

## A new approach of spasticity measurement using mechanomyography in patients with brain lesions

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### Introduction

Electromyography(EMG) and Modified Ashworth Scale(MAS) are among the most effective methods to evaluate spasticity. However, they are often inappropriate for clinical use due to the complicated procedure and subjective evaluation outcomes. Mechanomyography (MMG) is a better quantitative and convenient measurement compared to MAS and EMG. In this study, we hypothesized the presence of force-dependent MMG signal measured from muscle activation is dependent on spasticity during passive isotonic flexion and extension. Based on this, the goal of this paper is to verify the correlation between MMG and MAS for subject with low spasticity and to provide a more accurate clinical indicator to evaluate spasticity.

### Methods

A randomized pilot study for a parallel randomized controlled trial for comparison study was conducted. A passive stretch reflex test was performed for 10 subjects suffering from brain lesions. Mechanomyography, Electromyography, and Pendulum test were performed on vastus lateralis muscle (agonist) and semitendinosus muscle (antagonist) for subjects with brain lesion. The final output was measured a biomechanical signal that passive isotonic muscle flexion and extension.

### Results

Mechanomyographic data of vastus lateralis muscle (agonist) and semitendinosus muscle (antagonist) were analyzed proportionally reflecting analyzed electromyographic firing point for semitendinosus muscle to develop a new clinical indicator that statistically distinguishes spastic muscles and normal muscles ( $p=0.001$ ).

### Conclusions

The purpose of this study is a new approach that patients having even low degree of spasticity can be quantitatively evaluated by using the ratio of normalized hull area obtained by proportionally analyzing signals from spastic muscles using MMG combined with EMG. Our new approach is not only simple but also can overcome unnecessary human bias and can be used as a clinical indication.

**Keyword Spasticity;** Mechanomyography; Electromyography; Brain lesion; Quantitative assessment

### Acknowledgment

This study was supported by the Yonsei Biomechanics Research Laboratory.