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EFFECTIVENESS OF TRUNK PROPRIOCEPTIVE NEUROMUSCULAR FACILITATION TECHNIQUES AFTER STROKE: A METAANALYSIS

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Abstract

Aim: To find out the effectiveness of Trunk Proprioceptive Neuromuscular Facilitation Techniques to improve Trunk Control in stroke patients. **Statistical analysis:** For all studies we calculated the mean difference and pooled the standard deviation of the baselines and at next assessment. The relevant studies for our meta analysis were identified by manual searches from google scholar**.** Total number of participants was 75 in 4 studies. The age range was 43 to 78.1 yrs with the mean age of 60.55 yrs and the duration of stroke was 2.1 yrs. **Results:** A total of 4 trials were identified. Results were in favor of the intervention groups using PNF techniques. Trunk impairment assessed with the Trunk Impairment Scale (TIS) in 2 studies showed statistically significant results ($P<0.05$). Trunk Lateral Flexion Range of Motion (TLF ROM) and Tinetti Test (TT) showed statistically significant results ($P<0.05$) in the PNF training group. **Conclusion:** This meta-analysis shows that stroke survivors may benefit from trunk PNF technique during acute and sub-acute stages to improve trunk control and balance Thus, PNF technique should be considered in acute and sub-acute stroke rehabilitation.

Key-words : Stroke, PNF pattern, trunk impairement scale, PASS scale

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Introduction:

Stroke is a common neurological disorder, representing a major cause of disability. It is considered as a significant health problem, which needs an unremitting and wide-ranging rehabilitation. [1] Stroke is also known as "cerebral vascular accident", "brain attack" or "apoplexy". [2,3] According to WHO Stroke is defined as "acute onset of neurological dysfunction due to abnormality in cerebral circulation with resultant signs and symptoms that corresponds to involvement of focal area of brain lasting more than 24 hours". [4] Approximately 700,000 individuals in United States are affected by it each year. About 500,000 are new strokes and 200,000 are recurrent strokes. [5] According to W.H.O (16 November 2011) the incidence of stroke in India was 130/100,000 individuals every year.[6] The Indian Council of Medical Research estimates that among the non-communicable disease, Stroke contributes for 41% of deaths and 72% of disability adjusted life years.[7,8] In stroke, there is paralysis or weakness of one side of the body includes upper limb, trunk and lower limb leading to the disturbances in the trunk muscles. The sensory and motor impairments of upper limb, lower limb and trunk interfere with the functional performance after Stroke. Trunk performance has been identified as an important early predictor of functional outcome after Stroke. Unlike hemiplegic limb muscles, the

trunk muscles are impaired on both sides of the body following a unilateral stroke as evaluated by computed tomography and motor evoked potential studies. [9] In the acute stage, the patient is unable to move his trunk in lying and neither can they sit. [10] Movement analysis of trunk also found that selective trunk muscle control, particularly the lower trunk muscle activity was minimal in patients with stroke.[11] the primary contribution of the trunk muscle is to allow the body to remain upright, adjust weight shift, and performs selective movements of the trunk against constant pull of gravity. Hence, it helps to maintain the centre of mass within the base of support during static and dynamic postural adjustments in sitting, standing and stepping. [12,13] A study on electromyography analysis found an impaired anticipatory postural trunk muscles activity in patients with stroke, which in turn essential for static postural control. [14] Furthermore, studies on posture graphic analysis found an impaired dynamic postural control in patients with stroke during sitting and standing.[15,16] Measuring balance is important for clinicians in diagnosing the severity of a stroke, selecting the most appropriate therapy for people with stroke.[17,18] A variety of functional scales measuring balance are commonly used in people with stroke; viz., Berg Balance Scale. BBS was developed to measure balance among older people with impairment in balance function by assessing the performance of functional tasks. It is a valid instrument used for evaluation of the effectiveness of interventions and for quantitative descriptions of function in clinical practice and research, but this is not stroke specific balance impairment scale.[5] The Tinetti Performance Oriented Mobility Assessment (POMA) is a task- oriented test that measures an older adults gait and balance abilities. It has better test-retest, discriminative and predictive validities concerning fall risk. But this scale is not specifically designed for assessment of the stroke patients.[19] The Brunel Balance Assessment (BBA) is designed to assess functional balance for people with a wide range of abilities and has been tested for post-stroke patients. There are many ways of measuring balance, but none are suitable for use in the clinical setting to assess the effects of individual rehabilitation interventions or to measure change over a long term.[20] However, only a few scales are specifically designed for stroke specific balance assessment. Benaim et al [21] developed a new scale, the Postural Assessment Scale for Stroke patients (PASS) that directly addressed the need for an assessment tool that specifically measures balance in people with stroke. Mao et al further compared the reliability, validity, and responsiveness of the PASS with 2 balance scales (i.e., the Berg Balance Scale and the balance subscale of the Fugl-Meyer test) in people with stroke and found the PASS to have superior psychometric characteristics among the balance measures.[22] Thus, the PASS demonstrated great potential for use in both clinical and research settings.

Material methods:

The relevant studies[23-26] for our meta analysis were identified by manual searches from Google scholar.

Inclusion Criteria: one group of the study received the PNF technique. The article strength was grade 3 according to PEDRO scale. Only Randomized Controlled Trials were enrolled in meta analysis.

Exclusion Criteria:- Study published before 2008 were excluded from meta analysis. Study Duration: 9 Months. Data Analysis: Data was analyzed by using Graph pad In stat. We included 4 original articles with trunk PNF as one of the intervention for patients with stroke in improving trunk control. The studies were either Randomized controlled trials or experimental in nature with participants as patients with stroke. We were interested to examine the effect of trunk PNF pattern on improving the trunk control. Outcome measures were included 1.Trunk Impairment Scale (TIS), 2.Trunk Lateral Flexion Range of Motion (TLF ROM), 3.Tinetti Test (TT), Curl-up test, 4.Sorenson test, 5.lumbar mobility measurements, 6.Modified ODI score 7. VAS score Emory 8.Functional Ambulation Profile (EFAP), 9.timed-test.

Results:

A total of 4 trials were identified. Results of study were in favour of PNF techniques used in the intervention group to improve trunk control in stroke patients. Trunk impairment was assessed

with the Trunk Impairment Scale (TIS) in 2 studies and showed statistically significant results (P<0.05). Trunk Lateral Flexion Range of Motion (TLF ROM) and Tinetti Test (TT) showed statistically significant results (P<0.05) favoring the PNF training group.

Table 1: Outcome Measures Chart

Name of Author	Paneri et al [26]	Akosile *et al* [23]	Karthikbabu et al [24]	Khanal et al [25]
Stroke Duration	Previous 24 months	8-weeks	4- weeks	1 month-1 yr
Type of Study	Randomized control	Pre and post interventional	randomized control	randomized control
Number of participants in each Group	A=15, B=15	A=17	A=15, B=15	A=15, B=15
Outcome Measures	1. Trunk Impairment Scale (TIS)	1. Emory Functional Ambulation Profile (EFAP) 2. timed-test	1. Curl-up test, 2.Sorenson test, 3. lumbar mobility measurements, 4. Modified ODI score 5. VAS score	1. Trunk Impairment Scale (TIS) 2. Trunk Lateral Flexion Range of Motion (TLF ROM) 3. Tinetti Test (TT)
Intervention	Group-A received PNF training for trunk Group-B received only conventional treatment	A=PNF techniques	Group-A received PNF training Group-B received only conventional treatment	A=Pelvic PNF exercise, B=Regular physiotherapy in the form of tonal management and range of motion exercises for the affected limbs
Favourable Results	Group A PNF training	PNF technique led to improvement in the functional ambulation of post stroke individuals	Group A PNF training	A= Pelvic PNF exercise

Table 2: Methodological quality of included studies (PEDro scale)

Criterion	Eligibility criteria specified Â	Random allocation to groups	Concealed allocation	Groups similar at baseline	Subject blinding	Therapist blinding	Assessor blinding	<15% dropouts	Intention -to-treat analysis	Between groups statistics reported	Point estimates and variability data reported	Total score (0/10)
Khanal et al [25]	1	1	0	1	0	0	0	1	0	1	0	5
Karthikbabu et al [24]	1	1	0	1	0	0	0	1	0	1	0	4
Akosile *et al* [23]	1	0	0	0	0	0	0	1	0	1	0	3
Paneri et al [26]	1	1	1	1	0	0	0	1	0	1	1	6

Discussion:

From this meta analysis it is observed that trunk PNF patterns are effective in improving trunk control in patients with stroke. This met analysis aimed to evaluate the effects of Pelvic Proprioceptive Neuromuscular Facilitation (PNF) technique on facilitation of trunk movement in acute and sub acute stroke patients. Post treatment result showed improvement in terms of static and dynamic sitting balance and coordination when assessed by Trunk Impairment Scale. The probable mechanism by which PNF could have worked is by facilitating the neuromuscular mechanism, by stimulating the proprioceptors. Kabat [27] reported that a greater motor response can be attained when employing facilitating techniques in addition to resistance. Facilitation resulted from a number of factors such as application of stretch, use of particular movement patterns and use of maximal resistance in order to induce irradiation. Gellhorn and Loofbourroe [28] showed that when a muscle contraction is resisted, the muscle's response to cortical stimulation increases. The use of particular movement patterns also causes changes in spinal and supraspinal level All these facilitatory techniques might help to facilitate trunk motion and stability, treat upper trunk and cervical areas indirectly through irradiation thus enhancing the motor control and motor learning thereby improving performance of participants in post treatment group showed on TIS. A study done by Deletis, et al. [6] explained in detail about neuromuscular mechanism. They stated that in PNF position, sensory inputs from the periphery leads to stronger excitation of the cortical areas, leading to variations in the thresholds of a number of motor neurons, which was reflected in the motor evoked potentials. This was further supported by a study of Benecke et al [29] which reported that the amount of sensory input coming from the periphery was greater in PNF position than in normal position, which induces changes in the excitability of the pyramidal tract and the final motor pathways. In another study done by barker et al. it was observed that transcranial magnetic stimulation produce complex descending corticospinal volleys which usually contain a direct component via corticospinal neurons and an indirect trans-synaptic component [30, 31]. Even the treatment methods that allegedly are based on neurophysiological principles, however, do not have a fully comprehensive and experimentally proven neurophysiologic basis. Neurophysiological approaches, however, focus on upgrading of the lost motor capacities[32]. In that sense, Knott and Voss referred to "hidden potentials" of the patients for the recovery [33]. PNF increases the ROM by increasing the length of muscle and the neuromuscular efficiency. The physiological mechanism for increasing the ROM and strength may be due to autogenic inhibition, reciprocal inhibition, and stress relaxation [20].The techniques which were used in this study i.e. rhythmic initiation, slow reversal and agonistic reversal might have helped to normalize the tone of affected side trunk muscles, lengthening the contracted structures, relax the hypertonic muscles, initiating the movements, strengthening the weak muscles and improving the control of the pelvis. All these effects might directly or indirectly aid in improving the trunk control .This was in accordance with the observations made by Ruth et al studied rehabilitation using three exercise therapy approaches where they found pattern of muscle tone improvement in the PNF treatment group [34]. The PNF approach to treatment uses the principle that control of motion proceeds from proximal to distal body regions. Facilitation of trunk control, therefore, is used to influence the extremities. The result of the present study found improvement in trunk performance in terms of static sitting balance and dynamic sitting balance and coordination. However, the improvement in the entire outcome measures in this study could be due to natural recovery also, as we have included the acute and sub-acute stroke participants.

Limitation:

1. Less number of RCT's were enrolled in the study.
2. Those studies should have been enrolled where PNF is given for specific health conditions like Stroke.

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