



Original Article

Acute effects of neural mobilization and infrared on the mechanics of the median nerve

MONARA KEDMA NUNES^{1)*}, GABRIELLY FONTENELE DOS SANTOS¹⁾, DIANDRA CAROLINE MARTINS E SILVA¹⁾, ANA CLÁUDIA MOTA DE FREITAS¹⁾, ISADORA FERREIRA HENRIQUES²⁾, PETERSON MARCO ANDRADE³⁾, DIONIS DE CASTRO MACHADO^{1, 4)}, SILMAR TEIXEIRA⁵⁾, MARCO ORSINI NEVES⁶⁾, GILDÁRIO DIAS⁷⁾, FERNANDO SILVA-JÚNIOR^{1, 5, 7)}, VICTOR HUGO BASTOS^{1, 4)}

¹⁾ Brain Mapping and Functionality Laboratory (LAMCEF/UFPI), Federal University of Piauí: Av. São Sebastião, 2819, Bloco 16, sala 6 –Parnaíba-PI, CEP: 64202-020, Brazil

²⁾ Masters Program in Physical Education, Federal University of Triângulo Mineiro, Brazil

³⁾ Federal University of Juiz de Fora (UFJF), Governador Valadares Campus, Brazil

⁴⁾ Brain Mapping and Sensorial Motor Integration, Institute of Psychiatry of Federal University of Rio de Janeiro (IPUB/UFRJ), Brazil

⁵⁾ Brain Mapping and Plasticity Laboratory (LAMPLACE/UFPI), Federal University of Piauí, Brazil

⁶⁾ Masters Program in Rehabilitation Sciences, University Center Augusto Mota, Brazil

⁷⁾ Laboratory of Neurophysics (LANF/UFPI), Federal University of Piauí, Brazil

Abstract. [Purpose] This study analyzed the acute effects of infrared and neural mobilization on the median nerve on the range of elbow extension of the dominant limb. [Subjects and Methods] Forty participants from university, neurologically asymptomatic, 12 males and 28 females (22.8 ± 1.9 years), were randomly divided into four groups: Group 1 (control) rested for 25 minutes in the supine position; Group 2 received the specific neural mobilization for the median nerve; Group 3 received an application of infrared for 15 minutes on the forearm; Group 4 received the same application of infrared followed by neural mobilization. The goniometric parameters of elbow extension were evaluated after the intervention. [Results] Significant differences of extension value were observed between Group 1 and Group 3 (15.75 degrees), and between Group 1 and Group 4 (14.60 degrees), and the average higher in Group 3 (26.35 degrees). [Conclusion] This research provides new experimental evidence that NM in relation to superficial heat produces an immediate effect on elbow range of motion versus NM isolated.

Key words: Range of motion, Median nerve, Infrared

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INTRODUCTION

Functionality depends on tangible aspects as well as personal and environmental factors. One of its components is human movement which needs undamaged body structures for its proper functioning¹⁾. During daily activities, the human body experiences mechanical stresses that are distributed in order to prevent injuries and dysfunction. This force transfer is partially a consequence of the structure of the nervous system^{2, 3)}, and it can be evaluated through neurodynamic tests that analyze, based on anatomy, the mobility of specific nerves for being designed in a controlled position of the member^{4, 5)}. Nervous system movement disabilities or / and elasticity may compromise the homeostasis of neurodynamics and result in Adverse Neural Tension (ANT), a term used to explain how pathology affects the normal movement and biomechanics of the nervous system and its surrounding tissues⁶⁾.

Techniques that restore nerve mobility that has restricted longitudinal movement are often called neural mobilization

*Corresponding author. Monara Kedma Nunes (E-mail: monarakedma@hotmail.com)

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techniques. Neural Mobilization (NM) includes manual therapy techniques (gliding and stretching) that have been shown to decrease disability and hypoalgesia when used as a treatment for various musculoskeletal and neural disorders. When neural mobilization is used to treat adverse neural tension, the primary objective is to restore the movement and the elasticity of the peripheral nervous system, besides promoting a return of normal function^{7, 8)}, and amelioration of the symptomatic condition. Neural mobilization studies have been reported to be effective at reinstating functionality^{9, 10)}, but to the best of our knowledge no study has investigated NM in association with hyperthermia provided by infrared (IR), a modality often used in clinical practice for muscle relaxation^{11, 12)}, pain reduction and repair promotion of soft tissue injuries¹³⁾. Infrared acts on collagen and decreases tissue resistance^{12, 14)}. Moreover, heat promoted by neurotendineous sensitivity reduces muscle tension reduction¹⁵⁾, tiredness and muscle pain and it also limits blood flow and prevents the removal of metabolites¹⁶⁾. Some factors such as connective tissue extensibility influence the magnitude of body motion¹⁷⁾, and this insufficient median nerve mobility compromises elbow extension¹⁸⁾. It thought that IR might enhance NM effects, thereby increasing the amplitude elbow extension. Thus, this study analyzed the acute effects of superficial heat and neural mobilization of the median nerve on the range of elbow extension of the dominant limb.

SUBJECTS AND METHODS

A randomized controlled clinical trial was carried out at the Federal University of Piauí Physiotherapy Clinical School. The subjects were 40 students, 12 males and 28 females (average age 22.8 ± 1.9 years), from the university who had no neurological diseases. Subjects were excluded if they had limited passive range of movement of the upper body. All participants were aware of the aims of this study before participating in the study, which was approved by the University of Piauí Committee Research Ethics –838854 / 2014.

The participants were randomly divided into four groups of ten subjects: G1 (control group), G2 (neural mobilization group), G3 (infrared group), and G4 (neural mobilization and infrared group). The dominant arm was identified using the Edinburgh Handedness Inventory¹⁹⁾, NM involved placing subject in the supine position. The neck was pulled and tilted to the opposite side of the limb to be tested, and the shoulders were lowered and abducted at 90° followed by external rotation. Gradually, the elbow, wrist and fingers were extended. When slight tension was reported by a subject, the therapist decreased the angle of the elbow and oscillatory movements of the wrist for a minute, followed by three minutes of rest. Neural mobilization three sets^{20–23)}. In G1 (control), the participants rested comfortably for 25 minutes lying on the table in the supine position, with their arms extended along the body. In G2, a NM technique for the median nerve was applied. In G3, infrared (IR) was applied for 15 minutes from 40 cm above the forearm²⁴⁾. In G4, IR was applied for 15 minutes followed by a NM technique for the median nerve.

Before and after the intervention subjects scored a Visual Analogue Scale (VAS) to identify the intensity of pain experienced. Goniometric measurements were made before and after the intervention using a universal goniometer in order to evaluate the effects of the interventions on the maximum angle elbow extension. The Upper Limb Neurodynamical Test (ULNT) was performed at the same position described for the NM technique for the median nerve, and the reported individual neural tension was measured based on the angle. The reference points used for the goniometer were the styloid process, medial epicondyle of the humerus and the coracoid process²⁵⁾, which were identified and marked before positioning the individuals in order to reduce the chances of error during the goniometry.

All protocols were performed by the same examiner and the goniometric analyses were performed by an assistant.

Statistical analyses were performed using the BioEstat 5.3 program. The Kruskal-Wallis and the Dunn test were performed to compare the groups, and significance was accepted for values of $p \leq 0.05$. The differences in elbow extension were analyzed as well as the delta of the values of VAS (Delta=final value –initial value).

RESULTS

The Kruskal-Wallis test found no significant differences in the VAS data, $H(3)=1.3307$, $p=0.72$. The group that received neural mobilization reported higher pain scores (Table 1). Analysis of the gain in the range of motion there were very significant showed differences among the intervention groups $M(3)=11.3837$, $p \leq 0.01$ (Tables 2 and 3).

DISCUSSION

The aim of this study was to analyze the acute effects of superficial heat with neural mobilization for the median nerve on the elbow extension range. As expected, the combination of NM and infrared significantly increased the range of motion in comparison to the control group. The nervous system has two intimately related components: a connective tissue component and a neural tissue component. NM and infrared act on these tissues and increase their extensibility. Increased elbow extension after NM was also reported by Vasconcelos, Lins and Dantas¹⁰⁾, whose sample and method of measuring elbow extension were similar to those of this study. The increase in elbow extension is explained by the ability of NM to restore the nerve system movement and musculoskeletal structures innervated by it^{26, 27)}.

The combination of NM and hyperthermia proved to be more effective than NM alone, because infrared has an acute

Table 1. VAS Values: The median, and maximum and minimum values of Delta of VAS scores of each intervention group

Groups	Median	Mean rank	Min–Max
Control	2	20.80	0–2
Neural Mob.	2	21.50	0–5
Infrared	0	17.00	0–0
Infrared and Neural Mob.	3	22.70	0–3

*p<0.05, Kruskal-Wallis test

Table 2. Goniometry values (degrees): The median, and maximum and minimum values of the gain in the range of motion elicited by the intervention of each intervention group

Groups	Median	Mean rank	Min–Max
Control	1	10.60*	–9–5
Neural Mob.	7	19.85*	–2–23
Infrared	10.5	26.35*	1–20
Infrared and Neural Mob.	8.5	25.20*	–1–50

*p<0.05, Kruskal-Wallis test

Table 3. Differences in the averages of goniometry values among the groups

Differences between the averages	
G1–G2	6.50 degrees
G1–G3	5.35 degrees
G1–G4	9.25 degrees
G2–G3	1.15 degrees
G2–G4	15.75 degrees *
G3–G4	14.60 degrees *

G1: control, G2: neural mobilization, G3: infrared, and G4: infrared plus neural mobilization.

*p<0.05, Kruskal-Wallis test

effect on the mechanical interface, acting directly on the tissue collagen in the muscles modifying its viscoelastic properties, as well as causing sensory and analgesic stimulation enhancing tolerance to stretching²⁸). The heat transmitted by infrared penetrates about one centimeter in depth by thermal conduction^{29, 30}), preferably influencing the most superficial tissues²⁴). IR effects are elicited by vasodilation which increases the supply of nutrients and oxygen to the tissues decreasing feelings of fatigue^{31–33}). In addition, muscle relaxation resulting from an increase in the sensitivity of the neurotendineous organs³⁴), and a decrease in pain as a consequence of increased stretching and pain tolerance, allows a greater range of motion²⁸).

Sousa et al.²⁹) used a sample of 103 patients with impact syndrome diagnosis and verified the effect of isolated kinesiotherapy associated with infrared or laser GaAs. They verified that the combination of the techniques does not influence the outcome of the intervention. Thus, the use of human movement is still one of the main intervention resources that the physiotherapist has to treat injuries. However, unlike the study of Sousa et al.²⁹), the sample used in this study consisted of asymptomatic individuals, and inflammatory processes or other variables difficult to control, such as pain level or degree of injury were not limiting factors.

In the present study, unlike other studies, NM was not superior to the other techniques compared with it^{10, 35}). Its use resulted in a significant increase in elbow range of motion, showing it is an effective remedy for the treatment of ANT. Differences between the present results and those reported in the literature may be explained by the capacity for perception of pain, a subjective variable that is influenced by psychosocial factors^{36, 37}). Pain influences the range of motion¹⁰).

This research provides new experimental evidence that NM in combination with superficial heat elicits an immediate effect on elbow range of motion compared to NM alone. Future controlled trials are warranted to evaluate changes in the range of motion in different musculoskeletal disorders that can be treated with NM and to compare this technique with other physiotherapeutic modes.

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