

Effects of PNF Method for Hemiplegic Patients with Brachial Predominance after Stroke: Controlled and Blinded Clinical Trial

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Abstract: In stroke, ninety percent of survivors have motor sequelae, being the main one is hemiplegia or hemiparesis, respectively defined as total or partial paralysis of the movements of one side of the body, interfering directly on the balance and Activities of Daily Living (ADLs). The hemiplegia or paresis are prevalent in the upper limb disability, so this study will address this impairment. The Proprioceptive Neuromuscular Facilitation (PNF) method is applied to restore motor deficits promoting the return of function and independence of the patients in ADLs. The aim of this study was to evaluate the effectiveness of the PNF method in relation to functional performance, being assessed by two scales: the Functional Independence Measure and Fulg-Meyer Assessment. Twenty predominantly brachial hemiplegic individuals after stroke inserted in physical therapy treatment twice a week (one hour each session) were selected.

The subjects were randomly divided into two groups, one staying with conventional physical therapy and the other group receiving application of 30 minutes of exercise of the PNF method during the conventional physiotherapeutic session. The scales were applied before and after 20 sessions of intervention. The study found that the PNF presents significant results in the recovery of upper limb hemiparetic patient functionality.

Keywords: Hemiplegic; Proprioceptive Neuromuscular Facilitation (PNF); Stroke; Upper limb function

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Introduction

Stroke is characterized by a total or partial reduction of blood flow in a particular area of the brain. The neurological deficits resulting from stroke vary according to the location of the vascular injury, time of inadequate perfusion and the existence of collateral circulation. Thus, these events may result in loss of strength, sensitivity, ability to move and control of several corporal areas, in addition to result in disorders of speech, loss of balance or coordination, visual disturbances, and loss of control of the anal and vesical sphincters [1].

Specifically, the stroke is a disease of the upper motor neurons and may result in loss of voluntary control regarding motor movements. As the upper motor neurons do decussation (cross), a disorder of voluntary motor control at one side of the body may reflect damage to the upper motor neurons on the opposite side of the brain. In this case, hemiplegia is the most common motor dysfunction as a result of injury of the opposite side of the brain [2].

Hemiplegia is characterized by loss of motor control at one side of the body, leading to typical disability to move the upper and lower limbs, spasticity, stereotyped synergies of motion with sensorial deficit and loss of balance reactions and protection. The balance reactions assist maintain and restore our balance while performing all activities, especially when there is risk of falls [3].

With the presence of hemiplegia, the patient has difficulty to move its trunk in relation to gravity, regardless of what type of muscle activity required. The absence of proximal stabilization (trunk) profoundly influences the members, since the upper and lower limbs can be moved only in spastic synergy and the distal spasticity is further increased as the patient attempts to compensate the loss of attachment when it attempts to move yourself against gravity [4].

The PNF method used for treating hemiplegia is a therapeutic option that can alleviate complications imposed by the chronicity of hemiplegia, allowing greater functional independence, besides decreasing the risk of falls and consequently improving the quality of life of hemiplegic [5].

PNF techniques are mainly based on stimulation of proprioceptors to increase demand to the neuromuscular mechanism to obtain and simplify their responses. The treatment by these techniques is very understandable and involves the application of its principles in all phases of rehabilitation [3]. The PNF method is a technique with a treatment philosophy [5].

For the quantitative assessment, physiotherapy adopts scales that punctuate the sensory motor activities and their functional capacity, providing therapeutic strategies and developments in rehabilitation [6].

The choice of the PNF method was by aim increased strength, flexibility, coordination, as well as selective rehabilitation of movements occurring learning movement, reinforced through repetition. This occurs because the technique recruits the three planes of motion (for example: extension, abduction and internal rotation of shoulder), in a single motion executed. Figure.1 illustrates this movement pattern.

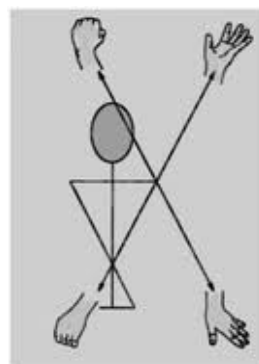


Figure 1. Movement pattern of PNF. Adler et al. [5].

The aim of the present study was to evaluate the effectiveness of the PNF on recovery of functional performance in daily life activities , being a complaint (unanimous) of hemi paretic individuals post stroke. The is also a complaint so lodged in rehab, however, there are devices such as walkers, canes and orthotics, that assist this function, therefore, the prevalence of complaints of activities with upper limbs.

Methodology

The study is a randomized controlled trial, conducted in the private school of Physical Therapy of Nove de Julho University (UNINOVE) during the years 2011 and 2012. It was approved by the Ethics Committee of UNINOVE under protocol # 323650 in accordance with the Resolution 196/96.

We selected twenty predominantly brachial hemiplegic adult patients of both genders, with a diagnosis of stroke and complaints of functional limitations of the upper limb impaired by stroke. This functional limitation was assessed by scoring two scales, the Fugl-Meyer Assessment (FMA) and the Functional Independence Measure (FIM). We excluded patients with not controlled associated diseases, structural deformities and lack of collaboration in the sessions. Patients agreed to participate as volunteer in the study and signed a consent form.

The evaluation of ADLs by the two scales was performed before and after the intervention purposed by this study. The FMA verifies seven functional items of both upper and lower limbs. This study assessed only the four items of the upper limb that include passive mobilization and pain, sensitivity, upper limb motor function and coordination/speed.

The FIM was applied using individual interviews conducted by an examiner trained for this procedure. Were questioned ADL's related to self-care and sphincter control, transfers, locomotion, communication and social cognition, for a total score ranging between a minimum of 1 and a maximum of 7, respectively classifying the individual as dependent to independent.

After the pre intervention evaluation, the selected patients were randomly divided into two groups by a lottery with a sealed envelope. The first group (control group; CG) was submitted to conventional physical therapy treatment that included muscle stretching exercises, joint mobilization, fitness tonic, resistive training for muscular strengthening, as well as static and dynamic balance training. The second group (PNF intervention group; IG) performed 30 minutes of conventional physical therapy and another 30 minutes of upper limb exercises by PNF method, as shown in Table 1. The exercises of the PNF method were previously selected from a book: PNF - Proprioceptive Neuromuscular Facilitation

- An Illustrated Guide [5] and under the guidance of a researcher specialized in the technique. The proposed intervention for both groups had a total of 12 sessions, being performed twice a week during six weeks, lasting 60 minutes each session. The evaluations were performed by same researcher, i.e., the pre and post Scale Fulg-Meyer, MIF, and the intervention of IG. Both researcher and patients were blinded to the treatment proposed for each group.

Statistical analysis

For the analysis of adherence to the Gaussian curve it was used the Kolmogorov-Smirnov (KS) test. Data were described as mean and standard deviation or median and interquartile range according to its normality. For parametric variables it was used unpaired t test in the comparison inter groups and the paired t test for within group comparison. For nonparametric variables were used Mann Whitney and Wilcoxon tests for comparison inter and within group respectively. For correlation analysis it was used the Spearman test. For the analysis it was used the software Minitab 14 and was considered statistical significant a p value <0.05

Results

Table 1 shows the anthropometric data of each group.
Table 1: Anthropometric characteristics of the sample studied.

Conventional Group	PNF Intervention group
Age (years)	63 ± 9.16
61.1 ± 5.72	
Height (cm)	165 ± 4.9
164.2 ± 7.08	
Body mass (kg)	70.2 ± 6.82
67.9 ± 11.68	
Body mass index (kg/m ²)	30.8 ± 6.09
28.45 ± 8.81	
Injury time (months)	14.2 ± 5.59
14 ± 5.14	
Right:left hemi paresis	6:4
5:5	

The results show that in both groups (CG and IG) individuals presented higher control of the functionality in the upper limbs. This reflects an increase in the ability to perform ADLs and increased functional independence, since the upper limbs are responsible for a greater number of ADLs.

Table 2 shows the median values and interquartile range of the FMA score and FIM level, both for evaluating the functionality. Compare the pre- and post-intervention data for both groups (CG and IG) with the results of the scales. Both groups showed improvement in functional independence and when analyzing the effectiveness of the type of treatment (conventional or PNF) there was no difference between groups (CG x IG). Thus, both techniques are effective for functional recovery of the hemi paretic upper limb after stroke.

Table 2: Functional evaluation.

Conventional Group		PNF Intervention Group	
Pre	Post	p	
Pre	Post	p	
FIM	2.5[2-4]	4.0 [2-6]	0.006
	2.0[2-4]	4.0[2-6]	0.001
FMA	23.5 [17-26]	31[21-42]	0.002
	17[13-25]	38.5[14-48]	0.003

FIM: Functional Independence Measure (level); FMA: Fugl-Meyer Assessment (score); Value expressing median and interquartile range; *p<0.05.

Discussion

The present study presents positive outcome in both interventions. However, even if the PNF was associated with the thirty minutes of conventional physiotherapy, which adopted only mobilizations, stretching and fitness of the muscular tonus, which are preparatory activities for improved applicability of functional training and strengthening exercises.

The PNF was choose due to technique providing in the same movement strengthening and functionality, different from conventional physiotherapy which carries out first strengthening exercises and second functional exercises.

To verify the effectiveness of the PNF, other studies also have applied pop associated with conventional physiotherapy comparing only with the conventional physiotherapy. As shown in the study of Modesto [7], they verified that there was no difference between groups in relation to muscle strength and activities of daily living. These data are consistent with the results of the present study.

Studies such as of Franco et al. [8] indicate that the technique to gain muscular strength, muscular endurance and range of motion as well as obtaining relaxation of the antagonist pattern are contributing factors to the functionality. Dean et al. [9] reports the use of the technique in the presence of spasticity, which generates changes in morphological, physiological and biomechanical characteristics of the muscle, promoting pain relief and increased range of motion.

Marques and Nogueira [10] compared PNF associated with Functional Electrical Stimulation (FES) with FES alone and found that both were effective for the gain of functional capacity, reduction in muscle tone of the paretic upper limb and improvements in the ability to perform activities of daily living.

Kim et al. [11] evaluated the influence of the PNF in chronic hemi paretic in relation to the stability of the trunk through a reaching test and by muscle activating by electromyography. It was noted that the PNF showed positive results when compared to using only the exercises with ankle weight. In the present study, both strengthening activities and functional training techniques were positive.

Lacerda et al. [12] found similar results on the effect of physiotherapy associated with PNF for the postural stability of hemiparetic subjects, which was reflected in the risk of falls. Ribeiro et al. [13] compared two different methods of treatment in the recovery of postural and gait symmetry in hemiparetic subjects with stroke sequelae: PNF and treadmill training with partial weight bearing. These authors observed that both methods provided significant improvements, especially in asymmetry, differing only with respect to the ankle, and the subjects undergoing treatment with PNF showed a better performance. This compares to our study, suggesting that the two methods of treatment offer positive results in rehabilitation.

However, an observation to be held in relation to the study of Ribeiro et al. [13] is about the cost-effectiveness of the technique, as the partial support of the weight is carried out by equipment, while the PNF requires only the manual application. In the present study there is no such influence, because both techniques are manual, not requiring the assistance of equipment.

The intervention of conventional physical therapy involves movements performed in an analytical way and the movements of the PNF method are performed in diagonal and spiral way, making movements more functional. This concept was also described by Pereira and Junior [14]. However, in our study, it was found that conventional physical therapy also obtained satisfactory results, which may be related to functional training of ADLs performed after conventional kinesiotherapy. However, the time and energy consumption spending to PNF compared to functional kinesiotherapy associated with the specific training of ADL were not measured in this study.

Conclusion

This study suggests that the PNF method is effective for functional rehabilitation of the upper limbs in hemiplegic patients after stroke and may be an alternative to the physical therapy sessions. Thus, physiotherapy may adopt one more treatment technique with positive effects in rehabilitation, in order to modify therapy sessions, for which individuals not accustomed nor lose the motivation to perform the exercises.

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