Research Article
http://dx.doi.org/10.17784/mtprehabjournal.2014.12.186

The effect of neural mobilization of the brachial plexus on the flexibility of the lower limb: a double-blind trial.

O Efeito da mobilização neural do plexo braquial sobre a flexibilidade do membro inferior: um estudo experimental duplo cego.

Priscila de Souza Valente[(1)], Priscilane de Souza Valente[(1)], Augusta da Silva[(2)], Guilherme Peixoto Tinoco Arêas[(3)], Renato Campos Freire Júnior[(3)], Thiago dos Santos Maciel[(4)], Fernando Zanela da Silva Arêas[(5)].

Instituto de saúde e biotecnologia, Universidade Federal do Amazonas (ISB/Coari), Manaus (AM), Brazil.

Abstract
Introduction: The technique of neural mobilization promotes ease in carrying out the movement and they elasticity of the nervous system, creating and perfecting straining their normal functions, with resulting increase in range of motion . **Objective:** The aim of this study was to evaluate the effects of neural mobilization of the brachial plexus on the gain range of motion in the lower limbs in asymptomatic individuals. **Method**: The evaluation was conducted in three steps , immediate post-neural pre-mobilization and post - late , by testing the 3rd finger to the ground test and fleximetry. The technique of brachial plexus neural mobilization was applied for ten days, with three weekly sessions to complete ten days (four weeks), performed on alternate days, with a minimum interval of 24 hours between sessions. The sample consisted of 17 sedentary college students, between 18 and30 years, . All statistical analysis was performed with ($p<0.05$). **Results:** In assessing the hamstrings and quadriceps with fleximeter there was not a statistically significant gain range of motion after neural mobilization , however, there was a significant increase in overall flexibility evaluated with the test of the 3rd finger soil to reach the left finger. **Conclusion**: In this study, neural mobilization brachial plexus got no efficacy to gain range of motion of the lower limbs in asymptomatic individuals. However, the overall results showed earned flexibility to reach the left finger.
Keywords: physiotherapy, neural mobilization, musculoskeletal manipulations, brachial plexus

Resumo
Introdução: A técnica de mobilização neural promove facilidade na realização do movimento e a elasticidade do sistema nervoso, gerando e aperfeiçoando suas funções normais, com consequente aumento da amplitude de movimento. **Objetivo:** O objetivo do presente estudo foi avaliar os efeitos da mobilização neural do plexo braquial sobre o ganho de amplitude de movimento nos membros inferiores em indivíduos assintomáticos. **Método:** A avaliação foi realizada em três momentos, pré- mobilização neural, pós-imediato e pós-tardio, por meio do teste do 3º dedo solo e da fleximetria. A técnica de mobilização neural do plexo braquial foi aplicada durante dez dias, sendo três sessões semanais até completar dez dias (período de quatro semanas), realizadas em dias alternados, com intervalo mínimo de 24 horas entre as sessões. A amostra foi composta por 17 estudantes universitárias sedentárias, na faixa etária de 18 a 30 anos, com idade média de 22,29 ± 2,62 anos. Toda a análise estatística foi realizada com $p<0,05$. **Resultados:** Na avaliação dos músculos isquiotibiais e quadríceps com o flexímetro não houve um ganho estatisticamente significante da amplitude de movimento após a mobilização neural, porém, houve um aumento significativo da flexibilidade global avaliada com o teste do 3º dedo solo para alcance do dedo esquerdo. **Conclusão:** No presente estudo a mobilização neural do plexo braquial não obteve eficácia para o ganho de amplitude de movimento dos membros inferiores em indivíduos assintomáticos. Entretanto, os resultados mostraram ganho da flexibilidade global para alcance do dedo esquerdo.
Palavras-chave: Fisioterapia, manipulações musculoesqueléticas, plexo braquial

Received: 7 March 2014. Accepted: 11 June 2014. Published: 18 June 2014.

1. Physical Therapist, Universidade Federal do Amazonas (ISB/Coari), (AM), Braszil.
2. Physical Therapy Student, Universidade Federal do Amazonas (ISB/Coari), (AM), Brasil.
3. Professor of physical therapy school, Universidade Federal do Amazonas (ISB/Coari), Manaus (AM), Brazil.
4. Doctor in Engenharia Biomédica, Universidade do Vale do Paraíba (UNIVAP); Professor of physical therapy school, Universidade Federal do Amazonas (ISB/Coari), (AM), Brazil.
5. Doctor student in neurociences; Professor of physical therapy school, Universidade Federal do Amazonas (ISB/Coari), (AM), Brazil.

Corresponding author:
Fernando Zanela da Silva Arêas. - Rodovia Amaro Antônio Vieira 2651, Itacorubi, Florianópolis – SC. Zip Code: 88034-101. - e-mail: fernandozanela@ufam.edu.br

INTRODUCTION

The neural mobilization (NM) has been widely described in the literature over the past decades. The NM idea of the application is based on promote restoration of functional movement through passive or active oscillatory movements. Over the years the NM has been improving both in theory and in clinical application.(1,2)

The nervous system (NS) is mainly responsible for the conduction of impulses being extremely dependent on its mechanical function for optimal operation. The interconnection of the mechanical and physiological function of the NS was gathered in neurodynamics term. If this system is presenting neurodynamics harmony, which means their mechanical and physiological properties are normal.(3)

Neural mobilization is accomplished by increasing tension on the nervous system, mediated by certain postures, followed by slow and rhythmic movements targeted to the peripheral nerves and the spinal cord, providing improved conduction of nerve impulses. This technique has some effects as restoration of elasticity and movement of the nervous system (NS), which promotes return to its normal functions.(4)

The technique of neural mobilization promotes improvement in the performance of motion, improving its normal functions, with increased amplitude. The effect achieved is due to the fact that the nervous system is a mechanical interface that consists of everything that lies close around the nerve, as tendon, muscle, bone, intervertebral discs, ligaments, fascia and blood vessels; behaves like a flexible telescope that is contained in the NS.(5)

It is natural that daily the nervous system adapt to mechanical changes, and pass through situations: Stretches, slips, transverse shifts and mechanical compressions.(6)

The application of neural mobilization has increased significantly in recent years, however, there is little evidence about the effects of manual therapy technique, which explains the increased interest of researchers in the field to investigate the mechanical and physiological effects of neural mobilization.

Thus, based on the information submitted is assumed that the mobilization of the upper limb would result in a greater range of motion (ROM) of the lower limbs. In this context, the present study aims to evaluate the effects of neural mobilization of the brachial plexus on the gain range of motion in the lower limbs in neurologically asymptomatic individuals.

METHODS

Study design

This study was experimental, randomized, blind type, performed at the physical therapy laboratory of Universidade Federal do Amazonas (UFAM) - Campus Médio Solimões.

Ethical aspects

All participants received information for participation in the project and signed an informed consent agreeing to participate, according to Resolution 196/96 of the National Health Council. The procedures complied with the ethical principles postulated by Ethics committee of the Universidade Federal do Amazonas number 12739713.3.0000.5020.

Inclusion and exclusion criteria

The study included 19 volunteers, students from the Universidade Federal do Amazonas, with a mean age of 22.29 ± 2.62 years. Inclusion criteria were: age between 18 and 30 years; female, to ensure greater homogeneity; sedentary according to the International Physical Activity Questionnaire version 8 (IPAQ-8); and propose not to participate in any exercise program during training, consent to participate in the study and sign the informed consent. Exclusion criteria: presentation of pathologies limiting range of motion, neurologic, musculoskeletal, rheumatic and orthopedic disabilities, volunteers with abnormal blood pressure, with diabetes mellitus and heart disease pathologies, refer pain, or who did not attend the assessments and/or interventions. Three participants due to faults, did not complete the treatment. Thus, the final sample consisted of 16 women.

Instrumentation

The instruments used for data collection were: an identification; International Physical Activity Questionnaire, short version; a digital scale brand Balg 1FW, max. 150 kg, d = - 0.1 Kg G.TECH; a portable stadiometer (Edulab); one sphygmomanometer; one Fleximeter Research produced by the Instituto Code de Pesquisa e Comércio Ltda, a tape measure, a roll and litter for sessions of mobilization.

Procedures

Data collection was performed by three people: the first examiner filed an identification and assessment of the level of physical activity. All volunteers completed the questionnaire International Physical Activity Questionnaire version 8 (IPAQ-8), short form, validated in Brazil. This had been tested for validity in Brazil by Matsudo et al. The IPAQ, version 8, in its short form, addresses the amount of days and minutes of physical activities and leisure, occupational, commuting and housework activities. The score was the sum of the number of days or hours and minutes of physical activities in the previous week to completing the questionnaire. Considering the criteria frequency, intensity and duration, levels of physical activity were classified as: sedentary, insufficiently active, active and very active. Only selected individuals were classified as sedentary.

The second evaluator made the assessment of flexibility through the "Third Finger Test the Soil" and fleximetry the quadriceps and hamstring muscles. Such research had three stages of assessment of flexibility: before intervention (pre-mobilization); after the application of neural mobilization (post-immediate, first session); and 10 days after the last intervention (post-late). It was made a random draw of assessment methods, members (left and right), and muscles to be evaluated first, following the same order in the immediate post-revaluation and later.

The first method of evaluation consisted of knee flexion with the subject in the prone position, with a scroll above the patella and to the use of a fleximeter attached to the ankle of the volunteers. During this knee flexion (refer to the individual stretching the hamstrings) the device indicated the value obtained in degrees (°) by the individual in each trial, which was immediately taken by the evaluator. The second consisted of leg extension with the subject in supine position (refer to the individual stretching the hamstrings), with fleximeter set in the same area as the previous position.

The third review was through the 3rd Solo Toe test measures the overall flexibility of the individual in maximum trunk flexion without knee flexion and with relaxed head. With a tape measure the distance between the third finger of both hands and the soil should be measured. The volunteers performed three trials in both evaluation methods and the average was only considered in the data analysis. The flow chart summarizes the procedures performed in this study (Figure 1).

Mobilization sessions

The third person applied the technique to mobilize the brachial plexus from the first to the tenth day. The procedure was performed in four steps in a series of liabilities and oscillatory movements for 40 seconds. The third evaluator positioned the participant in supine position (SP) on a stretcher to submit it to mobilize the brachial plexus.

Involves the application of movements in sequence, depression of the shoulder girdle, shoulder abduction to 90°, external rotation of the shoulder, forearm supination, wrist and finger extension, elbow extension, and cervical flexion to the opposite side as maneuver awareness. Neurodynamic test evaluation of median nerve 1 (ULTT1). The program consisted of four steps:

Step 1: oscillatory movements of the shoulder girdle depression;

Step 2: oscillatory movements of cervical flexion;

Step 3: oscillatory movements of the shoulder girdle depression associated with cervical flexion;

Step 4: oscillatory movements of the shoulder girdle depression followed by cervical flexion.

Ten sessions were held, with three weekly sessions to complete ten days (four weeks), performed on alternate days, with a minimum interval of 24 hours between sessions. The techniques were performed with 1 minute interval between steps and maintained until the end of treatment.

Data were tabulated by mean ± standard deviations (SD). Shapiro Wilk test were used to determine the normality of the data. For the parametric values the ANOVA test was used. For the nonparametric data Friedman test was accepted as significant at $p < 0.05$. The statistical program used was BioEstat.5.0 ®. (Federal University of Pará, Belém, PA, Brazil).

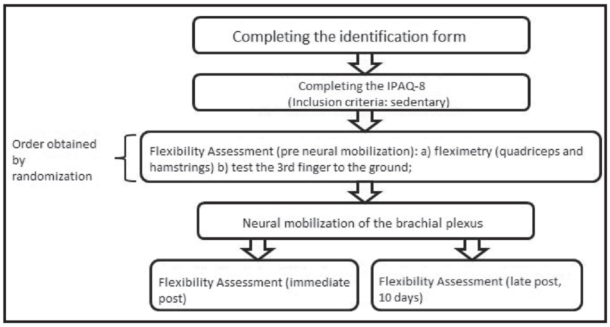

Figure 1. Flowchart of the study.

Table 2. Values of the third finger to the ground test before, immediately after, and late after neural mobilization of the upper limbs. Data expressed as mean ± SD (n = 17).

	Before	Immediately after	Late after
Right	6.7cm ±6.8	5.7cm ± 6.3	3.3cm ± 4.5
Left	7.6cm ±7.0	6.4cm ± 6.4	3.9cm ± 4.8*

* Diference between before and late after (p < 0,05)

Table 1. Values of lower limbs fleximetry before, immediately after, and late after neural mobilization of the upper limbs. Data expressed as mean ± SD (n = 17).

	Before	Immediately after	Later after
Right quadriceps	124º ± 8.9	128º ± 17.2	123º ± 9.3
Left quadriceps	122º ± 8.8	120º ± 9.4	122º ± 10.3
Right hamstring	67º ± 11.5	66º ± 11.7	69º ± 9.4
Left hamstring	68º ± 13.1	70º ± 10.2	69º ± 9.8

RESULTS

The sample had a mean age of 22.29 ± 2.62 years, Table 1 shows the behavior of the control group in the three steps in the evaluation of the program with fleximeter: pre, post immediate and post late. In fleximeter (Table 1), the group obtained as means, in relation to times pre, immediately post and post-late, respectively: 124º (± 8.9), 128º (± 17.2), 123º (± 9, 3) to right quadriceps; 122º (± 8.8), 120º (± 9.4), 122º (± 10.3) for left quadriceps; 67º (± 11.5), 66º (± 11.7), 69º (± 9.4) for right hamstring; 68º (± 13.1), 70º (± 10.2), 69º (± 9.8) for the left hamstring, no statistically significant difference between the groups studied (p> 0.05).

Table 2 presents data related to the third finger test the ground may be the following values at the three observed: 6.7 cm (± 6.8), 5.7 cm (± 6.3) and 3.3 cm (± 4.5) for the scope of the right finger and 7.6 cm (± 7), 6.4 cm (± 6.4) and 3.9 cm (± 4.8) to reach the left finger. Although not obtain statistical difference (p> 0.05), the variation observed from pre to post-late achieved a reduction of 3.4 cm in the right limb. However, the pre to post-late reach the left finger showed a statistically significant difference (p <0.05).

DISCUSSION

The benefits of neural mobilization have been widely researched in the clinical diagnosis of neuropathies, for example, carpal tunnel syndrome[7] and also as a therapeutic resource manual aimed at increasing the muscle activities and maintenance of the power levels seeking to slows the process of muscle fatigue[2] furthermore it has been sought to verify the effectiveness of the technique for gain of range of motion in asymptomatic individuals.[8]

The aim of the study was to evaluate the effects of neural mobilization of the brachial plexus on the gain range of motion in the lower limbs in asymptomatic individuals. The results showed that the evaluation of flexibility of the hamstrings and quadriceps with fleximeter there was no significant gain in range of motion after neural mobilization, however, there was a significant increase in overall flexibility evaluated with the 3rd finger to ground test to reach the left finger.

Many disorders of the musculoskeletal system are changes from the nervous system, and affects the same. Neural mobilization is a therapeutic technique indicated for the treatment of these disorders, but the suggested treatment techniques have limited evidence. [9]

The physiological mechanisms responsible for the therapeutic effects of neural mobilization are not clear, but an effect of neural mobilization is further described in the literature related to flexibility.[10][11][12][13] Neural thixotropic occurs globally, because the nervous system is connected, so when performing a movement in one end automatically promotes the elasticity of the tissues in the other segments.[1] [14] [15] [16] [17] [18]

The results of this research, is somewhat antagonistic to the theory that neural mobilization acts indirectly on the contralateral side to the metameres treatment target, an idea based on the continuity of the peripheral nervous tissue. Importantly, there are no studies that show more evidence on the effect of neural mobilization indireda form, ie in the opposite quadrant or opposite side of the treatment. In one study, Brown *et al* showed that the internal fluid of the nerve bodies moved after the application of neural mobilization, suggesting that this technique promotes axonal transport and therefore the operation of the peripheral nerve.

In another study, Shacklock demonstrates the influence of the voltage neural mobilição nerves, improving flexibility by decreasing the voltage of nerve and muscle tissue. In the present study, although isolated flexibility of the lower limb muscles have not changed significantly, the overall flexibility analyzed through the test of the third finger was altered, suggesting that the mobilization plexus (which was performed only on one side) has decreased neural tension of the entire upper limb altered flexibility of the lumbar spine. More studies are needed to identify the variables only in the lower limbs, or, even metameres or future studies may show that neural mobilization can change the flexibility in specific places.

CONCLUSION

In the present study it is concluded that the neural mobilization does not significantly alter the flexibility of the lower limbs, however there was no difference in overall flexibility, suggesting the need for more studies on the subject and for improving identification of the real indirect effects of mobilization neural.

REFERENCES

1. Schaklock MO. Neurodinamica clínica, primeira edição, butterworth heinemann elsevier, 2007.
2. Maciel TS, da Cruz VWC, Jorge FS, Areas FZS, Ribeiro Junior SM. Efeitos da mobilização neural na força, resistência e recrutamento muscular dos flexores de punho. Ter Man. 2012; 10 (50): 411-416.
3. Ekstron RA, Holden K. Examination of and intervention for a patient with chronic lateral elbow pain with signs of nerve entreptament. Phys Ther. 2002; 82: 1077-1082.

4. Coppieters MW, Butler DS. Do '*sliders*' slide and '*tensioners*' tension? An analysis of neurodynamic tchniques and considerations regarding their application. Manual therapy. 2008;13: 213-221.
5. Coppieters MW, Kurz K, Mortensen TE, Richards NL, Skaret IA, Mclaughlin LM, et al. The impact of neurodynamic testing on the perception of experimentally induced muscle pain. Manual therapy. 2005; 10: 52-60.
6. Butler DS. Mobilização do sistema nervoso. 1 ed. São Paulo: Manole, 2003.
7. Coppieters MW, Ali MA, Paul WH. An experimental pain model to investigate the specificity of the neurodynamic test for the median nerve in the differential diagnosis of hand symptoms. phys med rehabilitation. 2006; 87: 1412-1418.
8. Balster S, Jull J. Upper trapezius muscles activity during the brachial plexus tension test in asymptomatic subject. Manual Therapy. 1997; 2(3): 144-149.
9. Ellis JR, Hing WA. Neural mobilization: A systematic revei of randomized controlled trials with. The journal of manual & manipulative therapy. 2008; 16(1): 8 – 22.
10. Abreu ACD, Godinho IO, Aquino MS. Efeito da técnica neurodinâmica na mobilidade da coluna lombar. Terapia manual. 2007; 5(22); 322-325.
11. Coppieters MW, Stappaerts K, Janssens K, Jull G. Realiability of detecting 'onset of pain' and 'submaximal pain' during neural provocation testing of the upper quadrant. Physioterapy research international. 2002; 7(3): 146-156.
12. Greening J, Leary R. Improving application of neurodynamic (neural tension) and treatments: a message to researchers and clinicians. Manual Therapy. 2007; 122-126.
13. Coppieters MW, Stappaerts KH, Staes FF, Everaert GD. Shoulder girdle elevation during neurodynamic testing: and assessable sign? Manual therapy. 2008; 6(2): 88-96
14. Butler DS, Glifford LS. The concept of adverse mechanical tension in the nervous system. Physiother. Manual Therapy. 1989; 75: 629-636.
15. Godoi J, Keppers II, Rossi LP, Corrêa FI, Costa RV, Corrêa JC, et al. Eletromyographic analysis of bíceps brachii muscle following neural mobilization in patientes with stroke. Eletromiograp clin neurophisiol. 2010; 50(1); 55-60.
16. Hall TM , Zusman M, Elvey R. Adverse mechanical tension the nervous system? Analysis of straight leg raise. Manual Therapy. 1998; 3(3): 140-146.
17. Hall TM, Elvey RL. Nerve trunk pain: Physical diagnosis and treatment. Manual Therapy. 1999; 15: 132-131.
18. Herrington L, Bendix K, Cornwell C, Fielden N, Hankey K. What is the normal response to structural differentiation within the slump and straigt leg raise tests? Manual Therapy. 2008; 13: 289-294.
19. Brown CL, Gilbert KK, Brismee JM, Sizer PS, James CR, Smith MP. The effects of neurodynamic mobilization on fluid dispersion within the tibial nerve at the ankle: an unembalmed cadaveric study. Journal of manual and manipul therp. 2011; 19(1): 26-34.
20. Schacklock MO. Clinical aplication of neurodynamic (neuro tension) testing and treatments: A message to researches and clinicians. Manual Therapy. 2005; 10: 175-179.