

IDENTIFICATION OF FUNCTIONAL UPPER EXTREMITY PHASES IN AMYOTROPHIC LATERAL SCLEROSIS

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1. Introduction

Amyotrophic Lateral Sclerosis (ALS) is a progressive neuromuscular disease leading to gradual loss of muscle control. As muscle function declines, independence of patients in daily activities is affected. Assistive devices help maintain independence by supporting joints like the elbow. However, ALS progresses quickly, requiring almost continuously adaptation of these devices. To develop adaptable assistive devices, knowing the required forces to support joints at various ALS phases is essential.

2. Objectives

This study aims to define functional phases for the upper extremity during ALS progression, and to determine required supportive forces for the wrist, elbow and shoulder at each phase.

3. Methods

First, muscle strength data from the Pooled Resource Open-Access ALS Clinical Trials Database (PRO-ACT) [1] are used to create muscle strength decline curves for muscles related to the wrist, elbow and shoulder based on a sigmoid functions [2]. Second, patients are grouped based on the order in which their muscles are affected. Third, the curves are normalized, and an average curve is determined for each group. Fourth, these curves are divided into functional phases based on required muscle strength to perform daily activities. The residual muscle strength at each phase, along with required forces for activities, determines the supportive forces in each phase.

4. Results

The outcomes of this study include average muscle strength decline curves with phasing, along with required supportive forces in each phase.

5. Conclusion

The results provide new insights into the ALS disease course from an engineering perspective and are valuable for developing adaptable assistive devices for diseases with rapid muscle strength decline.

6. References

[1] Neurological Clinical Research Institute. (2014) PRO-ACT (Pooled Resource Open-Access Clinical Trials Database). [database] https://ncri1.partners.org/ProACT/Home/Index

[2] Thakore, N. J., Drawert, B. J., Lapin, B. R., & Pioro, E. P. (2021). *Progressive arm muscle weakness in ALS follows the same sequence regardless of onset site: use of TOMS, a novel analytic method to track limb strength.* Amyotrophic Lateral Sclerosis and Frontotemporal Degeneration, 22(5–6), 380–387. https://doi.org/10.1080/21678421.2021.1889000