**Assistive Shoe for Foot Drop**

Brandon Grunberg, Farzin Khorasani, Allison Poffenroth, Erinn Sloan, Luis Walsh

**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.

**Current Treatments:** Orthotic inserts, surgery, physical therapy, electrical nerve stimulation.

**The Problem:** Available solutions are cost prohibitive, uncomfortable/painful, obtrusive, or not sufficiently effective.

**Overview**

**Our Solution**

![Final prototype of a shoe to aid with foot drop.](image1)

**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.

**Key Components**

**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.

**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.

**Cadence**

![Rendering of the final shoe prototype.](image2)

**Results**

**Specifications of Final Prototype**

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

**Acknowledgements**

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