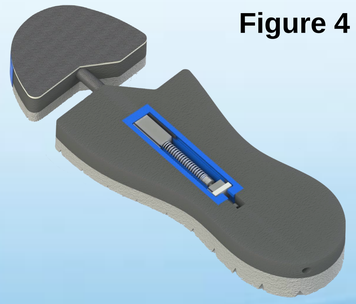
Figure 3



Sliding Block: This component will make contact with the ground when the user scuffs. The blue plastic tip reduces contact friction with the ground and is replaceable to prevent premature wear of the shoe.

Linear Bearing: The smooth retraction of the sliding block is enabled by a spring loaded linear bearing. The spring rate is based on the necessary return time during the leg swing and the force applied by an average scuff.

Figure 4



Results

Figure 5 *Volunteer scuffing in the final prototype.*

Table 1 *Specifications of Final Prototype*

Specification	Value	Comment
Block Return Time	0.125 sec	Sufficient to return block before foot strikes ground
Scuffing Force Reduction	**85%**	**User feels significantly less force from the scuff**
Maximum Slope Allowed	23°	Safe and effective on slopes up to 23°
Weight	9.84 ounces	Compared to 10.7 ounces for stability running shoes

Cadence was successful in mitigating the effects of foot drop. The user felt a significant reduction of forces during a scuff which resulted in easier walking.

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