

Pediatric Drop Foot

Blair Gatland, Courtney Ton-Nu, Joey Preziosi
Dr. Joan Burtner, Dr. Vo
Mercer University - School of Engineering, Macon, GA



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 previous 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.



Figure 1: Image of Drop foot brace

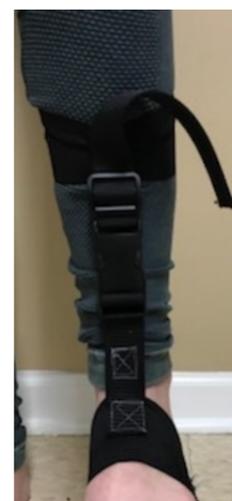


Figure 2: Image of Front View of Drop foot brace

Goal of Project

Normally the treatments to drop foot are costly and temporary. This is especially true for pediatric patients. Due to their development they grow out of his/ her light weight brace more frequently than others. As a result, the team decided to concentrate on the pediatric patient. The teams goal is to make a lightweight brace that is durable, inexpensive, and can be used for a longer period of time.

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.

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.

References

Foot drop. (2017, December 14). Retrieved March 24, 2018, from <https://www.mayoclinic.org/diseases-conditions/foot-drop/symptoms-causes/syc-20372628>
DAFO Turbo Sofly. [Photograph found in Dafo.com]. (n.d.). Retrieved March 23, 2018, from <https://cascadedafocom/products/dafo-turbo-sofly/>
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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

Results

Subject 1

Table 1. Results for Subject 1

Muscle	Mean % Activity during Normal Walking	Mean % Activity during drop foot imitation	Mean % Activity while wearing brace
Tibialis Anterior	16.4	16.8	20.3
Lateral Gastrocnemius	16.3	7.81	11.9
Rectus Femoris	2.74	6.23	4.64
Biceps Femoris	4.52	4.99	3.19
Gluteus Maximus	20.5	7.91	7.71

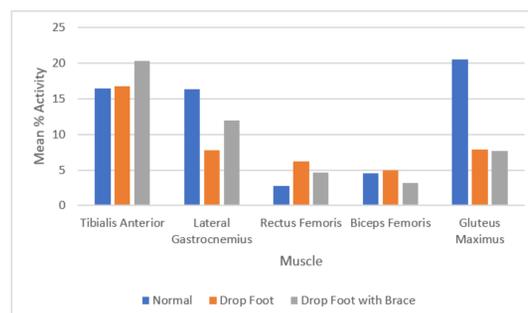


Figure 3. Results for Subject 1

Subject 2

Table 2. Results for Subject 2

Muscle	Mean % Activity during Normal Walking	Mean % Activity during drop foot imitation	Mean % Activity while wearing brace
Tibialis Anterior	10.0	6.89	10.3
Lateral Gastrocnemius	39.6	10.9	18.0
Rectus Femoris	18.8	11.9	14.9
Biceps Femoris	10.9	4.42	8.03
Gluteus Maximus	9.96	6.12	7.64

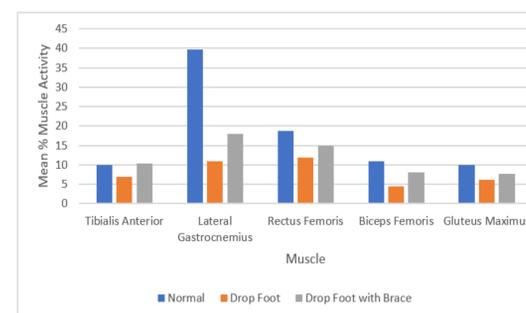


Figure 4. Results for Subject 2

Discussion

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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