



# Neural mobilization as a therapeutic option in the treatment of stroke.

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## ABSTRACT

**Introduction:** The neural mobilization is a technique aimed at functional recovery of the nervous system and structures innervated by it. However, little is known about its effects in patients affected by stroke (CVA). **Objective:** To review and integrate studies that investigated the effects of neural mobilization (NM) in the treatment of patients with stroke. **Method:** an integrative review of scientific studies with primary and secondary data, both addressing the NM in the treatment of spasticity, flexibility and functionality of stroke patients. The review was carried out by independent authors from July to October 2014. databases were consulted: LILACS, PEDRO, PUBMED and SCIELO. For the selection of manuscripts, we used the following key words: Neural Mobilization, Neurodynamics Mobilization, neurodynamic tests, stroke, spasticity Muscle, joint range of motion, flexibility and their counterparts in English. Studies were screened by reading the titles and objectives. Then deleted resumes in duplicate and performed the reading of articles to verify that met the inclusion criteria. **Results:** Six studies were selected, one being reviewed. In general, all the research has investigated the effects of NM in stroke patients. Four of the six articles were published in English. Only one study used a control group. As for treatment, there was divergence in relation to the NM application protocol. **Conclusion:** The reviewed studies indicate beneficial effects of neural mobilization in the control of muscle tone, range of motion and functionality of patients affected by stroke.

**Keywords:** Muscle Spasticity; Physical Therapy Modalities; Musculoskeletal Manipulations; Physical and Rehabilitation Medicine; Osteopathic Medicine.

## INTRODUCTION

Despite the notorious technical and scientific growth of health sciences, chronic non-communicable diseases such as stroke (CVA), still ranks among the major problems of global public health. Curiously in this regard, the literature has revealed a data at least intriguing, one in six individuals will suffer a stroke throughout life and as consequence many survivors will present biopsychosocial limitations and significant decline in functionality and quality of life. <sup>(1)</sup>

Thus minimize the effects of this disorder, has been one of the main objectives of health teams. However, the selection of the most appropriate therapeutic approach to rehabilitate the functional motor behavior in patients after stroke is still limited and questionable, which implies the need for new scientific knowledge. <sup>(1-3)</sup> Accordingly, studies suggest that stretching of the peripheral nerve through exercises proposed

by the neural mobilization (NM) technique can be useful in physical rehabilitation of patients with lesions of the nervous system. <sup>(4,5)</sup>

This suggestion corroborates with scientific studies which indicate that the NM can be used in the prevention, assessment and treatment of neuromuscular disorders. <sup>(5)</sup> NM demonstrated efficiency in prevention of hypertrophy, muscular strength gains, improved nerve conduction velocity and reduction of pain in animals. <sup>(6,7)</sup> Whereas in humans were evidenced gains of flexibility and range of motion, pain relief, increase in the recruitment of muscle fibers, improve in neural conduction velocity, increase in the muscle strength and improve in the functionality. <sup>(8-13)</sup>

Although the explored studies have shown positive results, researchers still have antagonistic thoughts regarding the

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clinical applicability of NM.<sup>(14)</sup> Another point to be discussed is the scientific gap in its effects in patients with central nervous system injury. In this regard, a randomized and double-blind clinical trial found that this technique was not efficient to improve spasticity in individuals with traumatic brain injury, however, improvements were observed in joint range of motion, which could result in better functional motor performance of these patients.<sup>(15)</sup>

Therefore, based on the rationale presented above, the present paper aimed to review and integrate studies that investigated the effects of neural mobilization technique in spasticity, flexibility, joint range of motion and functionality of patients with stroke.

## METHOD

This study is characterized as an integrative review of the literature<sup>(16)</sup> about studies that analyzed the effects of neural mobilization technique in stroke patients. The method used allows joining original studies with primary or secondary data of various designs<sup>(17)</sup> when scientific knowledge on a particular topic is not clearly substantiated in the literature.<sup>(18, 19)</sup>

Were adopted as eligibility criteria: original studies with humans, transversal or longitudinal section, case studies and literature reviews that were meant to examine the effects of NM on the following outcomes: muscle spasticity, flexibility, joint range of motion and functionality in stroke patients. In addition, studies should be available in full view, published in English or Portuguese, until the year 2014. We opted for the non-inclusion of abstracts published in annals of congress, monographs, dissertations, commentaries and reviews, since it would be logistically unfeasible. Were also established as exclusion criteria articles published in non-indexed journals.

The literature review was developed by independent authors, between the periods from July to October 2014. The following electronic databases were consulted: LILACS, PEDRO, PUBMED e CIELO. For the selection of manuscripts, was used as descriptors crossed in the gaps “words”, “subject descriptors”, “title words”, “title” and “summary” the following keywords: Mobilização Neural, Mobilização Neurodinâmica, Testes Neurodinâmicos, Acidente Vascular Cerebral, Espasticidade Muscular, Amplitude de Movimento Articular, Flexibilidade; and their corresponding in English. The descriptors related to neural mobilization technique were selected through consultation with expert physiotherapists in osteopathy and manual therapy. Systematic review studies previously published were also consulted since those keywords relating to NM were not identified in the descriptors in health sciences and terms of Medical Subject Headings.

Screening of the studies was initially conducted through the reading of titles and objectives. Then, duplicated references were excluded and new reading of articles abstracts was realized to verify if they fulfilled the pre-established selection criteria. The studies that attended the eligibility criteria

were retrieved for reading of the full text, new assessment concerning to the selection criteria adopted and extraction of data regarding to the methodological characteristic of the studies, objectives, study population, treatment with neural mobilization and outcomes related to muscle spasticity, joint range of motion and functionality. Finally, the references of the articles included in this review were evaluated in order to verify the existence of eligible studies not identified in searches of the selected databases.

## RESULTS

The research in databases with the selected descriptors resulted in a total of 957 references. Of these, 34 were excluded for duplicity between PEDRO and PUBMED databases. Other 917 were excluded for the absence of descriptors and interest outcomes of this work. Finally, six studies were selected for analysis in full and composed this integrative literature review.<sup>(4, 20-24)</sup>

Regarding the included studies, they are configured as a narrative review,<sup>(4)</sup> a case study,<sup>(21)</sup> a pilot study,<sup>(22)</sup> a descriptive cross-sectional study,<sup>(20)</sup> a prospective cross-sectional study<sup>(23)</sup> and a randomized clinical study.<sup>(24)</sup> All the manuscripts selected primary data<sup>(20-24)</sup> involves only patients who suffered a stroke at least once. Only two studies<sup>(21, 24)</sup> combined neural mobilization with other therapies. In this sense, the first one<sup>(24)</sup> submitted all the selected patients to neurofunctional physiotherapy sessions based on functional exercises, then only a part of the randomly selected sample was treated with NM, whereas the second<sup>(21)</sup> described the effects of the combination of botulinum toxin type A with NM sessions. The remaining<sup>(20, 22, 23)</sup> only analyzed the effects of the studied technique on the motor outcome of patients after stroke.

The main outcomes identified by the studies involved the adequacy or reduction of muscle tone,<sup>(21, 22)</sup> gain of joint range of motion in upper and lower limb,<sup>(20, 21, 24)</sup> improvement in the body weight distribution on the lower limb affected by the stroke,<sup>(23)</sup> balance gain and functionality of the lower limbs.<sup>(24)</sup>

## DISCUSSION

In this integrative literature review, was observed that the available studies suggest beneficial effects of neural mobilization technique as neurofunctional rehabilitation strategy of patients affected by stroke. All included studies showed positive effects on the gain of joint range of motion, lower limb functionality, decrease of myoelectric activity of the spastic muscle and reduction of pain and spasticity when combined with the application of botulinum toxin type A. However, the evidence is still limited and the subject is little explored scientifically. Furthermore, the literature still lacks studies with greater methodological rigor and adequate design, as well as the most clinically relevant outcomes.

One of the six studies that compose this Review, written by Zmberlan and Kerppers<sup>(4)</sup> suggested that the sequence



of movements used in NM technique could be beneficial in maintenance of elasticity and extensibility of the nervous system, thereby assisting the muscular plasticity and the maintenance of joint range of motion and adaptive capacity of the nervous system during movement. The most intriguing is that the authors did not identify any research that deals directly with this topic and the study proposal is based on biological plausibility, experimentation in other populations and reports published in the classic technique book. <sup>(25)</sup>

Corroborating the hypothesis of increased joint range of motion mentioned in the review study, <sup>(4)</sup> Santana et al., <sup>(20)</sup> evaluated the effect of NM in range of motion of patients with stroke. The authors demonstrated that ten technical sessions applied in the median, radial and ulnar nerves of the upper limb, affected by the disease, were enough to increase the range of motion of the shoulder joint in all degrees of freedom. The authors also concluded that the sequence of movements used in NM technique could be inserted in physical rehabilitation protocols of patients with stroke.

A case study <sup>(21)</sup> reported the effects of combination treatment with botulinum toxin type A and NM in the upper limb spasticity of an individual aged 76 with stroke. Initially, was conducted an evaluation of spasticity by the Modified Ashworth Scale and range of motion by the goniometry. The treatment consists of two applications of botulinum toxin type A, one in every three months. The NM was started immediately after the first application of botulinum toxin, which was performed five sessions per week for six months. Each session was applied on the affected upper limb for three series of four minutes with one-minute intervals between each series. The mobilized nerves were the median and radial. The study results indicated increase in range of motion and reduction of 71% in spasticity. According to the authors, these results remained for six months after finishing treatment. These findings reinforce the discussions on the NM effects in the gain of articulate and indicate the possibility of this technique have beneficial effects in controlling or reducing muscle spasticity.

About spasticity, an interesting study published in 2011 <sup>(22)</sup> aimed to determine the influence of NM spasticity in patients with stroke sequela. To this end, were selected six adults with an average age of 54 years and a mean time of four years of stroke sequela. Spasticity was evaluated based on the Modified Ashworth Scale, whereas the biceps myoelectric activity was measured by electromyography. The volunteers underwent the NM technique for the median nerve of the contralateral upper limb to the affected by the stroke. The technique was performed with twenty oscillations per minute being repeated three sets of one minute, respecting one-minute intervals for rest between each set. Shortly after finalizing the implementation of NM, the volunteers had the myoelectric activity of the biceps brachii measured. The results of the study demonstrated a reduction in myoelectric activity of

the patients with grade 1, 1+ and 2 of spasticity during elbow flexion, however, intriguingly, those with grade 1+ showed increased myoelectric activity during the extension of the same joint. The other kept decreased myoelectric activity even during the elbow extension movement. The results presented, besides reinforcing findings that point to NM as a resource able to minimize muscle spasticity, indicates the decrease in myoelectric activity as a possible mechanism for the control of muscle tone in patients with stroke.

In accordance with the findings mentioned above, a prospective study <sup>(23)</sup> was published in 2008 aiming to analyze the effect of mobilization of the median nerve in the regulation of muscle tone of hemiplegic patients after stroke. This was evaluated using the peak plantar pressure observing the distribution of body weight and the evaluation of bipodalic position by the baropodometry. The study sample consisted of 12 subjects of both genders, seven hemiplegic on the left and five on the right. The average age of the sample was 59 years and spasticity ranged between grade 1 and 2 in Ashworth scale. The treatment with NM was done in the upper limb that was affected by stroke and the technique was applied during three sets of one minute each with intervals of three minutes in every set. When analyzing subjectively the evolution of patients, the authors noted decrease of spasticity and increase of joint range of motion in the third application of NM. However, after analyzing the results, was not identified statistical difference. Nevertheless, despite the negative result, researchers have documented improvement in the distribution of body weight on bipodalic position apparently justified by the greater load release on lower limb affected by stroke.

Lastly, Cha et al., <sup>(24)</sup> studied the effects of the sciatic nerve in the NM functionality of the lower limbs of hemiparetic patients after stroke. In this study were selected 20 individuals with at least six months of the last diagnosis of the disease. Volunteers were treated with conventional therapy for lower limbs five times a week for four weeks. Physiotherapy sessions were based on functional training, which included moving from sitting position to standing position, up and down stairs and gait in anteroposterior direction. Then, ten of the volunteers treated with the functional exercises, formed the experimental group and received sessions of mobilization of the sciatic nerve. The NM technical consisted of three stages involving 20 seconds of nerve vibration repeated three times, straight leg raising associated with ankle dorsiflexion and flexion of the cervical spine. The total time for all stages of application was ten minutes. According to the authors, the group submitted to NM obtained better functional performance when compared to the group that was not submitted to the technical. This is because the participants treated with NM presented better balance and plantar pressure distribution in the hemiparetic lower limb, higher performance on the sit-and-reach test and increase of the hamstrings flexibility and the range of motion of the knee joint.



Despite the methodological limitations of the studies that composed this review, such as transversal design of some studies, no sample size calculation and limitations in characterizing the samples, we can infer interesting effects of NM in patients with stroke sequela as seen in this discussion.

## CONCLUSION

In short, the research included in the present study indicate beneficial effects of NM in the gain of range of motion, reduction of spasticity, improvement of myoelectric activity, increase of muscle flexibility and improvement in distribution of body weight and in the postural balance.

## AUTHOR'S CONTRIBUTIONS

Conception and research design: Santos ACN and Petto J; Data collection: Santos ACN and Goes ACG; Analysis, data interpretation and manuscript writing: Santos ACN, Goes ACG and Petto J; Critical review of the manuscript on the important intellectual content: Santos ACN, Lago RMV and Petto J.

## CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest in the research.

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