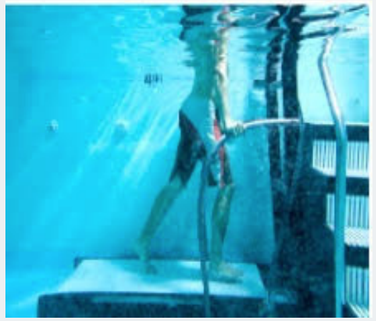
TEAM 8 Intervention to Prevent Drop Foot in Hydrotherapy

Morgan Gower[1], Tessa Mazzarella[1], Neha Nevasekar[1], Aleksandar Gonevski[1] – Advisor: Dr. Adrian Shieh[1]
[1]Drexel University School of Biomedical Engineering, Science, and Health Systems

Need



20% of stroke patients experience drop foot

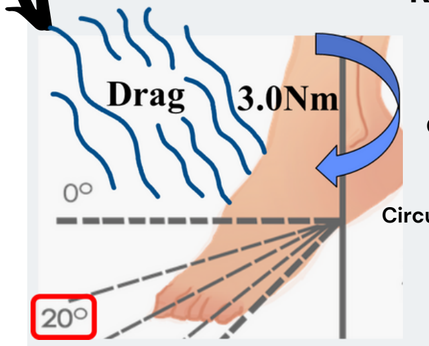
Hydrotherapy is beneficial for stroke survivors, but often causes adverse injury due to toe drag – ankle sprains, abrasions

Objective

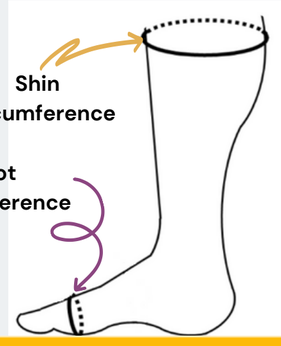
Counteract the moment from drag force so patients can complete hydrotherapy without toe drag

Design Inputs & Solution

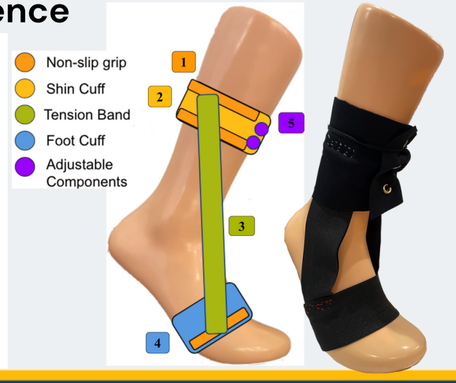
R.1 Moment-Angle



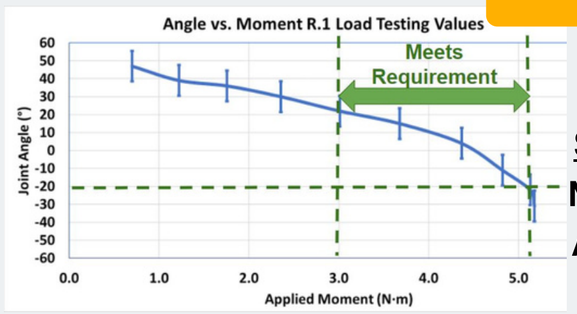
R.2 Cuff Circumference



Solution



Testing

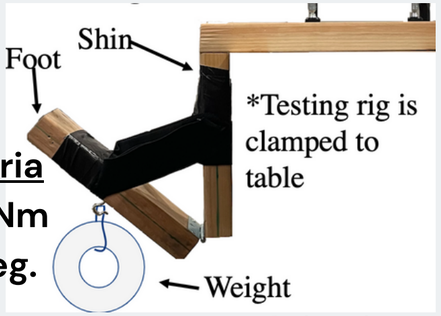


R.1

Success Criteria

Moment > 3.0Nm

Angle > -20 deg.



Cuff Circumference Test:

	Shin Limit ↓	Shin Limit ↑	Foot Limit ↓	Foot Limit ↑
Expected	29.2 cm	47.2 cm	21.6 cm	27.1 cm
Measured	29.0 cm ✓	51.0 cm ✓	19.4 cm ✓	27.1 cm ✓

R.2

Success Criteria

Measured must be <= lower limit and >= upper limit

Impact

Prevent unwanted plantarflexion to avoid abrasions/ankle injury during hydrotherapy

Future Work & Considerations

Test Shin Cuff Slippage

Investigate Usage for Functional Rehabilitation

Adapt to Land-based Practices

DREXEL UNIVERSITY School of Biomedical Engineering, Science and Health Systems

References: [1] "Severe strokes: Research & educational video library," HydroWorx, 19-Mar-2020. [Online]. Available: https://www.hydroworx.com/learning-center/video-library/severe-stroke/. [Accessed: 01-Nov-2021]. [2] E. S. Donkor, "Stroke in the 21st century: A snapshot of the burden, epidemiology, and quality of life," Stroke Research and Treatment, vol. 2018, pp. 1–10, 2018. [3] "Aquatic therapy images, pictures and stock photos," ▷ Aquatic therapy Images, Pictures HD and Free Stock Photos. [Online]. Available: https://photostockeditor.com/free-images/aquatic-therapy. [Accessed: 01-Nov-2021]. [4] "Possible Causes of Drop Foot" VeryWell Health. [Online]. Available: https://www.verywellhealth.com/foot-drop-physical-therapy-2696046. [Accessed: 27-Nov-2021]. [5] "The ankle bone is connected to the Shin Bone," ProActive Physical Therapy, 19-Aug-2015. [Online]. Available: https://proactive4pt.com/the-ankle-bone-is-connected-to-the-shin-boneand-knee-hip-and-back-bones/. [Accessed: 01-Mar-2022]. [6] M. C. Gonzalez, A. Mehrnezhad, N. Razaviarab, T. G. Barbosa-Silva, and S. B. Heymsfield, "Calf circumference: cutoff values from the NHANES 1999–2006," The American Journal of Clinical Nutrition, vol. 113, no. 6, pp. 1679–1687, Mar. 2021. [7] Gordon, C. C., Blackwell, C. L., Bradtmiller, B., Parham, J. L., Barrientos, P., Paquette, S. P., et al. (2014). 2012 anthropometric survey of us army personnel: Methods and summary statistics. Army Natick Soldier Research Development and Engineering Center MA. [8] Y. Sunagawa et al., "Effects of Products Containing Bacillus subtilis var. natto on Healthy Subjects with Neck and Shoulder Stiffness, a Double-Blind, Placebo-Controlled, Randomized Crossover Study," Biological and Pharmaceutical Bulletin, vol. 41, no. 4, pp. 504–509, 2018, doi: 10.1248/bpb.b17-00780. [9] "Towel Stretch," Saebo. [Online]. Available: https://www.saebo.com/blog/get-back-feet-exercises-foot-drop/. [Accessed: 9-May-2022]. [10] "Foot Drop," Mayfair Foot Care. [Online]. Available: http://www.mayfairfootcare.com/foot-drop.php. [Accessed: 27-Nov-2021]