Pediatric Drop Foot
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Abstract

Current solutions to drop foot are expensive, temporary, or both, and orthotics for pediatric patients need to be replaced often due to development. Therefore, the team sought to design an elastic, adjustable, and cost-effective brace for this demographic. Using pervious patents, the team verified that the optimal design was effective. The team tested 5 muscles used in gait. For both subjects, the average energy output by muscles in the leg returned to more standard values when the brace was worn. In conclusion, the data from these experiments suggest that the brace alleviates the effects of drop foot on the gait.

Causes of Drop Foot

Drop foot is the paralysis in the muscles that lift up the foot. Drop foot has three main causes. The first cause is muscle and nerve disorders. These come in various forms including muscular dystrophy, cerebral palsy, polio, and Charcot-Marie-Tooth disease. The next cause is nerve injury. This includes the most common cause which is the compression of a nerve in the patients leg. A nerve injury could also be contributed to complications with hip or knee replacement surgery. Lastly, brain and spinal cord disorders can cause drop foot. These disorders include multiple sclerosis, ALS, having a stroke, and an traumatic brain injury.

Brace Design

This design is comprised of one elastic band located on the leg and one on the foot. Both of the bands utilize hook and loop straps, and are attached by straps and a buckle. The hook and loop straps are located on both of the bands to allow growth. Using previous patents, the team verified that the optimal design was effective. The design was constructed using a sewing machine, thread and the supplies bought off of amazon. The amazon supplies include the nylon elastic bands, buckle, straps, and Velcro

Cost of Treatments

The lightweight braces cost $60-$200. Shoe insets cost $35-$40. Per visit physical therapy can cost between $60-$180. The electronic devices cost $200-$300. Surgery is the most expensive and can cost thousands of dollars.

Results

Table 1. Results for Subject 1

<table>
<thead>
<tr>
<th>Muscle</th>
<th>Mean % Activity during Normal Walking</th>
<th>Mean % Activity during Drop Foot</th>
<th>Mean % Activity while wearing brace</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tibialis Anterior</td>
<td>16.4</td>
<td>16.8</td>
<td>28.3</td>
</tr>
<tr>
<td>Lateral Gastrocnemius</td>
<td>15.1</td>
<td>7.8</td>
<td>11.8</td>
</tr>
<tr>
<td>Rectus Femoris</td>
<td>2.74</td>
<td>6.23</td>
<td>6.64</td>
</tr>
<tr>
<td>Hips Femoris</td>
<td>4.52</td>
<td>4.98</td>
<td>3.18</td>
</tr>
<tr>
<td>Glutes Maximus</td>
<td>20.3</td>
<td>7.91</td>
<td>7.71</td>
</tr>
</tbody>
</table>

When using the brace, both subjects exhibited muscle activity that was more similar to their normal gait than to their drop foot imitation. With only two subjects being tested, further data collection should be performed. It is important to note that the two subjects tested on in this project had different sized feet and legs. This brace was able to conform to the specific user, and functioned to be a successfully adjustable and gait improving device. The team recommends that projects should be broad. Rather than focus on a certain demographic, the project should aim to cater to several demographics.

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References


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