International Journal of Medicine & Healthcare
Vol. 2, No. 2, 2017, pp. 1-7
www.ijmh.ielas.org
ISSN: 2545-4188 (Online)

The Efficacy of TENS in Hemiplegic Patients

Rezarta Stena

Albanian University, Tirana, Albania
stenarezarta@hotmail.com

Received: 2017-05-10 **Accepted: 2017-06-20** **Published online: 2017-07-30**

Abstract

Introduction: Hemiplegia is one of the most common paralysis these last years. The risk factors of this pathology are thrombosis, arterial hypertension, diabetes, stress, and so on. This illness has serious consequences for the patient and isolates him/her from many family and social activities. Early rehabilitation by physiotherapist is very important for a greater recovery of lost functions.
Objective: The main purpose of this study is to confirm the efficacy of TENS in hemiplegic patients to reduce spasticity and to restore lost reflexes.
Methodology: The patients taken to this study were with Hemiplegia caused by cerebrovascular accidents. The study included 32 patients of whom 22 were females and 10 were males. Patients referred loss of sensitivity and motor movement of the foot and hand and an increased spasticity. The study was based on two methods: TENS treatment and placebo stimulation.
Results: After 9 months of study, in different periods and groups of patients, it was observed that patients who used TENS had decreased spasticity, improved plantar and dorsal flexion and delayed stretch reflexes compared to patients who used placebo stimulation and hadn't significant effects.
Conclusion: Depending on all the studies we concluded that patients who used TENS on their treatment had satisfactory improvements and returned to normal life activities.

Keywords: Hemiplegia, Spasticity, TENS, Placebo, etc.

Introduction

Hemiplegia is defined as the loss of volunteer movement with muscle tone and sensitivity irritation in the entire left or right side of the body. Etiology Cerebro-vascular diseases are one of the main causes of Hemiplegia. Other causes are: cranioencephalic traumas, cerebral tumors, infections, cerebral arthritis and multiple sclerosis.

The clinic and progressive course

The progressive course is divided into three stages. The first stage is *sleeping period*. It usually occurs in coma processes due to haemorrhage. The second stage is Flaccid Hemiplegia. It is associated with the absence of cerebral control where all of reflexes disappear. This period takes 4-5 weeks, and then appears Hypertonia. The third stage is Spastic Hemiplegia where the inferior centers begin to recover and the reflexes appear. The tone grows and spasticity appears. After the acute phase it is noticed that the lower limb starts to recover faster than the upper limb. Within three months, the patient begins to walk, but the hand will stay for a long time compromised. Five

problems that accompany Hemiplegia are muscle tone changes, sensitive changes, loss of motor movement, loss of balance reactions, and communication.

The posture and the movement of hemiplegic patient

The patient benefits if the elements he is interested in are on the damaged side. The television, remote control, water cups should be placed on the damaged side to stimulate patient moves this part of body. The bed should have a strong mattress that can be adjusted. The patient should change the position every two hours to prevent decubitus wounds or pressure sores.

Stages of hemiplegic patient treatment

The treatment should start immediately after the stabilization of Hemiplegia. The prognosis will be faster if the patient is treated twice or three times a day in the early stages.

TENS Transcutaneous electrical nerve stimulation (TENS or TNS) is the use of electric current produced by a device to stimulate the nerves for therapeutic purposes. TENS, by definition, covers the complete range of transcutaneously applied currents used for nerve excitation although the term is often used with a more restrictive intent, namely to describe the kind of pulses produced by portable stimulators used to treat pain.

The unit is usually connected to the skin using two or more electrodes mostly auto adhesive electrodes to reduce the risk of skin infection and for easier application. A typical battery-operated TENS unit is able to modulate pulse width, frequency and intensity. Generally TENS is applied at high frequency (>50 Hz) with an intensity below motor contraction (sensory intensity) or low frequency (<10 Hz) with an intensity that produces motor contraction. The success is not guaranteed with the application of TENS. The percentage of patients profiting pain reduction is 65% for acute pain and 50% for chronic pain. The typical current intensity is 0-80 mA.

Mechanism of action

The type of stimulation offered by TENS tends to activate the natural specific mechanisms of pain reduction: the gate control mechanism of pain and the opioid system. Reducing pain through the gate control mechanism involves the activation of A-beta sensors that reduce the transmission of nociceptive stimulus from the 'C' fibers through the spinal column. The stimulation should be with high frequencies (90-130Hz). Another way is to stimulate A-delta fibers with low intensity (2-50Hz) which will activate opioid mechanisms and provide pain reduction by releasing an endogenous opioid (Encephaline) in the spinal cord that will reduce activation of toxins in sensitive paths. The third possibility is to stimulate simultaneously two fiber nerves through the Burst Model, which gives a slower effect and which lasts longer.

Application of TENS in clinical practice

There is currently a general consensus that favors the application of TENS in different clinical situations. The time from the beginning of the treatment to the analgesic period varies from immediate effect to several hours (20 -30 minutes) in 75% of patients and 1 hour to 95% of patients. The duration of the analgesic effect depends on the time of application and pain intensity.

Effects of TENS

TENS is effective to treat acute and chronic pain. It decreases drug dependence and pain tolerance, and also it helps in physiological factors and post operative situations.

TENS' program names

Traditional TENS uses high frequency stimulation 90-130Hz applied for 30min. *Acupuncture TENS* uses frequency stimulation 2 to 5Hz applied for 30min. The effect is achieved slowly but lasts longer. *Intensive brief TENS* is used to achieve rapid pain relief but some patients cannot support the power of stimulation. The frequency and intensity of stimulation is different for each patient.

Methods and Materials

There are 32 patients taken in the study. All of these patients suffer from spastic hemiparesis caused by cerebrovascular accidents. Patients taken in the study are selected by these criteria:

- Lower limbs spasticity
- A passive dorsal flexion of ankle less than 10 grades
- Without prior history of neurological disorders
- Without major damage and pain to the lower limbs

Patients were advised and informed about the nature of the study and have given their approval.

Clinical evaluation

The clinical examinations evaluate the spasticity of Achilles tendon, the resistance of the passive dorsal flexion of ankle and the duration and the amount of ankle spasms. This assessment was conducted by the same examiner using a four-point scale for repeated spasms and a five-point scale for the two other types. While the points for the "Passive dorsal flexion resistance" phenomenon was doubled. These amounts of points were collected to generate total spasticity scores. The points in the range from 0 to 9

International Journal of Medicine & Healthcare
Vol. 2, No. 2, 2017, pp. 1-7
www.ijmh.ielas.org
ISSN: 2545-4188 (Online)

correspond to the lightest form of spasticity, from 10 to 12 correspond to the moderate form and from 13 to 16 correspond to severe spasticity. Initially, subjects were randomly distributed, 25 patients treated with TENS and 7 patients with placebo stimuli. As the placebo stimulation did not have much effect, these patients underwent in TENS therapy for 3 weeks increasing the number of patients treated with TENS.

Table 1 A comparison between clinical data of spastic hemiparetic patient with TENS and Placebo treatment

Clinical data				Reflexes' profile				Maximal contractions	
Age (years)	Etiology	The time from the begging of the damage (months)	The points of spasticity	H/M (%)	Hvib/Hctl (%)	SR in group	STR/M (%)	The force PF (kg)	The force DF (kg)
The group with TENS stimulation									
75	L.CVA	18	6	17.1	53.4	7	37	16.1	5
49	L.CVA	27	9	98.1	17	16.9	82	16.7	7.3
67	L.CVA[b]	8	9	22.3	80.9	29.5	27	10.7	4.2
31	L.CVA	25	10	94.7	43.2	20.3	53	22.4	5.8
76	R.CVA[b]	43	10	19.8	81.7	11.5	29	10.4	7.9
43	L.CVA	8	11	19.9	24.3	12.1	16	28.9	1.4
67	R.CVA	23	12	88.6	29.8	23.2	51	23.8	6.4
57	L.CVA	85	13	100	96.3	13.5	60	3.1	0
73	R.CVA[b]	26	13	57.9	30.12	11.4	100	12.4	0
58	R.CVA	16	15	77.9	96.3	11.4	48	10.5	1.2
47	L.CVA[b]	11	16	100	81.4	10.5	100	17.6	0
58.5		26.4	11.2	63.3	57.7	15.2	50.3	15.7	3.6
14.7		21.9	2.9	36.6	30.3	6.6	25.7	7.3	3.1.
The group with placebo treatment									
67	L.CVA[b]	8	9	22.3	80.9	29.5	37	11	3.1
76	R.CVA[b]	43	10	19.8	81.7	11.5	65	12.3	0
58	L.CVA	50	12	85.9	76.9	8.2	49	9.5	1
47	R.CVA	37	13	60.2	75.6	10.6	53	13.5	5.1
73	R.CVA[b]	26	13	57.9	30.1	11.4	100	9	5
47	L.CVA[b]	11	16	100	84.3	10.5	100	14	0
64.7		29.2	11.8	57.7	71.6	13.6	68	11.6	2.4
10.6		17.2	2.5	32.5	20.6	7.9	27.8	2.1	2.4

Spasticity points: 0-9 lightest form; 10-12 moderate form; 13-16 severe form -10 patients took part at both groups
SR=Stretch Reflex, PF/DF=plantar flexion/dorsal flexion, L/R CVA = Left/Right, CVA- Cerebro-vascular accidents

Instrumental protocol

Most subjects were tested twice a week to determine the reproducibility of the data. The test consists in 5 measurements:
-Clinical spasticity points
-The maximal amplitude of H reflex as a percentage of maximal response M (H / M)
-The amount of H reflex inhibited during vibration
-The excitability of stretch reflex
-Volunteer isometric plantar and dorsal flexion of ankle

The test procedure is performed as follows: The spasticity of ankle joint was the first evaluation. The main threshold of sensitivity was defined as the average after three tests in which the stimulation intensity gradually increased from the moment when patients referred nerve tickle. The subjects were informed that they might not feel anything by stimulation. Under these conditions, the undergrowth was considered placebo stimulation for 60 minutes, days/weeks. This time of treatment was considered optimal based on the previous findings of the effects of a single electrical stimulation in pain. To reduce the time course and stimulation effects in the five factors taken in the study, the measurements were repeated after 2-3 weeks from the stimulation.

The results

Based on the clinical evaluations of the subjects, 8 of them had light spasticity, 12 moderate spasticity and 5 severe spasticity. In the placebo group, 5 had light spasticity and 2 other had severe spasticity. The effects of TENS and placebo stimulation on spasticity and H reflex's points. After all the tests, it was noted a significant reduction of hemiparetic spasticity after 2 weeks of treatment and the additional week did not produce further reductions. The effects of TENS and placebo stimulation on stretch reflex. After all the observations, it was noted that the TENS treatment but not placebo stimulation tended to delay and to reduce the magnitude of stretch reflexes. Specifically after 3 weeks, stretch reflex was extended to 134.6 ± 69.7% compared with placebo stimulation 105.9 ± 31.9%. The effects of TENS and placebo stimulation in maximal isometric volunteer contractions. The most impressive result of our study was the improvement of dorsal flexion in the affected limb. 15 patients had a maximum control force of 1.4 kg before TENS treatment and after two weeks it was increased by 3.4 kg. At the end of the 3rd week treatment it was 7.4 kg. The range of this clinical improvement varied from 5% to 80% in 20 subjects. However, the plantar flexion force showed only a slight increase from both therapies TENS and Placebo without significant differences between the values of the two groups. The relief of hemiparetic spasticity from TENS. The EMG contraction rates during dorsal and plantar flexion were stable throughout days. The group that received TENS treatment, the contraction rate before the treatment was 50 ± 21.4%, during the treatment was 42±16.5% and after it was

38.1±24% (respectively after two and three weeks of treatment). During plantar flexion, the rate of contraction remained stable for two weeks after stimulation 49.2±32.8% and significantly decreased to 32.1±18% at the end of the third week. Placebo stimulation there had no effect on the two types contraction.

Discussion

Our main findings from this study demonstrate that repeatedly applications of TENS significantly improve clinical spasticity simultaneously with volunteer motor reflexes in hemiparetic patients. Specifically, TENS therapy:

- reduced spasticity scores
- increased the vibrant inhibition of H reflexes
- reduced the magnitude of stretch reflexes of the soleus muscle
- improved the force of dorsal flexion
- reduced the EMG at the co-contraction rates.

Conclusion

The results of the study showed initial improvements of dorsal flexion and after 2 weeks of TENS stimulation we noted partial improvement as a result of H reflex inhibitors. These changes were accompanied by a reduction of stretch reflex magnitude in plantar flexion and co-contraction of EMG scales only after three weeks of stimulation. Another factor in this study was the vibratory growth of H reflex inhibition through repeated TENS application. This may have been due to a reinforcement of presynaptic inhibition that has been proven to be inhibited in spastic Hemiplegia (Ashlay and Verrier, 1976). It was interesting that TENS treatment resulted in a pronounced increase in dorsal flexion but not of plantar flexion. As it can be partially mentioned at the introductory part of our study, at least two current mechanisms can affect voluntary spasticity abnormalities. On the one hand, the lower threshold of stretch reflexes can result as an excitement of hyperactive segmental reflexes whereas on the other hand, we may assume that part of motor deficit in the poorly dorsal flexion is associated with the deficiency or the decreasing of the excitability of flexor motor neurons. Repeated TENS stimulation may have improved dorsal flexor by increasing the inhibition of presynaptic associated with a hyper excitability of stretch plantar flexion and by reducing EMG contraction rate.

References

1. Levin MF, Hui-Chan CWY. Relief of hemiparetic spasticity by TENS is associated with improvement in reflex and voluntary motor functions. Electroencephalogr Clin Neurophysiol. 1992; 85:131–142.
2. Almay, B.G.L., Johansson, F., Von Knorring, L., Sakurada, T., Terenius, L. Long-term high frequency transcutaneous electrical nerve stimulation (hi-TENS) in chronic pain. Clinical response and effects of CSF-endorphins, monoamine metabolites, substance P-like immunoreactivity (SPLI) and pain measures. Psychosom. Res. 1985; 29:247–257.
3. Hale, J.L., Chan, C.W.Y. Possible enhancement of presynaptic inhibitory mechanisms following nine days of TENS in hemiplegic patients. In: Proc. Int. Union Physiol. Sci. XVI.; 1986:256.
4. Wikipedia: TENS
5. Wikipedia: Hemiplegia
6. E. Hiluk. Neurological rehabilitation
7. Ali Aliu, Visar Memaj: Modalitetet Termale