ELECTRICAL STIMULATION OF THE TRANSCUTANEOUS POSTERIOR TIBIAL NERVE FOR TREATING URINARY INCONTINENCE DUE TO NEUROGENIC HYPERACTIVE BLADDER IN MULTIPLE SCLEROSIS

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Abstract: This study evaluates the therapeutic effectiveness of Transcutaneous Electrical Nerve Stimulation (TENS) of the posterior tibial nerve, for treating urinary incontinence (UI) due to detrusor overactivity (DO) in patients with multiple sclerosis (MS). Five volunteers having positive cutaneous plantar reflexes and intact innervation of the anterior tibial participated in the study. Individuals with a positive Babinski reflex were excluded. We applied 10 sessions of TENS currents (20 Hz, 200 milliseconds, tetrapolar), over a period of 5 weeks (2 sessions per week). The treatment was monitored through a Urogynecology Physiotherapeutic Assessment Questionnaire and by a Voiding Log. We observed a reduction in the average frequency of miction, as well as decreased nocturia; also, the urge incontinence symptoms in the treated patients were cleared up.

1 INTRODUCTION

Multiple sclerosis (MS) is a progressive multifocal neurological demyelinating condition in the central nervous system. It is characterized by exacerbations and remissions, and is prevalent in young adults, females and Caucasians (Coelho, 2009; Poser, 1986; Lana-Peixoto, 2002; Grzesiuk, 2006; Mendes, 2000; Diament and Cypel, 1996; Stephen, 1995). Despite the unknown etiology of MS, the presence of autoimmune factors triggering attacks on myelin have been reported (O-Sullivan, 2004).

The symptomology of MS is multiple and variable, and it can cause lesions from the medulla to the cerebral cortex (Poser, 1986). Pyramidal signs such as spasticity, hyperreflexia and the Babinski reflex are common in those with MS (Hauser and Goodin, 2008). The presence of this pathological reflex indicates lesions on the pyramidal tracts, compromising voluntary motor control modulation (Souza and Figueiredo, 1995; Dantas, 1992).

Among the symptoms, sensory deficits and bladder disorders frequently stand out. Loss of vibratory perception in the lower limbs, paresthesia, hypoesthesia, disturbance in position awareness, dysesthesia, and trigeminal neuralgia hyperpathia are commonly found among the sensations (O-Sullivan, 2004). And with the evolution of the pathology, the urgency or urinary incontinence (UI) will affect most people with MS (Stephen, 1995). Around 90% of those with MS display detrusor hyperactivity (DH). Involuntary contraction of the detrusor muscle causes the bladder to be filled incompletely with a constant loss of urine (Coelho, 2009), causing further patient discomfort .

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Assuming the presence of nerve projections from the posterior tibial nerve to the bladder, treatment with TENS may decrease the frequency of UI (Fischer-Sgrott, 2009). Transcutaneous Electrical Nerve Stimulation (TENS), an electrotherapeutic resource used in physiotherapy, uses a low frequency current, with intensity adjustable from 0 to 50 mA; the wave form is asymmetrical biphasic; and the used frequency is between 1 and 150 Hertz (Hz) (Frampton, 1998; Agne, 2004).

The electrodes may be placed on the medial region of the leg, stimulating motor and sensory innervation. For someone with MS, sensory innervation may be compromised, and the physiotherapist will then adjust the intensity of the current by observing the motor stimulation in the muscle. The use of this technique may promote a decrease in the detrusor's involuntary contractions (Maciel and Souto, 2009).

Another resource that the physiotherapist can use is the visualization of the rhythmic flexions/bending of the hallux, which indicates that the electrodes are correctly positioned and confirms preserved motor innervation (Maciel and Souto, 2009; Amarenco, 2003). However, for individuals positive for Babinski's reflex, establishing the appropriate dosage of the therapeutic current is more difficult, due to the incorrect motor modulation that they present. In these cases, it may become impossible to control the intensity of the current produced by the electrostimulous device and its motor response.

2 MATERIAL AND METHODS

This study was carried out in the School of Clinical Physiotherapy at the State University of Goiás (Goiânia, Goiás, Brazil). The research protocol was submitted to and approved by the Ethics and Research Committee at the Federal University of Goiás. We selected twelve volunteers having UI and who had been diagnosed with MS. Seven were female, five were male, six were white, three were mixed-race or medium dark-skinned and three were black. After signing the Informed Consent Form, the individuals were submitted to a Physiotherapeutic Evaluation questionnaire in Urogynecology from the Federal University of São Paulo and presented a Voiding Log for three days. Next, we conducted a physical exam in order to evaluate the cutaneous plantar reflex.

Volunteers with no pathological reflex had electrodes attached along the posterior tibial nerve, as seen in Figure 1, in order to detect if the innervation was intact with the use of electrical stimulation (NEURODYN TENS portable, Ibramed Ltda.).

Figure 1: Positioning of the electrodes.

Eight individuals presented a normal cutaneous plantar reflex and a positive response to posterior tibial nerve electrical stimulation, and were then included as participants in this study. Three patients abandoned the study. Five people of both sexes and aged between 33 and 42 years old were submitted to 10 sessions, twice a week, for 20 minutes of treatment. The TENS parameters used were: 20 Hz frequency, a pulse width of 200 milliseconds, stimulation with two channels with four electrodes positioned on the lower extremity. One electrode was fixed to the posterior medial malleolus and the other was fixed 10 centimeters above this (Figure 1). The intensity parameter in the individuals with hyper and normal sensitivity was dosed according to how the patient felt; in the individuals with hypersensitivity, the rhythmic flexes of the hallux motor signal were used as the dosing parameter. The maximum intensity used was 30 milliamperes, as a safety criterion in the procedure.

3 RESULTS AND DISCUSSION

The results we present below are based on the descriptive analysis of data collected by both the evaluation questionnaires and the voiding log of the volunteers. Through the physical examination, the presence of detrusor hyperreflexia (DH) was observed in all the volunteers.

The main complaints reported by the participants before the treatment and after the electrical stimulation treatment appear, respectively, in Table I and Table II. We observe, based on Table II, an

improvement in the urge incontinence and urine frequency symptomology after the electrical stimulation treatment.

Table 1: Description of the main patient complaints before (F_{before}: frequency and P_{before}: proportion) and after (F_{after}: frequency and P_{after}: proportion) the treatment.

Main Complaint	F_{before}	P_{before} (%)	F_{after}	P_{after} (%)
Urge Incontinence	3	37.5	-	-
Urine Frequency	3	37.5	2	50
Urgency	2	25	2	50
Total	8	100	4	100

We also observed that the sensation of the voiding act changed after the treatment. In Table II, we present the list of analyzed sensations, and the frequency at which they occurred. Observe that there was a decrease in the frequency of most sensations; in particular, symptoms such as pain, post-void desire and urge incontinence were no longer reported after the treatment.

Table 2: Sensation of the voiding act before (F_{before}: frequency and P_{before}: proportion) and after (F_{after}: frequency and P_{after}: proportion) the treatment.

Sensation of voiding act	F_{before}	P_{before} (%)	F_{after}	P_{after} (%)
Burning	2	18	1	20
Residual sensation	2	18	1	20
Post-void desire	4	37	-	-
Pain	1	9	-	-
Comfort	1	9	3	60
Urge incontinence	1	9	-	-
Total	11	100	5	100

In general, urinary incontinence treatment is considered effective when episodes of urinary loss are reduced by 50% (Schreiner, 2009). With respect to this parameter, involuntary loss of urine onto clothes was reported by only two patients. From void log entries, the average loss of urine in these patients before the treatment was 2 times and after treatment it was 1 time. This reduction may be explained by possible neuromodulation caused by the TENS current.

Another analyzed result refers to the reduction in voiding frequency during the day, as shown in Figure 2.

The average frequency of visits to the bathroom at night before the treatment was 4 times, and this frequency reduced to 2 times after treatment. Studies about the use of electrical stimulation treatment suggest a reduction in nocturia, with 38% relief of this symptom (Marques, 2008), 21% improvement in nocturnal voiding (Govier, 2001). In a study involving MS patients, there was an improvement in nocturia in 75% of patients (Kabay, 2009).

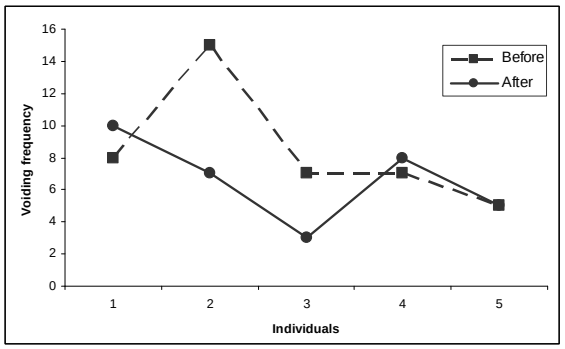

Figure 2: Voiding frequency during the day per participant.

Finally, we observed an improvement in nocturia in three patients, as shown in Figure 3.

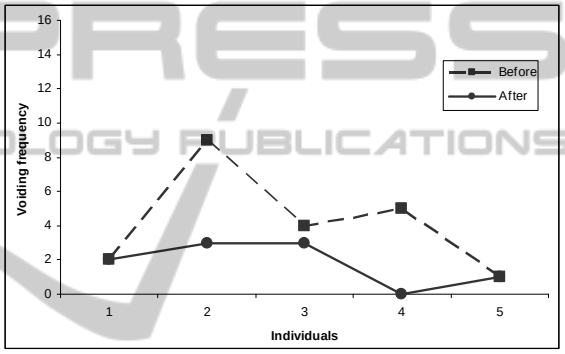

Figure 3: Voiding frequency during the night per participant.

4 CONCLUSIONS

Individuals with multiple sclerosis (MS), urinary incontinence, alteration in the sensitivity and preserved posterior tibial innervation can safely receive electrical stimulation treatment. We evaluated the effect of this treatment on MS patients with overactive bladders. Our results suggest that this type of treatment can lead to a decrease in bladder dysfunction symptoms, and thus improve this individuals' quality of life.

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