

THE THERAPEUTIC EFFECT OF LONG-TERM SURFACE ELECTRICAL STIMULATION ON STROKE SPASTIC HEMIPLEGIC LIMBS

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ABSTRACT

Poor ambulation function of stroke patients usually results from prominent spasticity. In this study, we evaluated the therapeutic effects of one-month surface ES course on spasticity and on ambulation function. 12 stroke cases were included in our study. They were all neurologically stable and were 1-3 years post-stroke. A surface ES was applied on the muscle-tendon junction of Gastrocnemius 20 minutes per day for one month in all cases. The ambulation speed increased significantly after one-month treatment course. The Ashworth Scale also shows a trend of reduced spasticity. The F/M ratio, H-reflex latency, H-reflex recovery curve all showed a significant spasticity suppression. The results implied that appropriate long-term surface ES application can improve the ambulation function by suppression of spasticity even in chronic spastic hemiplegic stroke patients.

Keywords: Spasticity, Ib Fiber, surface electrical stimulation, ambulation speed, modified Ashworth Scale, Fmax/Mmax ratio, H-reflex latencies, H-reflex recovery curves

INTRODUCTION

Spasticity is defined as “a motor disorder characterized by a velocity-dependent increase in tonic stretch reflexes (muscle tone) with exaggerated tendon jerks, resulting from hyperexcitability of the stretch reflex. as one component of the upper motor neuron syndrome.”[1] Spasticity usually interferes with ambulation function and limits activity of daily living.

The therapeutic effect of electrical stimulation (ES) on spasticity is still controversial.[2-7] The purpose of this research is to show the most favorable strategy of ours. In this study, we applied surface ES over the muscle-tendon junction of triceps surae 20 minutes daily for one month to suppress its spasticity. Measure of spasticity was by modified Ashworth Scale, [2] H-reflex latency,[3] H-reflex recovery curve,[4] and Fmax/Mmax ratio.[5,9] Also we measured the ambulation speed to analyze the ES effect.

METHOD

12 stroke cases with evident spasticity were included. They are all neurologically stable and were 1-3 years post-stroke. There are 8 male patients and 4 females. The mean age is 57 years old (from 43 to 68). 7 cases are right hemiplegic, 5 cases are left hemiplegic. The cases with diabetic mellitus and peripheral neuropathy were excluded. Some cases taking antispastic drugs were asked to maintain on regular schedule.

We treated the spasticity by applying surface ES on triceps surae 20 minutes daily for one month. The active electrode was set on the junction of triceps surae muscle and achilles tendon, while the reference electrode was set on the distal end of achilles tendon. The 20 Hz bipolar symmetric rectangular waves with 0.2 msec pulse width were carried. The intensity is adjusted at maximum without inducing muscle contraction.

Evaluation of spasticity was by modified Ashworth Scale, Fmax/Mmax ratio, H-reflex latency, H-reflex recovery curve before and after one-month ES treatment course.[8]

Also, the ambulation speed before and after ES treatment course were measured.

RESULTS

The modified Ashworth Scale shows trend of reduced spasticity after one-month ES.

Fmax/Mmax ratio before and after one-month ES are $(8.2\pm 4.5)\%$ and $(4.0\pm 2.4)\%$ respectively. Statistically, it shows significantly decreased after one-month ES ($p < 0.05$) (Table 1). It means spasticity was suppressed significantly after one-month ES treatment course.

In H-reflex latencies study. 11 cases show prolongation of latencies after ES treatment. Prolongation of H-reflex latency also means suppression of spasticity.

H-reflex recovery curves show downward shift after one-month ES treatment course. It means that the spasticity was effectively suppressed by ES.

All cases showed a significant increase of ambulation speed after ES.

Table 1: F max / M max:

	before ES	after one-month ES course
Mean	8.2%	4.0%
S.D	4.5%	2.4%
t (paired-t test)		<0.05

DISCUSSION

The therapeutic effect of ES on spasticity is still controversial.[2-7] Reviewing the literature, a wide variety of stimulation parameters, application methods and quantification measurement of spasticity made the results different. Alfieri [2] reported that 85-100 % efficacy in decreasing spasticity by using ES on hemiplegic subjects. Robinson et al [6] report increased spasticity by stimulating SCI cases 20 minutes twice a day for 4 week.

In our study, the ES strategy for spasticity suppression is based on the mechanism of Ib fiber activation.[10] All of the measures of spasticity show significant inhibition of spasticity statistically or show the trend of improvement after one-month ES treatment course. The successful suppression of spasticity enable stroke patients to walk with higher speed.

We concluded that the long-term surface ES is beneficial for spasticity suppression and for increasing ambulation speed in spastic hemiplegic stroke patients by the ES strategy mentioned above.

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