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PROPRIOCEPTIVE NEUROMUSCULAR FACILITATION IN RADIAL NERVE INJURY: A CASE REPORT

FACILITAÇÃO NEUROMUSCULAR PROPRIOCEPTIVA NA LESÃO DO NERVO RADIAL: UM RELATO DE CASO

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ABSTRACT: **Objective**: To report the physiotherapeutic treatment using Proprioceptive Neuromuscular Facilitation (PNF) in a patient with radial nerve neuropraxia. **Method**: Case report of a patient with wrist drop following alcohol consumption. Upper limb function was assessed using the DASH scale, muscle strength with the MRC, wrist range of motion with goniometry, grip strength with a dynamometer, and tactile sensitivity of dermatomes C5 to C8. **Results**: The DASH score decreased, indicating improved upper limb functionality. Muscle strength increased from grade 0 to 3 in wrist extension and from 0 to 4 in finger extension, with normalization of sensitivity and complete recovery of range of motion. **Conclusion**: The PNF protocol resulted in significant improvements in muscle strength, sensitivity, range of motion, and upper limb functionality after three months of treatment.

KEYWORDS: Case report. Physiotherapy. Radial neuropathy. Rehabilitation.

RESUMO: **Objetivo**: Relatar o tratamento fisioterapêutico utilizando Facilitação Neuromuscular Proprioceptiva (FNP) em paciente com neuropraxia do nervo radial. **Método**: Relato de caso de paciente com queda de punho após consumo de álcool. Avaliaram-se a função dos membros superiores pela escala DASH, a força muscular pelo MRC, a amplitude de movimento do punho por goniometria, a força de preensão manual por dinamômetro e a sensibilidade tátil dos dermátomos de C5 a C8. **Resultados**: O escore da DASH diminuiu, indicando melhora na funcionalidade do membro superior. A força muscular aumentou de grau 0 para 3 na extensão do punho e de 0 para 4 na extensão dos dedos, com normalização da sensibilidade e recuperação completa da amplitude de movimento. **Conclusão**: O protocolo de FNP resultou em melhora significativa da força muscular, sensibilidade, amplitude de movimento e funcionalidade do membro superior após três meses de tratamento.

PALAVRAS-CHAVE: Fisioterapia. Neuropatia radial. Reabilitação. Relato de caso.

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INTRODUCTION

Radial nerve injury (i.e., Saturday night palsy or honeymoon palsy) occurs by direct and prolonged compression of the radial nerve in the spiral groove of the humerus during sleep and is noticeable upon waking. The clinical sign is wrist drop (i.e., active wrist extension is not maintained) and numbness on the back of the hand[1], which impairs fingers and thumb function and hinders tasks that require manual dexterity. Although it is a self-limiting disease, radial nerve injury can be diagnosed using electromyography and presents a good prognosis[2, 3].

Proprioceptive Neuromuscular Facilitation (PNF) is a therapeutic approach that, through its principles, philosophy, and procedures, plays a crucial role in physical rehabilitation. Its basic principles include motor learning and the functional maintenance of newly acquired activities, using the repetition of specific tasks and the progression of motor behavior development. This approach allows patients to create and recreate efficient functional movement strategies, as well as to analyze biomechanics and motor learning[4, 5].

The PNF concept significantly aids the rehabilitation process, providing improvements in various areas such as motor learning, physical performance, flexibility, muscle strengthening, increased range of motion, and motor coordination. Proper rehabilitation not only facilitates recovery but also prevents the progression of conditions that could lead to more severe physical disabilities, such as muscle atrophy and loss of mobility[4, 5].

The therapeutic approach using Proprioceptive Neuromuscular Facilitation (PNF) is essential for recovering strength, flexibility, and motor coordination—key aspects for preventing loss of functionality and ensuring efficient performance in daily activities. An effective intervention not only contributes to a more complete recovery but also reduces the risk of future complications, allowing the patient to return more quickly to their daily life activities[4, 5]. Therefore, this study aimed to report the physical therapy treatment using PNF in a patient with radial nerve injury.

METHODOLOGY

This case report was conducted from July 2021 to September 2021 and approved by the research ethics committee of the Health Sciences Center of the Federal University of Pernambuco (no. 5,571,388). The patient signed the informed consent form.

CASE PRESENTATION

A male patient, 62 years, smoker, and retired, woke up on 7 July 2021 feeling numbness and painless loss of movement in the left wrist and fingers. The patient reported substantial alcohol consumption the previous night and denied any personal or family history of hypertension and diabetes, and he was not taking any medications. A neurologist performed electromyography (August 3, 2021) and found a radial nerve injury, likely in the spiral groove region (neurapraxia).

The patient was not submitted to previous treatment and started the physical therapy on 12 July 2021. A form containing personal information and clinical history was filled out, followed by physical assessment. A total of 36 sessions were initially performed three times a week, evolving to twice a week until patient discharge (29 September 2021). The treatments were performed at home over a three-month period.

PHYSICAL THERAPY ASSESSMENT

Assessments were conducted on 12 July 2021, 09 August 2021, and 29 September 2021. Personal information and data on the clinical history of the disease were collected during anamnesis. Wrist drop and slight atrophy of wrist extensor muscles were observed during inspection (Figure 1A).

For functionality assessment, the DASH (Disabilities of the Arm, Shoulder, and Hand) was used, which is a specific evaluation instrument that covers the entire upper extremity and was developed to measure dysfunctions and physical symptoms. It consists of 30 questions involving 18 components: pain, weakness, recreational activities, daily activities, household chores, shopping, recreational activities, self-care, dressing, eating, sexual activities, sleeping, family care, work, socialization, and self-image. The total score ranges from 0 to 100, with zero representing no dysfunction and 100 representing severe dysfunction[6].

In the assessment of range of motion (ROM), wrist joint goniometry was used, which is a widely used manual method in clinical physiotherapy practice due to its low cost and ease of measurement, relying on the experience and manual skill of the evaluator. A universal goniometer, consisting of two arms and an axis, is used to assess each passive and active movement of the wrist joint.[7].

To assess muscle strength, the Medical Research Council (MRC) score was used. The applicability of this method involves performing a bilateral manual test on muscle groups, assigning scores that range from 0 (total paralysis) to 5 (normal muscle strength).[8] Tactile sensitivity was assessed using a cotton pad on areas corresponding to the C5 to C8 dermatomes, at two predetermined points (proximal and distal) for each root[9]. Sensitivity was classified as normal, altered, or absent.

To assess handgrip strength, the Jamar® dynamometer was used. The patient was seated with the arm at the side of the body, the elbow flexed at 90 degrees, and the wrist in a neutral position. The patient was instructed to squeeze the dynamometer with maximum strength and maintain the pressure for a few seconds. Three measurements were taken for each hand, with one-minute intervals between the measurements, and the average of the values obtained was calculated[10]. The patient did not report pain before and during treatment; however, mild discomfort was reported in the posterolateral region of the arm, mainly when waking up or after intense effort.

As a treatment proposal, a PNF protocol for radial nerve neuropraxia was developed and used as described in Appendix 1. The exercises were performed respecting the reinervation time, with the goal of promoting scapulothoracic and glenohumeral stability, gaining muscle strength in wrist and finger extensors, and improving muscle strength and coordination between agonist and antagonist muscles. To achieve this, the following techniques were used: combinations of isotonics, rhythmic initiation, and reversal of stabilizations in both direct and indirect ways (irradiation).

RESULTS AND DISCUSSION

This study proposed a physical therapy treatment based on the PNF concept using techniques unpublished in the literature to treat a patient with radial nerve injury. Although common, previous studies did not evaluate the prevalence of radial nerve injury causing neuropathies2.

In the first assessment, the patient could not perform active wrist, thumb, and finger extension and presented MRC grade 0 for the corresponding muscles (Table 1). A sensitivity alteration was also observed in the dorsal region of the thumb, and handgrip strength was almost six-fold lower than the healthy limb grip.

Table 1. Variables assessed during the physical therapy treatmentDASH = Disabilities of the Arm, Shoulder, and Hand scale; MRC = Medical Research Council. Kgf = kilogram-force

Variables	Assessment 1 (12 Jul 2021)	Assessment 2 (9 Aug 2021)	Assessment 3 (29 Sep 2021)
DASH (score)	44.2	32.5	7.5
Muscle strength - MRC (0 to 5)			
- Extensor carpi radialis longus	0	1	3
- Extensor carpi radialis brevis	0	1	3
- Brachioradialis	0	1	3
- Finger extensors	0	1	3
- Long thumb extensor	0	1	4
- Short thumb extensor	0	1	4
- Extensor digiti minimi	0	1	4
- Extensor indicis	0	1	4
Handgrip strength (Kgf)			
- Right hand	37.3	32.6	36.3
- Left hand	6.3	9.3	12.0
Tactile sensitivity			
Dorsal region of the thumb	Altered	Altered	Normal
Active range of motion (in degrees)			
- Wrist extension	Did not perform	0° (neutral position)	65°
- Finger extension	Did not perform	10°	30°
- Thumb extension	Did not perform	8°	60°

These clinical findings were related to radial nerve injuries, which included weakness in the extensor muscles of the hand and fingers or hypesthesia or dysesthesia over the superficial sensory branch area[3].

Radial nerve injuries present a good prognosis and are treated conservatively (e.g., analgesic drugs, corticosteroid and steroid injections, immobilization using splints for at least two to four weeks or until symptom reduction, and physical therapy) depending on injury severity and symptoms. Surgery is the last option, indicated to relieve pressure in cases of compression or when symptoms last for several months[2].

Furthermore, it is important to consider the regenerative capacity of the peripheral nervous system (PNS), which exhibits a remarkable ability to regenerate after injury. This process involves the coordinated action of various cell types and signaling pathways. Schwann cells (SCs), in particular, play a crucial role in nerve regeneration. After an injury, SCs transdifferentiate into repair cells, orchestrating a regenerative response that promotes nerve repair[11,12,13].

The physical therapy treatment must contemplate the performance (structural level) and functional expectations (i.e., components of activities and participation in personal and environmental contexts) of the patient[11]. In this sense, the PNF is a treatment option because it is based on motor learning principles and emphasizes functional movements[14] during daily activities to restore functionality, muscle strength, tactile sensitivity, and range of motion.

Figure 1 shows the evolution of wrist extension (structural level), while Figure 2 shows the movement during a daily functional task. The active participation of the patient was requested from the beginning of therapy, and the movement of strong body parts may have indirectly stimulated the activation of those weak parts[14]. In addition, the patient reported improvement during daily activities, such as holding objects, bringing the glass to the mouth, using deodorant, and cooking.

Figure 1. Position of the left wrist when asked to extend the wrist and fingers. A - during the initial assessment (wrist drop). B – during the final assessment.

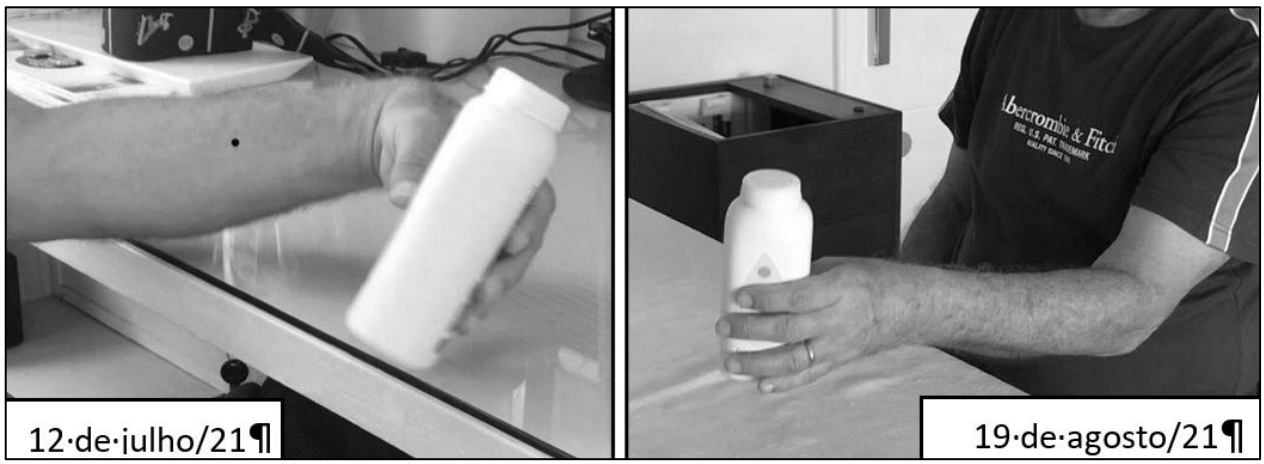

Figure 2. Evolution of the left wrist when holding an object.

Early intervention must be performed for adequate functional recovery and to avoid muscle atrophy, neuromas, and alterations in the cortical map. Thus, the PNF may have favored neural recruitment compared with movements performed in a single plane because it involved complex movements (i.e., stimulating functional muscle activation and improving movement efficiency)[15].

The use of functional tasks has proven to be more effective than isolated movements in rehabilitating patients, as it involves motor learning and the reorganization of perception and action systems related to tasks and environments in which patients are involved. In addition, repetitions of a

specific task improve motor learning and enables the patient to develop and recreate efficient movements with correct biomechanics[16].

The therapeutic approach based on PNF facilitated the restoration of movement capacity and the improvement of muscle strength by integrating functional exercises that stimulated both motor learning and the efficient activation of the affected muscles. With the application of specific PNF techniques, the patient showed notable improvements in range of motion, grip strength, and motor coordination, reflecting a quicker and more effective recovery of the compromised functions.

The exercise protocol was organized respecting the individuality of the patient regarding intensity, resistance, frequency, and progression of exercises. Thus, PNF may be considered a low-cost and easy-to-apply treatment because additional resources or equipment are not required; conversely, an experienced physical therapist is needed.

The adherence of the patient to the treatment was important to improve activities of daily living. No adverse events were reported during sessions, and a follow-up assessment was not performed. However, only one patient was treated in the present study, which is considered a limitation. Last, further studies conducted with PNF and large sample sizes are encouraged to guide clinical practice.

CONCLUSION

Upper limb function, muscle strength, tactile sensitivity, and range of motion improved in a patient with radial nerve neuropraxia after a Proprioceptive Neuromuscular Facilitation (PNF)-based physical therapy treatment.

REFERENCES

1. Duz B, Solmaz I, Civelek E, Onal MB, Pusat S, Daneyemez M. Analysis of proximal radial nerve injury in the arm. **Neurol India**. 2010;58(2):230. doi:10.4103/0028-3886.63802.

2. Gragossian A, Varacallo M. Radial nerve injury. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023. PMID: 30725989. Disponível em: https://www.ncbi.nlm.nih.gov/books/NBK537304/.

3. Kerasnoudis A, Ntasiou P, Ntasiou E. Prognostic value of nerve ultrasound and electrophysiological findings in Saturday night palsy. **J Neuroimaging**. 2017;27(4):428-32. doi:10.1111/jon.12414.

4. Alencar R, Cordeiro T, Anjos P, Cavalcanti P. Neuromuscular facilitation proprioceptive on the mat repurchase of functions in spinal cord injury. **Rev Neurocienc**. 2011;19:512-8. Disponível em: https://www.researchgate.net/publication/307936651_Neuromuscular_facilitation_proprioceptive_on_the_mat_repurchase_of_functions_in_Spinal_Cord_injury.

5. Queiroz MLdS, Wanderley D, Coriolano MdGWdS, Belo LR, Martins JV, Barboza PJM, et al. Efeitos da irradiação de força contralateral na extensão de punho de pacientes após acidente vascular cerebral. **Rev bras neurol**. 2016:5-11. doi:10.46979/rbn.v52i2.4187.

6. Orfale AG. Tradução e validação do Disabilities of the Arm, Shoulder and Hand (DASH) para a língua portuguesa. 2003. Disponível em: https://repositorio.unifesp.br/handle/11600/19992.

7. Marques AP. **Manual de goniometria**. Barueri: Editora Manole; 1997. Disponível em: https://www.manole.com.br/manual-de-goniometria-3-edicao/p?srsltid=AfmBOoqDrfKFhsVdycUP.

8. No MM. **Aids to the examination of the peripheral nervous system**. London: HMSO; 1976. Disponível em: https://www.ukri.org/publications/aids-to-the-examination-of-the-peripheral-nervous-system/.

9. NHS Scotland. Serviço escocês de lesões do plexo braquial adulto informações para fisioterapeutas, p. 30, 2016. Disponível em: https://www.brachialplexus.scot.nhs.uk/documents/Info%20for%20Physios.pdf.

10. Moreira D. Estudo sobre a realização da preensão palmar com a utilização do dinamômetro: considerações anatômicas e cinesiológicas. **Fisioter Bras**. 2001;2(5):295-300. doi:10.33233/fb.v2i5.651.

11. Nocera G, Jacob C. Mechanisms of Schwann cell plasticity involved in peripheral nerve repair after injury. **Cell Mol Life Sci**. 2020;77:3977-3989. doi:10.1007/s00018-020-03516-9.

12. Bosch-Queralt M, Fledrich R, Stassart R. Schwann cell functions in peripheral nerve development and repair. **Neurobiol Dis**. 2023;176:105952. doi:10.1016/j.nbd.2022.105952.

13. Cassilhas R, Tufik S, Mello M. Physical exercise, neuroplasticity, spatial learning and memory. **Cell Mol Life Sci**. 2016;73:975-983. doi:10.1007/s00018-015-2102-0.

14. Adler SS, Beckers D, Buck M. **PNF in practice**. 4th ed. Berlin: Springer-Verlag; 2014. Disponível em: https://www.academia.edu/36669442/An_Illustrated_Guide_PNF_in_Practice_Fourth_Edition.

15. Moreira R, Lial L, Monteiro MGT, Aragão A, David LS, Coertjens M, et al. Diagonal movement of the upper limb produces greater adaptive plasticity than sagittal plane flexion in the shoulder. **Neurosci Lett**. 2017;643:8-15. doi:10.1016/j.neulet.2017.02.022.

16. Shumway-Cook A, Woollacott MH, Rachwani J, Santamaria V. **Motor control: translating research into clinical practice.** 6th ed. Philadelphia: Lippincott Williams & Wilkins; 2023. Disponível em: https://www.researchgate.net/publication/228118305_Motor_Control_Translating_Research_Into_Clinical_Practice.