



# Extracting The Effectiveness Of Ankle Proprioceptive Neuromuscular Facilitation Techniques On Balance And Gait Parameters In Sub-Acute Stroke: A Study Protocol For Randomized Controlled Trial

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**Citation:** Dr. Vikrant Salphale, et. al (2024), Extracting The Effectiveness Of Ankle Proprioceptive Neuromuscular Facilitation Techniques On Balance And Gait Parameters In Sub-Acute Stroke: A Study Protocol For Randomized Controlled Trial, *Educational Administration: Theory and Practice*, 30(5), 519 - 524

Doi: 10.53555/kuey.v30i5.2888

## ARTICLE INFO

## ABSTRACT

**Background:** Stroke is a leading cause of morbidity, mortality and disability among the world. Stroke sufferers encounter numerous challenges with their ambulatory competencies due to a lack of dorsiflexor muscle control and a deficient dorsiflexor control is a major contributing factor in various musculoskeletal injuries. Proprioceptive Neuromuscular Facilitation techniques are proven to enhance the strength, stability, range, endurance, coordination etc.

**Objective:** To investigate the Effectiveness of Ankle Proprioceptive Neuromuscular Facilitation techniques on Balance and Gait Parameters in Sub-acute Stroke sufferers.

**Methods:** This double-blind, randomized controlled trial will study 42 participants with sub-acute strokes, divided into two groups using SNOSE. The experimental institution will be treated with ankle PNF techniques like rhythmic stabilization, rhythmic initiation, and slow reversals with static stretching, while the control group will handily get hold of static stretching for four weeks. Participants aged 40–65 with subacute stroke, grade 1 or 1+ at the modified Ashworth Scale, and both genders will be included, excluding those with ankle surgeries.

**Discussion:** The study's goal is to determine the effectiveness of ankle proprioceptive neuromuscular facilitation techniques on balance and gait parameters in participants suffering from subacute stroke.

**Conclusion:** The purpose of this study is to determine the effectiveness of ankle PNF procedures on stability and gait parameters in subjects with sub-acute strokes.

**Keywords:** Balance, Gait Parameters, Sub-acute stroke, Ankle Proprioceptive Neuromuscular Facilitation, Functional Independence.

## INTRODUCTION

Acute, focal neurological impairment is the clinically defined syndrome known as stroke, which is caused by vascular injury (infarction, hemorrhage) to the central nervous system. In contemporary clinical practice, neuroimaging is being employed more and more to identify the precise pattern of tissue injury. The most popular mechanistic subclassification system for patients with cerebral ischaemia is the Trial of Org 10172 in Acute Stroke Treatment (TOAST) classification system, which defines five subtypes: large artery atherosclerosis, cardioembolic, small vessel occlusion, stroke of other determined aetiology, and stroke of unknown aetiology<sup>(1)</sup>.

In India, stroke ranks among the top causes of death and disability. The predicted adjusted prevalence rates for stroke fall into two categories: 334–424/100,000 in urban regions and 84–262/100,000 in rural ones. The incidence rate, according to current population-based studies, is 119–145/100,000<sup>(2)</sup>.

In stroke survivors, low plantar flexor force during push-off, decreased swing phase dorsiflexion, and a sluggish preferred gait velocity have all been related to ankle muscle weakness. The primary cause of the spatial and

temporal asymmetry in stroke survivors and a contributing factor to their slower gait velocity was the spasticity of their ankle plantar flexors. Kinematic anomalies at the ankle-foot, such as decreased ankle dorsiflexion during the swing phase of locomotion and forefoot or flat foot initial contact, which result in impaired stance stability, are the general definition of dropped foot. Ankle deficiencies connected to stroke that result in insufficient dorsiflexion control during walking include unusual muscle coactivation, plantar flexor passive stiffness, dorsiflexor weakness, and plantar flexor spasm<sup>(3)</sup>.

Balance requires cooperation across several integrative, motor, and sensory systems. Variations in the foot and ankle's posture, sensitivity, strength, or flexibility could make it harder for them to maintain these functions. Postural sway and balance in the elderly and following strokes have been associated with proprioception and foot sensation. Diminished feelings could lead to a shorter stance time for the afflicted limb and more care while taking on weight during the gait cycle. Individuals who have experienced a stroke often display deficiencies in their motor and sensory abilities, which might hinder their ability to do daily chores. The aftermath of a stroke can differ from person to person and cause long-term impairments of varying degrees in addition to a variety of compensatory mechanisms<sup>(4)</sup>.

The definition of Proprioceptive Neuromuscular Facilitation (PNF) encompasses the terms proprioceptive (which has to do with any of the sensory receptors that offer records concerning movement and role of the body); neuromuscular (involving the nerves and muscle tissues); and facilitation (making it less complicated)<sup>(5)</sup>.

PNF is a neurophysiological technique that uses stretch and resistance stimulation of sensory receptors in muscles and the surrounding areas of joints to promote impulses from the periphery to the central nervous system. The muscle group contracts isometrically against resistance and is passively stretched. It is stretched simultaneously during progressive stretching, which enables it to stretch even farther during the next exercise. PNF activates proprioceptors in the tendons and muscles of stroke patients, improving function and increasing balance, strength, and flexibility<sup>(6)</sup>.

A stretch training method called proprioceptive neuromuscular facilitation (PNF) increases flexibility by combining static stretching with isometric muscle contraction. PNF stretch increases range of motion, initiates a deeper stretch, and activates neuromuscular activity through muscle contraction. To produce a variety of motion, PNF approaches such as the "contract-relax" or "hold-relax" procedures can be employed<sup>(7)</sup>.

The purpose of the study is to evaluate the effectiveness of ankle PNF techniques on gait and balance characteristics in subjects who have experienced a subacute stroke.

### **1.1 Need of the study**

Consistently with the former researches nearly 20-30% of stroke sufferers occur themselves with a foot drop which in the end influences the biomechanics of the stance segment of gait cycle. The literature amassed from the earlier studies advise that a restricted ankle dorsiflexion acts as a driving pressure for numerous musculoskeletal accidents like Achilles tendon damage thru alteration inside the kinetics of the joint. As there is a deficiency inside the studies emphasizing the capacity of mixing the Rhythmic Stabilization, Rhythmic Initiation and gradual Reversals of Proprioceptive Neuromuscular Facilitation for ankle in optimization of ankle dorsiflexion that's required for a preliminary touch at some stage in a physiological sample of gait.

### **1.2 Aim of the Study**

The aim of the study is to draw the fruitfulness of Ankle Proprioceptive Neuromuscular Facilitation Techniques on Balance and Gait Parameters in subjects with sub-acute stroke.

### **1.3 Objectives**

The objectives for the present study are:

- 1) To draw the efficacy of Ankle Proprioceptive Neuromuscular Facilitation Techniques on Balance in subjects with Sub- acute Stroke sufferers.
- 2) To extract the efficacy of Ankle Proprioceptive Neuromuscular Facilitation Techniques on Gait in subjects with Sub- acute Stroke sufferers.
- 3) To investigate the efficacy of Ankle Proprioceptive Neuromuscular Facilitation Techniques in optimizing the functional independence of Sub-acute Stroke sufferers.

### **1.4 Hypothesis**

#### **1.4.1 Alternative hypothesis**

Ankle PNF will have an advantageous effect on balance and Gait Parameters in subjects with sub- acute Stroke.

#### **1.4.2 Null hypothesis**

Ankle PNF will not have any enormous impact on stability and gait parameters in subjects with sub – acute Stroke.

## METHODOLOGY

### 1.1 Study Setting

The studies will take place in Neuro Physiotherapy OPD, MGM Physiotherapy Rehabilitation and fitness Centre, Chhatrapati Sambhaji Nagar, Maharashtra.

### 1.2 Study Design and Sample Size

In this randomized controlled trial, the quantity of subjects enrolled inside the experimental group are forty – two.

### 1.3 Study Population

Subjects having Subacute Stroke.

### 2.4 Sample size calculation

For calculations of sample size for present study, G. Power software is used. Alpha =  $\alpha = 0.05$ , Power = 0.80, large effect was considered = 0.8 . Using G\* Power software sample size will be found to be 21 samples/ patients in each group.

### 2.5 Sample size

42.

### 2.6 Inclusion Criteria

Subjects of both gender with sub-acute stroke, having grade of one or 1+ on Modified Ashworth Scale and with an age organization of forty to sixty-five years.

### 2.7 Exclusion criteria

Subjects having chronic stroke, showing grade of extra than 1+ on Modified Ashworth Scale, greater than sixty-five years of age, who has passed through any surgical treatment of the ankle.

### 2.8 Participant Timeline

The duration of the study is one year, and the duration of the intervention is four weeks, so subjects may be enrolled throughout the primary 11 months of the examination, and four weeks of the intervention will be completed successfully. On the first day of the lookahead, subjects may be assessed using Cadance, Step Length, the modified Ashworth Scale, and the Berg Balance Scale.

### 2.9 Implementation

The randomization technique may be supervised by the research coordinator and principal investigator. Participants will be asked to manually select the envelope containing the sealed assortment allocation for recruitment into both assortments.

### 2.10 Blinding

When assigning subjects to assortments, the assessor will be blinded. To attain blinding, subjects will be required not to reveal any facts about their treatment to the assessor.

### 2.11 Sample size consideration

This randomized controlled trial uses an experimental assortment design to determine the efficacy of ankle proprioceptive neuromuscular facilitation strategies on balance and gait parameters in sub-acute stroke patients. A total of forty-two subjects will be recruited, and they may then be randomly assigned.

### 2.12 Intervention design

Forty-two subjects with sub-acute strokes could be chosen from the physiotherapy OPD of the MGM Hospital and segregated into an exceptional assortment.

group A- Intervention group

group B- Comparator group

#### GROUP A:

Group A will be handled with the Ankle Proprioceptive Neuromuscular Facilitation (Ankle PNF) technique. subject' pre-treatment tests can be documented using Cadence, Step period, modified Ashworth Scale, and BBS.

Ankle proprioceptive neuromuscular facilitation strategies will incorporate Rhythmic Initiation, Rhythmic Stabilization, and Slow Reversals.

**Rhythmic Initiation-** In this technique initially the therapist will move the patient through a desired movement by using the Passive range of motion, latter an active- assisted, active- resisted range of motion, and at the end active range of motion.

**Slow Reversal-** It utilizes an isotonic contraction of the agonist group instantly followed by an isometric contraction, with a hold instruction which is given at the end of every active movement.

**Patterns:**

Plantar flexion

Inversion

Adduction so that the sole will face medially.

**Dorsiflexion**

Eversion

Abduction so that the sole will face laterally

Ankle Proprioceptive Neuromuscular Facilitation will last 30 minutes, five days a week, for four weeks, followed by a static stretch of the plantar flexors three times, each lasting 60 seconds, five days a week, for four weeks.

The subjects' post-treatment or post-intervention assessment will use the same outcome measures (Gait Parameters, Modified Ashworth Scale, BBS).

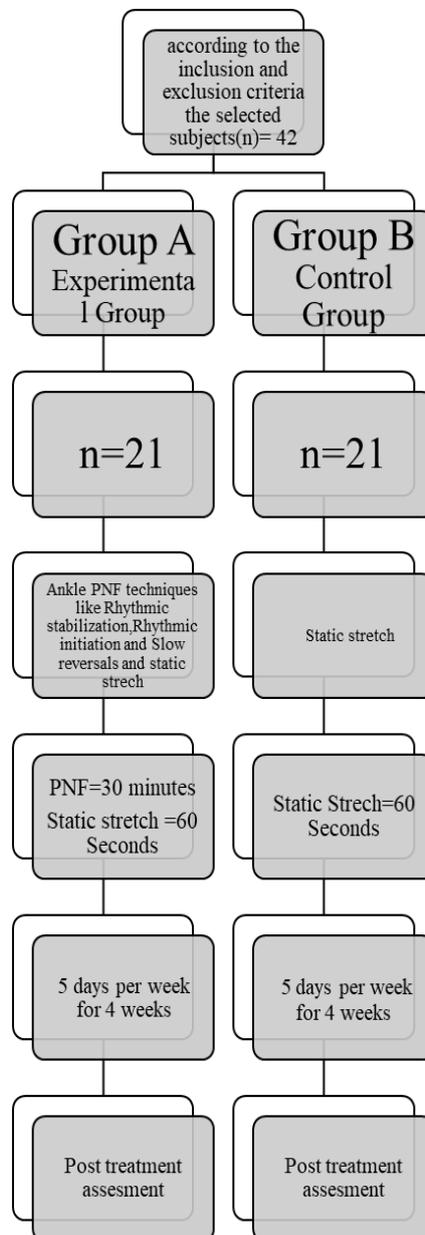


Figure 1 Intervention Design (original)

**GROUP B:** Group B will receive a static stretch for 60 seconds, five days in per week and for four weeks. The subject' baseline evaluation will be performed making use of Cadence, Step length, Modified Ashworth Scale, and BBS.

The static stretch will last 60 seconds, five days per week, for four weeks.

The subjects will be evaluated post-intervention using the gait parameters, Modified Ashworth Scale, and BBS specified above in the baseline or pre-assessment.

## **OUTCOME MEASURES**

### **3.1 Gait Parameters**

#### **3.1.1 Cadence**

Cadence is the wide variety of steps taken by someone according to a unit of time. Cadence may be measured as the variety of steps according to the number of steps per second or minute, but the latter is more common.

#### **3.1.2 Step length**

Step length is the linear distance between two successive points of contact of contrary extremities. it is usually measured from the heel strike of one extremity to the heel strike of the alternative extremity.

### **3.2 Modified Ashworth Scale (MAS)**

Ashworth has defined a 5-point ordinal scale for grading the resistance encountered in the course of such passive muscle stretching. As Ashworth's scale assigns grades to a manually decided resistance of muscle to passive stretching, it measures spasticity.

### **3.3 Berg balance Scale (BBS)**

This scale measures balance in older adults.

### **3.4 Functional Independence degree (FIM)**

The functional independence degree (FIM) is a device that was developed as a measure of disability for a selection of populations. The tool is used to assess a patient's degree of incapacity in addition to trade in affected person's reputation in response to rehabilitation or medical intervention.

## **4. DISCUSSION**

The goal of this randomized controlled trial research study is to determine the efficacy of ankle PNF strategies on balance and gait parameters in subacute stroke sufferers. A few studies have verified that ankle proprioceptive neuromuscular facilitation techniques have a great and favorable impact on increasing ankle dorsiflexion in stroke patients, as well as the capabilities of the decreased extremities.

## **5. CONCLUSION**

The purpose of this study is to determine the effectiveness of ankle PNF approaches on balance and gait parameters in subacute stroke sufferers.

## **IMPLICATION OF THE STUDY**

If the examination proves to be powerful, then training and enhancing ankle dorsiflexion will be a lively component in the treatment of subacute stroke sufferers.

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