

A Randomized Controlled Study: Effectiveness of Functional Electrical Stimulation on Wrist and Finger Flexor Spasticity in Hemiplegia

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Aim: The objective of this study was to investigate the effectiveness of functional electrical stimulation (FES) applied to the wrist and finger extensors for wrist flexor spasticity in hemiplegic patients. *Methods:* Thirty stroke patients treated as inpatients were included in the study. Patients were randomly divided into study and control groups. FES was applied to the study group. Wrist range of movement, the Modified Ashworth Scale (MAS), Rivermead Motor Assessment (RMA), Brunnstrom (BS) hand neurophysiological staging, Barthel Index (BI), and Upper Extremity Function Test (UEFT) are outcome measures. *Results:* There was no significant difference regarding range of motion (ROM) and BI values on admission between the groups. A significant difference was found in favor of the study group for these values at discharge. In the assessment within groups, there was no significant difference between admission and discharge RMA, BS hand, and UEFT scores in the control group, but there was a significant difference between the admission and discharge values for these parameters in the study group. Both groups showed improvement in MAS values on internal assessment. *Conclusion:* It was determined that FES application is an effective method to reduce spasticity and to improve ROM, motor, and functional outcomes in hemiplegic wrist flexor spasticity. **Key Words:** Cerebrovascular accident—hemiplegia—rehabilitation—functional electrical stimulation—spasticity.

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Introduction

Hemiplegia after stroke can severely limit an individual's ability to perform activities of daily living. Wrist flexor spasticity is a common complication of hemiplegia and causes motor and functional impairments.

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Functional electrical stimulation (FES) is a therapeutic strategy used to improve impaired extremity function. It has been claimed that FES has a positive effect on spasticity, range of motion (ROM), and muscle strength. FES is used on patients with spinal cord injury, traumatic brain injury, cerebrovascular accident (CVA), and other central nervous system dysfunctions, but with intact peripheral innervation.¹ FES has the potential to generate functional arm and hand movements and can be applied in a variety of ways to the hemiparetic upper extremity following a stroke.^{2,3}

The aim of the study was to investigate the effectiveness of FES applied to the wrist and finger extensors for wrist flexor spasticity in hemiplegic patients due to a CVA. Karakuş et al investigated the effect of short-term FES application on wrist function and spasticity in individuals with subacute or chronic stroke.⁴ In our study, we investigated the effectiveness of the long-term FES applied to

the wrist and finger extensors for wrist flexor spasticity in hemiplegic patients. In contrast to the work of Karakus et al, we applied FES for 4 weeks. The pulse width, frequency, and the ramp-up and -down times of the current and the outcome measures of the 2 studies were also different.

Methods

Patients and Inclusion and Exclusion Criteria

Thirty inpatients who had at least a 3-month history of CVA with at least a stage 2 wrist spasticity according to the Modified Ashworth Scale (MAS)⁵ and who were able to cooperate were included in the study. Patients with a previous motor deficit in the upper extremity (2 patients) or motor neuron disease (1 patient), active infection (1 patient), other neurological disorders (2 patients), uncompensated cardiac disease (1 patients), cardiac pacemaker (1 patient), tumor (1 patient), and convulsion history (2 patients) were excluded from the study. The patients were randomly divided into study and control groups. The ran-

domization was made by flipping a coin as a method of simple randomization. Ethics committee approval was received for the study from the local ethics committee of our hospital. Written informed consent was obtained from the patients who participated in the present study. The flowchart of the study is shown in [Figure 1](#).

FES Application

FES was applied to the motor points of the extensor carpi radialis longus, extensor carpi radialis brevis, extensor carpi ulnaris, and extensor digitorum communis ([Fig 2](#)) in the study group, and conventional treatment consisting of passive ROM exercises, stretching exercises, and a wrist-hand static splint was also used. Only conventional treatment was applied to the control group.

A FES device with 2 channels and 4 surface electrodes producing low-frequency currents was used ([Fig 3](#)). The intensity of the stimulation current was set to produce full wrist and finger extension with a duty cycle of 10

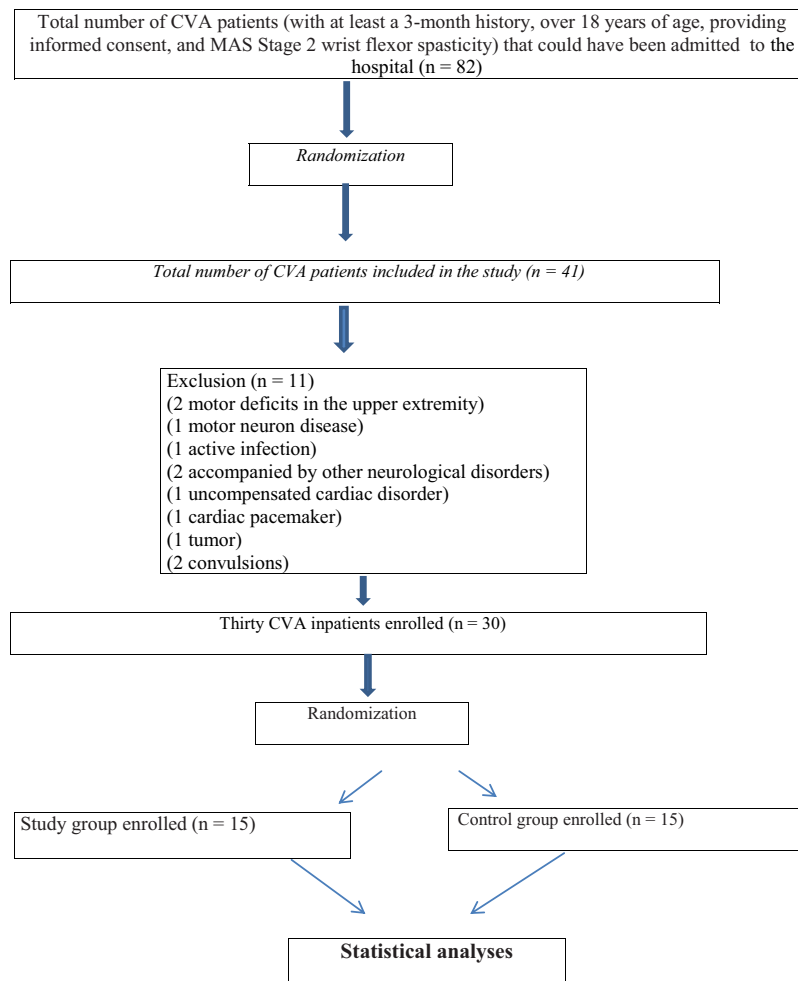


Figure 1. Study flowchart. Abbreviations: CVA, cerebrovascular accident; MAS, Modified Ashworth Scale.

CVA: Cerebrovascular Accident

MAS: Modified Ashworth Scale

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