

Introduction

A stroke can significantly affect hand function, making it challenging for patients to grip objects effectively. Electromyography (EMG) records the electrical activity of muscles using surface electrodes to detect signals produced during contraction.

In this study, we used EMG to identify the onset time of force during a ball squeeze task and developed software to analyze these signals, comparing results between healthy individuals and those with simulated stroke conditions to assess differences in muscle activation.

Methodology

Study Design

- EMG data was collected from two groups (n = 6 per group): healthy participants and individuals simulating stroke-related motor impairments.

Data Collection

- Surface EMG electrodes are placed on the forearm muscles.
- Participants performed repeated ball squeezes according to Squeeze Cues.
- Signals recorded during 5-second intervals.

Software Development

- Custom MATLAB software created to:
 - Detect the EMG onset time of muscle activation.
 - Analyze and compare signal amplitude and frequency.

Validation & Analysis

- Onset times were compared between groups
- Differences in activation patterns assessed
- Software effectiveness is evaluated based on consistency and accuracy

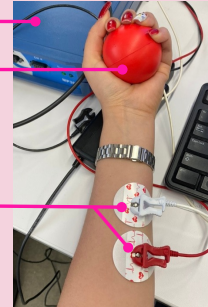
Findings

- EMG data clearly showed earlier and stronger muscle activation in healthy participants.
- Simulated stroke participants showed delayed or reduced EMG signals during the squeeze task.
- The custom software successfully detected the onset time of force in both groups
- Results support EMG as an effective tool for assessing a patient's ability to squeeze and initiate force.

BIOPAC EMG System

Red Squeeze Ball

Surface Electrodes



Squeeze Display Program

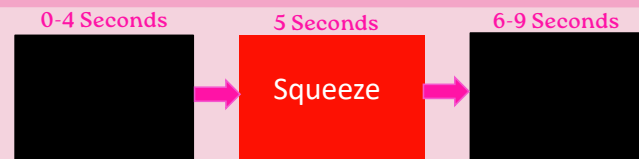


Figure 2. Diagram of the JavaScript-based program used to time hand squeezes. Participants are prompted to squeeze a red ball during the 1-second window, repeated every 5 seconds for one minute. This structure ensures consistent timing for EMG signal recording and analysis.

Observation

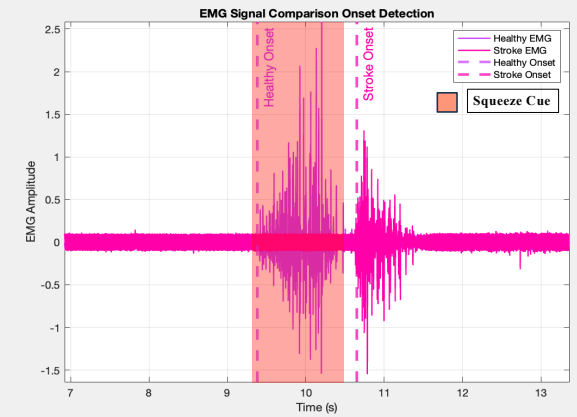


Figure 1. EMG signal comparison between a healthy individual and a simulated stroke patient during a squeeze task. The plot shows stronger and earlier signal activation in healthy participants compared to delayed activation in simulated stroke participants.

Conclusion

EMG is a reliable method for detecting the onset of muscle force during a squeeze task.

Our results show clear differences between healthy and simulated stroke participants, supporting the use of EMG as a tool to assess motor function and track recovery in stroke rehabilitation.

References

Hilkens, N. A., van der Worp, H. B., Kappelle, L. J., & Nederkoorn, P. J. (2024). Stroke. *The Lancet*, 403*(10446), 2820–2836.

Raez, M. B., Hussain, M. S., & Mohd-Yasin, F. (2006). Techniques of EMG signal analysis: Detection, processing, classification, and applications. *Biological Procedures Online*, 8*(1), 11–35.