Possible applications of Neuromuscular Taping in pain reduction in Multiple Sclerosis subject: a preliminary report

Carmine Berlingieri[1], Filippo Camerota[2], Claudia Celletti[2], Andrea Turolla [1], Alberto Peraro [3], David Blow [4] , Patrizio Sale[1]

[1]Neurorehabilitation Department, Foundation IRCCS San Camillo Hospital, Venezia, Italy.
[2]Physical Medicine and Rehabilitation Division, Umberto I Hospital, Rome Italy
[3]M.A.D. Medicine, Adria, Rovigo, Italy
[4]NeuroMuscular Taping Institute, Roma, Italy

*Corresponding author: Filippo Camerota, Physical Medicine and Rehabilitation Division Umberto I Hospital, Rome ,Italy. Email: f.camerota@libero.it

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Abstract

Pain is a common disabling symptom in patients with Multiple Sclerosis (MS). It has been indicated that pain prevalence in MS patients is between 29–86 %. It is evident that most MS patients requiring treatment will be also searching pain related treatments to assist in day to day activities. Neuropathic pain is a difficult symptom and is generally inadequately relieved even though different rehabilitative approaches may be used. Neuromuscular Taping inducing micro-movements by stimulating receptors in the skin has been described in literature as a possible intervention in neurological and orthopedic rehabilitation improving mobility and in pain reduction. The aim of this preliminary report was to analyze the effect and to evaluate the possible applications of Neuromuscular Taping (NMT) in patients with MS in order to reduce pain in comparison to the Transcutaneous Electrical Nerve Stimulation (TENS) and to physical rehabilitation treatment alone. We observed that NMT together with standard physical rehabilitation was able to reduce neuropathic pain to greater lengths, with statistically significant differences between pre and post treatment, compared to the other treatments evaluated. This study showed increased efficacy in pain reduction when NMT was applied to standard physical treatment in long standing pain conditions. Neuromuscular Taping may constitute a low cost treatment strategy for neuropathic pain conditions in MS.

Keywords: *multiple sclerosis; neuropathic pain; rehabilitation; taping; NMT pain treatment strategy; neuromuscular taping; quality of life.*

Introduction

Multiple sclerosis (MS) is an inflammatory demyelinating disease of the central nervous system (CNS) resulting in motor, sensory and cognitive impairment [1]. Pain is a common disabling symptom of MS and estimates of MS pain prevalence vary widely in the range 29–86 % [2-3]. The incidence of chronic pain in MS is not correlated with disease severity [4]. Neuropathic pain associated with MS is inadequately relieved with conventional drugs. Rehabilitation is often a treatment available to relieve functional symptoms, though its effectiveness in MS is still a matter of debate.

Recently a new therapeutic approach has been described in literature as a possible intervention in the treatment of neurological disease to improve motor functioning and reducing pain [5-8]. Common treatment for neuropathic pain includes Transcutaneous Electrical Nerve Stimulation (TENS), a non-pharmacological therapy that has been demonstrated to be safe and effective in the management of central pain in people

living with MS [9], and standard physical rehabilitation treatment. This particular system known as Neuromuscular Taping [6] with the application of tape creating eccentric forces is applied to the skin over the underlying muscles, may play a role in regulating the sensorimotor and proprioceptive systems. NMT application seems to modify a sensory input that is integrated by the central nervous system and used for assisting motor program execution process known as sensorimotor integration [8]. Evidences showed that the NMT could normalizes muscular function, increases lymphatic and vascular flow, reduces pain, strengthens weakened muscles, and assists the postural alignment relaxing the overused muscles [10]. This integration may play a role in pain reduction. It has been hypothesized that the application of NMT is able to stimulate or activate cutaneous mechanoceptors. The aim of this preliminary report is to evaluate the possible application of Neuromuscular Taping (NMT) in subjects with MS in order to reduce pain in comparison to other two common treatments.

Methods

Fifteen patients with a diagnosis of a progressive form of MS disease has been enrolled. According to Costantino the inclusion criteria were: diagnosis of MS according to Polman criteria; Disability from mild-to-moderate degree (EDSS ≤ 4); a clinically stable disease (no variation in the EDSS score during last year); absence of relapses during the last 3 months; absence of rehabilitation treatment or symptomatic drugs acting on muscular tone or fatigue for at least 2 months and a stable disease modifying treatment for at least 3 months [5].

Subjects enrolled has been quasi-randomized in three groups: the control group (CG) has been treated with physical rehabilitation program, the NMT-G has been treated with physical rehabilitation and in addition with neuromuscular tape and the TENS-G with physical rehabilitation and in addiction with analgesic electric stimulation. The baseline characteristics of patients and the median score before (T0) and after 8 weeks of treatment (T1) are illustrated in **Table1**.

The physical rehabilitation treatment was the same for the three groups: all patients underwent to two hours of rehabilitation for five time/week for total of eight weeks. All subjects (TENS-G, NMT-G, and C-G) underwent the same standard rehabilitation training to improve gait, improve joint range of motion and muscle strength, proprioception control, function and ability recovery, coordination and balance control.

The C-G groups in addition underwent active and assistive exercises for the lumbar paravertebral muscles for 30 minutes, five times per week for three consecutively weeks.

The TENS groups in addiction underwent the TENS stimulation for 30 minutes, five times per week for three consecutively weeks. Electrodes were applied over the lumbar paravertebral muscles.

The NMT Group I addiction underwent the application of NMT over the lumbar paravertebral muscles and in the hamstrings bilaterally two times per week for 8 weeks. The tape was applied in a particular way that characterized the NMT application with the aim to rise the skin in a wave, amplifying the stretching/contraction effect of the skin itself. The tape was applied constantly and changed every three days (2 times weekly) by the same physiotherapist. The lumbar applications were bilateral (lumbar spine standard treatment protocol) and consisted of two tapes of 30 cm in length and 5 cm width applied laterally to the spine from the central sacral line to the 10 thoracic vertebra with the patient maintaining an anterior lumbar flexion at 45° in a standing position; each tape is applied with 0% tension over the skin in a stretched position. While for the hamstrings (double Y hamstring decompression standard protocol) applied bilateral and consisted of two tapes 40 cm in length and 5 cm width (cut in half comprising strips of 2.5cm width) applied over the hamstrings with the patient maintaining an anterior lumbar flexion at 90° in a standing position with their elbows resting on a treatment table; each tape is applied with 0% tension over the hamstrings with the skin in a stretched position. The application was the same for all the patients.

All patients were evaluated using the Neuropathic Pain Scale [11], VAS (Visual Analog Scale) for pain [12] and Performance Oriented Mobility Assessment (POMA) scale, originally developed by Tinetti [13-14].

All assessments were performed by a trained Physical Therapist (PT) who was not aware of the research aims and treatment content. Each patient was informed about the study procedure and aims. Then, after a period of discussion and reflection, each patient either enrolled voluntarily and provided written informed consent or declined to participate. All procedures conformed to the World Medical Association declaration of Helsinki (2016).

	CG	TNM-G	TENS-G
Age	50 (23-64)	52 (40-60)	**49 (27-58)**
Gender	3F 2M	3M 2F	**3F 2M**
EDSS	2.5 (1-3.5)	2 (1-4)	**3 (1-3.5)**
POMA scale T0	16 (10-20)	18 (15-23)	**14 (9-23)**
POMA scale, T1	19 (13-20)	21 (20-25)	**19 (18-27)**
p	0.01	0.007	**0.005**
NPS score T0	5.36 (3.55-6.09)	6.18 (3.45-7.18)	**5.09 (3.91-6.27)**
NPS score T1	3.36 (2.27-4.09)	2.36 (0.55-3.00)	**2.45 (2.09-3.36)**
p	0.03	0.002	**0.00**
VAS score T0	7.6 (7.0-9.5)	7.4 (7.0-9.5)	**7.3 (6.5-8.0)**
VAS score T1	5.4 (4.1-5.7)	2.9 (2.0-3.5)	**4.0 (2.0-4.5)**
p	0.00	0.00	**0.00**

Table 1: Median value (Min-Max) evaluated among the three treatment groups (T0 - T1).

Statistical analysis

As non parametric distribution, the comparison between groups has been evaluated using the Kruskal-Wallis Test. The statistical significance was set at $p < 0.05$. To compare the variation in the main evaluated scores among the three groups, i.e. NPS, POMA and VAS scores, the Kruskal-Wallis Test for non-parametric scores has been used.

Results

At the baseline, no statistically significant differences concerning age, gender and Expanded Disability Status Scale (EDSS) between the three groups were noted. All patients recruited have a mild or moderate disability with no walking impairment.

Considering the values of the POMA scale, the VAS score for pain and the Neuropathic Pain scores, the comparison between pretreatment and post treatment shows statistically significant results in all three groups (Table 1). Considering the VAS and NPS scores among the three groups, the NMT treatment Group we observed major score variations. In particular the VAS score decreased mean 2.2 point in the Control Group, 3.3 points in the TENS Group and 4.5 points in the TNM Group. Similar results has been observed for the NRS scores. The Control Group showed a reduction of 2 points, the TENS Group a reduction of 2.5 points while in the NMT Group the reduction was about 3.8 points.

Discussion

Multiple sclerosis is characterized by different symptoms which often interact with each other resulting in a disability that requires different rehabilitative approaches. Among others, pain is often associated to fatigue, muscle weakness and motor impairment and needs to be correctly evaluated and treated accordingly.

In this pilot study we have observed that rehabilitation programs whose aim is to reduce motor impairment has a role in the reduction of pain, while better results are obtained with the association physical rehabilitation and TENS. Recently a new therapeutic approach has been described in literature in the treatment of different neurological based pathologies with the objective to give a sensitive input that may be integrated by the central nervous system to assist in physiological motor control. NMT has been shown to improve upper limb movement in patients with Cerebral Palsy [7], to modify gait strategy in patients with Joint Hypermobility Syndrome/Ehlers Danlos Syndrome–Hypermobility Type [8] and to improve motor performance in Multiple Sclerosis [5]. Moreover it has been hypothesized that the application of NT is able to stimulate cutaneous mechanoceptors. These receptors activate nerve impulses when mechanical loads (touch, pressure, vibration, stretch and itch) create deformation. Their activation by an adequate stimulus causes local depolarization, that triggers nerve impulse along the afferent fiber travelling toward the central nervous system. Our aim was to evaluate if NMT application may play a role in the day to day rehabilitation treatments of MS. We have observed that NMT applied as outlined, is able to reduce and improve physical functioning in a greater way than TENS and physical rehabilitation treatment alone, with statistically significant differences between pre and post treatment in all 3 groups. Comparing the variations obtained in the NRS and NPS scores, with the NMT treatment combined with physical rehabilitation obtained major reduction of pain reducing to a mean of 2.36 for NPS and 2.9 for VAS Pain score. These results may indicate NMT treatment as a possible intervention in the daily rehabilitation management and treatment strategy of MS patients. Our results agree with previous case series that also found a decrease in pain and improvement in range of motion after the application of Kinesio Taping [10]. Limits of this pilot study are the limited number of treated MS participants. Future studies will be enlarged to cater for a significant subject group also dividing the MS participants in subgroups testing higher levels of debilitating pain and immobility testing fatigue symptoms along with functional movement parameters.

Moreover, we could introduce modifications such as motion capture system acquisition protocol in order to better control other variables in gait analysis. Further analysis is required in the evaluation of cost/benefit over longer treatment time frames. The results from this pilot study further opens discussion concerning proprioception and neurosensorial signals in the treatment of neuropathic pain.

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