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Effect of PNF integration pattern on lower limb to improve limits of stability in geriatric population

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ABSTRACT

The purpose of the study was to determine the effect of Lower Limb PNF integration pattern on Limits of Stability in geriatric population, as there are lesser studies done which improve the limits of stability using inexpensive and easy techniques. Method: A total of 38 subjects both males and females in the age group of 65 years and above, with less reach in forward, backward, right and left lateral components of Multi-directional Reach test were included while those with impaired vision, recent musculoskeletal conditions and neurological conditions were excluded. Assessment was done according to the MDRT before and after the complete treatment of 4 weeks. The treatment session included warm up exercises, followed by D1 Flexion-Extension and D2 Flexion-Extension patterns of PNF techniques, and cool down exercises including Shavasana. Results: On statistical analysis, a significant improvement in all four components of Multi-directional Reach test was found. Conclusion: PNF integration pattern are effective and can be used in improving Limits of Stability in geriatric population.

Keywords: *PNF integration pattern, Limits of Stability, Multi-directional Reach Test, Geriatrics*

INTRODUCTION

World Health organization (WHO) forms the categories of the old which includes people in the age group 65-74 years which are young old, 75-84 years which are middle old, and above 80 years age which are classified as old old. Aging is a fundamental process that affects all of our system and tissues including the Respiratory system, Cardiovascular system, Body composition, Gastrointestinal system, Collagenous tissue, Nervous system, Immune system, Endocrine system and Musculoskeletal system. [2] In Musculoskeletal system, aging leads to decline in bone mineral density, muscle mass, muscle tone and muscle strength. Loss of strength can be associated with loss of function. [2] Loss of strength can be associated with loss of function in older adults. The relationship between strength and function appears to be curvilinear; that is, strength is directly related to function [2] Decrease in general physical functions due to aging, weakening of body balance control ability, decline in gait ability and fear of falls in the elders(Murray et al

2005) [3]. There are intrinsic and extrinsic factors associated with falls. Intrinsic factors can be defined as those related to the subject himself /herself, who have impaired function of system that compromise postural control, disease, vision and cognitive and behavioural disorders. Extrinsic factors include environmental factors such as lighting, walking, surface loose carpets, high or narrow steps. [4] Falls might occur during various daily activities leading to tripping or tangling the feet, reaching movements or bending. [4] Many of these activities are constrained by Limits of Stability (LOS). Limits of Stability can be described as the maximum distance a person can intentionally displace his/ her center of gravity and lean his /her body without losing balance, grasping, or stepping.Aging associate with decreased LOS and muscle strength [5-7]. There is association between ankle muscle strength and LOS because plantar flexors (PF) strength is more strongly associated with AP-LOS than dorsiflexors (DF). Anterior lean distance is controlled by PF and posterior lean distance is controlled by DF. Therefore there is a moderate to strong relationship between ankle muscle strength and functional balance (Lin SI WoollacottM) [8]. What we know today as PNF began as "proprioceptive facilitation "a term developed by Dr. Herman Kabat in the early 1940's. In 1954, Dorothy Voss added the word "neuromuscular "to give us the now familiar PNF. The use of developmental progression of motor behaviour that enables patient to create and re-create strategies of efficient functional movement and the biomechanical and behavioural analysis of motor control all activities within PNF intervention are directed towards functional goal and are relative to environment in which the goal is to be achieved. Proprioceptive neuromuscular facilitation (PNF) integration pattern stimulates the proprioceptor within the muscle and tendon to enhance the performance muscle vitality flexibility and balance (klein et al, 2002) [9]. Therefore, PNF utilized as a part of rehabilitation designed for those who have weakened muscle or joint functionalities. The number of PNF techniques applied enhances the muscle strengthening properties (Hyunseung et al 2014). [10]

Indications for PNF techniques includes strengthening, to improve range of motion, active control of motion, co-ordination. D1 flexion-extension and D2 flexion-extension are the patterns of PNF technique. D1 flexion follows hip flexion, adduction external rotation, ankle dorsiflexion, inversion and extension of the toes and extension include opposite to the flexion pattern. D2 flexion includes hip flexion, abduction, internal rotation ankle dorsiflexion eversion and extension of the toes and extension includes opposite to the flexion pattern. [11]

The multi-Directional Reach Test was devised by Dr Roberta Newton at the Department physical Therapy at Temple University In response to finding of the elderly falling backward and laterally, Newton developed Multi-Directional reach test (MDRT) which can be used to measure forward, backward, rightward and leftward bending. Therefore, Multi-Directional reach test is considered as a portable and valid tool to measure limits of stability in the anterior posterior and medio-lateral direction. [12]

Movement	Reach less than (Inches)
Forward	8.9
Backward	4.6
Right Lateral	6.2
Left Lateral	6.6

METHOD

This is an experimental study with purposive sampling with individuals in the age of. The study was carried out at Pune, Talegaon Dabhade. A total of 38 subjects, both males and females in the age group of 65 years and above were selected.

Inclusion criterion

- Subjects in the age group of 65 years and above
- Subjects with less reach in all four directions according to with Multi-directional Reach test

Exclusion criterion

- Subjects with other neurological conditions
- Impaired balance, vision problems, hearing problems
- Recent musculoskeletal condition of lower limb.

Procedure

The study was conducted on 38 individuals in the age group of 65 years and above, selected as per the inclusion criteria. Consent was taken from all the participants.

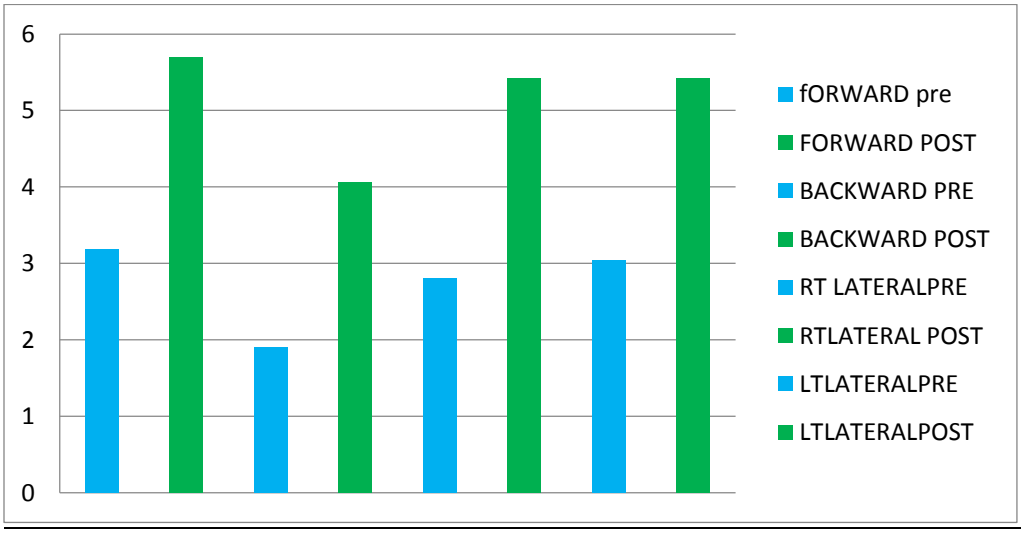
The program being used in this study consisted of warm up exercises, PNF integration pattern, and cool down exercises. Each set of warm exercise consisted of upper limb – shoulder flexion, Extension, Abduction, Rotation, Retraction. Trunk exercises – Finger to floor, Pelvic rotation, Trunk rotation, forward bending, Side bending. Each exercise was performed 10 times.

PNF integration pattern was done with patient lying in supine position and weight cuff tied around the mid foot. In the PNF pattern D1 and D2 were performed for both the legs. D1 flexion follows hip flexion, adduction external rotation, ankle dorsiflexion, inversion and extension of the toes and extension include opposite to the flexion pattern. D2 flexion includes hip flexion, abduction, internal rotation ankle dorsiflexion eversion and extension of the toes and extension includes opposite to the flexion pattern. Each pattern performed 10 times for 3 sets. After 1 set a rest time of 2 min was given.

After completion of the session, cool down exercises including stretching exercises for Hamstring, Adductors, Tensor fascia lata with a hold for 30 sec ws given, followed by Shavasana for 2 minutes.

RESULTS

A total of 38 subjects, with less reach according to the MDRT were selected and treatment was given for 4 weeks which included various warm up exercises, PNF integration patterns and followed by cool down exercises. On statistical analysis, paired t test was applied and a significant difference was seen between pre and post treatment on Multi-Directional Reach test.



	MEAN (INCHES)				
	PRE	**POST**	**DIFFERENCE**	**p VALUE**	**SIGNIFICANCE**
FORWARD	3.19	5.75	2.56	<0.0001	EXTREMELY SIGNIFIACNT
BACKWARD	1.9	4.06	2.16	<0.0001	EXTREMELY SIGNIFIACNT
RIGHT LATERAL	2.8	5.42	2.62	<0.0001	EXTREMELY SIGNIFIACNT
LEFT LATERAL	3.04	5.04	2	<0.0001	EXTREMELY SIGNIFIACNT

DISCUSSION

The present study was an experimental study including 38 subjects (16 females and 22 males) in the age group of 65 years and above, done to find out the effect of PNF integration pattern on limits of stability.

This study shows that statistically, there is an extremely significant improvement in all four components of MDRT after treatment with a p value of 0.0001.

It might be because of increased strength in the lower limb due to the effects of PNF used which helps in improving strength, ROM, muscle co-contraction, proprioception, functional activity which is due to TEMPORAL AND SPATIAL SUMMATION. Also, this PNF Integration Pattern led to activation of the STRETCH REFLEX during D1 and D2 patterns. D1 and D2 integration pattern focuses on agonist and antagonist muscle and also eccentric and concentric type of contraction that is through lengthened to shortened position of each muscle in the functional movement (PNF in practice suzanAdler).[11] Therefore PNF improves co-contraction between agonist and antagonist of the muscle.

PIP increases the mean power frequency thus increasing peak torque. Strengthening also stabilizes the body to undertake the movement. In PNF SPIRAL AND DIAGONAL stretch and resistance reinforce the effectiveness of the patterns, as shown by an increased activity in the muscles. The increased muscular activity spreads both distally and proximally within a pattern to related pattern of motion (irradiation). Treatment uses irradiation from that synergistic combination of muscle (pattern) to strengthen the desired muscle groups or reinforce the desired functional motion. Subjects showed the greatest value of MDRT in the forward direction whereas lowest value is in backward direction this may be due to biomechanical arrangement of the ankle and foot, which allows forward excursion than for backward excursion [12]

Plantar flexors are more strongly associated with AP-LOS than dorsiflexors, perhaps contribution of plantar flexors is larger simply because the anterior lean distance (controlled by plantar flexor) is larger than posterior lean distance (controlled by dorsi flexors) therefore forward reach is more than backward.

CONCLUSION

This study concludes that lower limb PNF integration pattern has an effect on Limits of Stability in Geriatric population.

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