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The efficacy of proprioceptive neuromuscular facilitation (PNF) in patients with stroke

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Abstract

Background: Stroke is one of the most common central nervous system disorders. Early intervention through the Proprioceptive Neuromuscular Facilitation (PNF) technique can contribute to the better physiotherapy treatment of the person with stroke by improving the quality of their movement and reducing their functional limitations.

Aim: The aim of this review is to describe recent research data on the efficacy of this method in improving functioning in patients with stroke.

Method: The Google Scholar and PubMed databases were searched with the following keywords: stroke, PNF, rehabilitation.

Results: This review included 10 articles.

Discussion - Conclusions: The application of the PNF method seems to have a positive effect on the treatment of movement disorders in patients with stroke when compared to conventional physiotherapy. The results of this review show that the intensive initiation of the PNF method is able to improve the functional level of the person with stroke in their daily life.

Keywords: Stroke, PNF, rehabilitation

Introduction

Stroke is a syndrome of acute loss of cerebral blood flow with cerebral and focal manifestations, which depend on the damage to the brain tissue resulting from arterial thrombosis, embolism or hematoma originating from a dysfunction of the brain circulatory system^[1]. This is a result of insufficient blood, oxygen and glucose flow to the brain. Stroke is classified according to its pathogenesis into two major categories, hemorrhagic and ischemic type. It is estimated that 12-20% of strokes are hemorrhagic type and about 80-88% are ischemic type^[1,2]. The factors that favor the strokes are divided into non-modifiable and modifiable factors. Non-modifiable risk factors are age, sex, nationality, race and heredity. The most important modifiable risk factors are hypertension, atrial fibrillation, hyperlipidemia, diabetes, smoking, carotid artery stenosis, alcohol consumption, drug use, lack of exercise, obesity, and obesity. Strokes have a special place in clinical neurology as the brain is the center of the nervous system. They require immediate treatment as the passage of time can dramatically worsen their development^[1].

Stroke is one of the leading causes of death globally after heart disease and cancer^[2,3]. It is responsible for a large percentage of disability caused by diseases of the central nervous system. Every year, according to data from the World Health Organization (WHO), 5.5 million people die worldwide due to strokes^[2]. According to the Stroke Association, every two seconds a stroke occurs somewhere in the world. One in eight S.A.E. is fatal within the first 30 days, while almost 2/3 of those who have survived will be discharged from the hospital showing some disability in the future^[3].

To combat stroke a multifactorial treatment is required through a rehabilitation team, i.e., specialized medical nursing staff and collaboration with physiotherapists, speech therapists and other health scientists, who will design the treatment based on the specificity of each patient^[4].

Proprioceptive Neuromuscular Facilitation (PNF) is a method used to restore joint range of motion, improve functioning and increase endurance and strength in patients with tissue damage (e.g., muscle, tendons), who are in the post-operative recovery phase or have damage to the central nervous system such as stroke^[5].

The philosophy of PNF includes the process of designing evolutionary therapy that focuses on the positive functional approach, the activation of reserves, the examination of the individual as a whole and the use of motor control and motor learning rules [6]. It is a method that is not applied to muscles individually but concerns movement patterns. It can be applied directly to an area of the body or indirectly. The indirect approach does not directly mobilize the affected area, but activates it by activating other healthy parts of the body using the phenomenon of reflection [7]. The aim of this review is to describe recent research data on the applications of PNF in patients with stroke.

Literature review

The Google Scholar and PubMed databases were searched with the following keywords: stroke, PNF, rehabilitation. The review included clinical trials, systematic reviews and case studies. Below are the main conclusions of the articles included in this review.

In their review, Gunning and Uszynski [8] focused on studying the efficacy of specific PNF techniques on gait parameters in stroke patients. The studies included attempted to evaluate the parameters of gait, in which PNF techniques would be used in individuals after the stroke. There were five studies that met the inclusion criteria for this review. The data were extracted from the studies by both authors and examined independently. The researchers eventually found that treatment using the PNF method resulted in a statistically significant improvement in gait in stroke patients in all studies. Three of the studies also showed that groups receiving PNF techniques had significantly greater improvement in gait outcomes than groups receiving conventional physiotherapy.

Kim *et al.* [9] in a clinical study investigated the efficacy of exercise for core stability using PNF to activate the muscles of patients with stroke. The study involved 40 adult patients with hemiplegia, who were randomly divided into two groups: the experimental group, in which patients performed core stability exercise using the PNF method and the control group, who performed only one general exercise program for six weeks (five times per week). The experimental group showed significant improvements in the activities of the quadriceps and the plantar muscles on the affected side as well as on the unaffected side, while the control group showed significant improvements only in the activities of the quadriceps and the plantar muscles on the unaffected side. The final results showed that core stabilization exercises using PNF in patients with stroke were effective in improving the muscular activity of the sole and quadriceps, in both the healthy and the affected lower limb.

Furthermore, Seo and Kim [10] investigated the effect of PNF on ramp gait exercise training using PNF patterns on the lower limb for dynamic balance ability in patients with chronic stroke. The study involved 30 patients with stroke, who were randomly assigned to the experimental group receiving 30 minutes of exercise therapy and 30 minutes of ramp walking training with PNF and the control group receiving 30 minutes of exercise therapy and land-based training for 30 minutes. The interventions were performed in 30-minute sessions, three times a week for four weeks. This study showed that ramp gait training with PNF improved the dynamic balance ability of patients with stroke and is recommended as a combination therapy in the treatment of these patients.

Also on the topic of dynamic balance in stroke patients, Seo *et al.* [11] examined the effects of the combination of step training and PNF. A total of 30 stroke patients participated in this study, who were divided into intervention and control groups. The intervention group followed an exercise program for 30 minutes in combination with step walking training and PNF, also for 30 minutes. The control group followed exercise therapy for 30 minutes and land-based gait training with PNF application for 30 minutes. The program lasted for four weeks and was performed three times a week, for 30 minutes at a time. The research showed that the gait training group to which PNF was applied significantly improved their balance ability.

In their review, Guiu-Tula *et al.* [12] found that there are potential benefits of using PNF to improve the activities of daily living and the quality of life of people with stroke. The researchers included in their review randomized clinical trials involving PNF intervention performed on stroke survivors up to April 2017. They concluded that PNF improves the functioning and quality of life of stroke patients by making them more functional in their daily activities.

Moreover, Wang *et al.* [13] studied the direct effect of PNF on muscle tone and muscle stiffness in patients with stroke. The study involved 30 individuals, who were equally divided into the stroke group (15 participants with chronic stroke) and the healthy group (15 healthy participants). Measurements taken before the intervention revealed that the muscles of the lower limb of the stroke group showed unusually increased muscle tone and stiffness compared to the muscles of the lower limb of the healthy group. The findings of this study showed that PNF intervention in both affected and unaffected sides helped reduce abnormally increased muscle tone and stiffness in the lower limb muscles of patients with chronic stroke.

In a case study, Cayco *et al.* [14] described the effects of a PNF program on balance, strength, and mobility in older adults with chronic stroke. The patient was a 69-year-old man with right hemiplegia for 17 years and had decreased balance, decreased balance confidence, decreased lower limb strength and decreased gait speed. The patient received one hour of PNF-based treatment three times a week for six weeks. The conclusion was that PNF was effective in enhancing balance, strength and mobility in the patient with chronic stroke. The authors suggested that similar research be conducted in the future and argued that this treatment may also reduce the risk of falls in this population.

In another study, Morreale *et al.* [15] investigated the effect of treatment initiation time on the recovery process of patients with stroke. The researchers observed that early mobilization combined with the PNF technique could improve functional recovery after stroke. Finally, researchers argue that the significant impact of time and technique can influence decision-making in the acute phase of care in order to better restore mobility, especially in the lower limbs.

The observation that PNF is a neurophysiological approach that facilitates central and peripheral nervous system stimulation was made by Poonam *et al.* [16]. In this study, the aim was to assess Brain-Derived Neurotrophic Factor (BDNF) levels as well as functional recovery, before and after PNF intervention in patients with acute stroke. A total of 208 patients with confirmed stroke were evaluated for the first time for severity, type, psychological screening,

functional independence measurement scale and BDNF levels before and after the PNF intervention. BDNF levels were also assessed in healthy subjects to determine cut-off values in healthy subjects. The researchers concluded that PNF is effective in improving the functional level in acute stroke, regardless of the type of stroke and risk factors. Lastly, Paulina *et al.* [17] studied the effect of the combination of kinesiotherapy and PNF in relation to the application of only conventional kinesiotherapy on functional ability and muscle tone in patients after ischemic stroke. Their study involved 30 patients after an ischemic stroke, who were equally divided into two groups of 15 participants each. Group I (intervention) followed a combination of PNF and kinesiotherapy, while group II (control) followed only kinesiotherapy. The results showed that the combination of PNF and kinesiotherapy had better result with a statistically significant difference in both functional ability and tone reduction. The researchers concluded that the addition of PNF to a conventional physiotherapy program significantly improves functional ability and muscle tone in patients with stroke.

Discussion – Conclusions

The results of this review show that the PNF method contributes significantly to the rehabilitation of patients with stroke. PNF is effective in improving the functional capacity of patients with stroke, when applied in combination with training on a ramp or steps in conjunction with conventional physiotherapy [10-11]. Many studies in patients who have used the PNF method during their rehabilitation treatments have shown a significant improvement in core stability and therefore in their gait as well as in their daily activities, both on the affected and the healthy side [9, 11-12]. This had the effect of better balance, strength and endurance of the patient regardless of gender or time of onset of stroke [13]. In addition, the timely start of its application has an important role in the rehabilitation of patients, because the long stay of the patient in bed causes irreparable damage [15]. In conclusion, the PNF technique has the advantage - compared to other techniques - that it is based on the positive functional approach of the patient and the activation of the hidden reserves, in order to reduce the stiffness of the brain and to facilitate the functional recovery of the patient. This is the reason why physiotherapists who apply the method of PNF must be properly trained, very careful and with respect to the particularities of each patient.

References

1. Smith T. The Macmillan Guide to Family Health. Macmillan; 3rd Ed [Internet] 1994, 880. Available from: <https://books.google.co.il/books?id=tUuBQgAACAAJ>
2. Hadjiev DI, Mineva PP, Vukov MI. Multiple modifiable risk factors for first ischemic stroke: A population-based epidemiological study. *Eur J Neurol* 2003;10(5):577-82.
3. Sheila L, Gita R, Geert V. Neurological Physiotherapy Pocketbook E-Book (Physiotherapy Pocketbooks) 2nd Edition, Kindle Edition. Elsevier 2018, 592.
4. Pollock A, Baer G, Campbell P, Choo PL, Forster A, Morris J, *et al.* Physical rehabilitation approaches for the recovery of function and mobility following stroke. *Cochrane Database Syst Rev* 2014, (4).
5. Hindle K, Whitcomb T, Briggs W, Hong J. Proprioceptive neuromuscular facilitation (PNF): Its mechanisms and effects on range of motion and muscular function. *J Hum Kinet* 2012;31(1):105-13.
6. Adler Susan, Beckers Dominiek, Buck Math. PNF in Practice: An Illustrated Guide 3rd Edition by Adler, Susan, Beckers, Dominiek, Buck, Math (2007) Paperback Paperback – January 1, 1707. 2007, 3rd Editio:302.
7. Sato H, Maruyama H. The effects of indirect treatment of proprioceptive neuromuscular facilitation. *J Phys Ther Sci* 2009;21(2):189-93.
8. Gunning E, Uszynski MK. Effectiveness of the Proprioceptive Neuromuscular Facilitation Method on Gait Parameters in Patients with Stroke: A Systematic Review. *Arch Phys Med Rehabil* [Internet] 2019;100(5):980-6. Available from: <https://doi.org/10.1016/j.apmr.2018.11.020>
9. Kim Y, Kim E, Gong W. The effects of trunk stability exercise using PNF on the functional reach test and muscle activities of stroke patients. *J Phys Ther Sci* 2011;23(5):699-702.
10. Seo KC, Kim HA. The effects of ramp gait exercise with PNF on stroke patients' dynamic balance. *J Phys Ther Sci* 2015;27(6):1747-9.
11. Seo KC, Park SH, Park K. The effects of stair gait training using proprioceptive neuromuscular facilitation on stroke patients' dynamic balance ability. *J Phys Ther Sci* 2015;27(5):1459-62.
12. Guiu-Tula FX, Cabanas-Valdés R, Sitjà-Rabert M, Urrútia G, Gómara-Toldrà N. The Efficacy of the proprioceptive neuromuscular facilitation (PNF) approach in stroke rehabilitation to improve basic activities of daily living and quality of life: A systematic review and meta-analysis protocol. *BMJ Open* 2017;7(12):1-5.
13. Wang JS, Lee Bin S, Moon SH. The immediate effect of PNF pattern on muscle tone and muscle stiffness in chronic stroke patient. *J Phys Ther Sci* 2016;28(3):967-70.
14. Cayco CS, Gorgon EJR, Lazaro RT. Effects of proprioceptive neuromuscular facilitation on balance, strength, and mobility of an older adult with chronic stroke: A case report. *J Bodyw Mov Ther* [Internet] 2017;21(4):767-74. Available from: <http://dx.doi.org/10.1016/j.jbmt.2016.10.008>
15. Morreale M, Marchione P, Pili A, Lauti A, Castiglia SF, Spallone A, *et al.* Early versus delayed rehabilitation treatment in hemiplegic patients with ischemic stroke: Proprioceptive or cognitive approach? *Eur J Phys Rehabil Med* 2016;52(1):81-9.
16. Poonam C, AjaiKuman S, Vandana T, AnupKuman T. Post-stroke BDNF concentration changes following proprioceptive neuromuscular facilitation (PNF) exercises. *J Family Med Prim Care* 2020, 3361-69.
17. Paulina K, Anna K, Agnieszka J, Marta W-O. The effect of standard kinesiotherapy combined with proprioceptive neuromuscular facilitation method and standard kinesiotherapy only on the functional state and muscle tone in patients after ischaemic stroke. *Pol Merkur Lek organ Pol Tow Lek* 2013;35:268-71.