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Added effect of proprioceptive neuromuscular facilitation on functional ability and trunk muscle endurance in chronic low back pain patients

Sayali R. Sawant[1], Dr. Snehal Ghodey[2]

[1]*BPTh Intern, Musculoskeletal Physiotherapy Department, MAEER'S Physiotherapy College, P.O. Talegaon General Hospital, Tal. Maval, Dist. Pune-410507, India*

[2]*Principal, MAEER'S Physiotherapy College, P.O. Talegaon General Hospital, Tal. Maval, Dist. Pune-410507, India*

***Corresponding Author: Sayali Sawant**

Email Id: sayaliphysio@gmail.com

ABSTRACT

Objectives

The purpose of the study was to determine added effect PNF on trunk muscle endurance and functional ability using trunk muscle endurance test and Oswestry low back pain disability questionnaire.

Methodology

40 subjects with Chronic mechanical low back pain were selected and were randomly allocated into experimental and control groups. Subjects were assessed on measures of trunk muscle endurance and oswstry low back pain disability questionnaire score prior to and after 3 weeks of intervention. The intervention in the experimental group included PNF (COI) with conventional treatment and control group included only conventional treatment for, 3 times/week for 3weeks.

Results

In the inter-group comparison conducted through arch index values, experimental group showed significant increase in trunk extensor endurance. Among intra-group comparison, both the groups showed significant increase in trunk flexion and extension endurance with significant decrease in oswetry score.

Conclusion

In the present study, it could be seen that PNF technique showed significant improvement in trunk extension endurance in patients with chronic mechanical low back pain. Therefore it has got an added effect in trunk extension endurance.

Keywords: Low back pain, Muscle endurance, Proprioceptive neuromuscular facilitation, Combination of isotonics.

INTRODUCTION

Low back pain (LBP) is the most common musculoskeletal condition affecting the adult population, with a prevalence of up to 84%. Chronic LBP (CLBP) is a chronic pain syndrome in the lower back region, lasting for at least 12 weeks. Chronic pain is pain that lasts beyond the expected period of healing, avoiding this close time criterion.

This definition is very important, as it underlines the concept that CLBP has well-defined underlying pathological causes and that it is a disease, not a symptom.

LBP symptoms can derive from many potential anatomic sources, such as nerve roots, muscle, fascial structures, bones, joints, intervertebral discs (IVDs), and organs within the abdominal cavity. LBP can also be influenced by psychological factors, such as stress, depression, and/or anxiety. [1]

Mechanical low back pain is usually cyclic, often referred to the buttocks and thighs. Morning stiffness or pain is common. There is pain on forward flexion and often also on returning to the erect position .pain is often produced or aggravated by extension, side flexion ,rotation , standing ,walking, sitting, and exercise in general.it usually becomes worse over the course of the day and relieved by the change of position. [2]

The symptoms of CMLBP are usually worsened by activity and improved partially by rest. Physical activity, particularly bending, extending, twisting and lifting, commonly aggravates the symptoms, whereas restriction of pain-producing activities results in improvement at least temporarily. Typical physical findings are nonspecific, including restricted range of motion of the spine, tight hamstring muscles, paravertebral muscle spasms, muscular trigger points, tenderness and aggravation of symptoms on flexion or extension and straight leg raising tests. PNF is an approach to therapeutic exercises that combines functionally based diagonal patterns of movement with techniques of neuromuscular facilitation to evoke motor responses and improve neuromuscular control and function [4]. They are designed to enhance the response of neuromuscular mechanism by stimulating proprioceptors. Patterns of movements associated with PNF are composed of multijoint, multiplanar, diagonal and rotational movements of the extremities, trunk and neck. [5]

Performance of these patterns is in line with the topographic arrangement of the muscles being used and may permit muscles to act in ways that are close to the actions. Therefore these exercises should be better suited for performance enhancement than is conventional single plane or single direction training programs. [5]

Combination of isotonics consist of combined concentric, eccentric and isometric contractions of one group of muscle without relaxation.

Neurophysiologic studies have linked pain development in the lumbar spine region of the vertebral column with disturbances in the mechanoreceptors and probably with impairment of the superior proprioception centers. Therefore, exercise programs that enhance proprioception may be beneficial for managing CLBP [6].

METHODOLOGY

40 subjects with chronic mechanical low back pain were selected for the study which included both males and females in the age group of 20-40 with Oswestry low back pain disability questionnaire score 20-60%. Subjects with PIVD, Severe instability of spine, severe spinal deformity, Spondylolisthesis, Fracture of spine, Pregnancy, Malignancy, Previous surgery or trauma to the region were excluded from the study. Subjects were explained about the study i.e. aim, method, duration and need for regular visits. Before recruitment in the study, written consent was obtained from the subjects who were willing to participate in the study. Initial evaluation of subject include –

1. Assessment of Trunk muscle endurance
2. Functional disability on OSWESTRY LOW BACK PAIN DISABILITY QUESTIONNAIRE was noted.

The subjects were randomly assigned in two groups using chit method.

Control group

All the subjects in the control group were given conventional treatment which include –

- Moist hot pack: given for 10 minutes.
- TENS 2 pole : given for 10 minutes.
- Bridging : 15 repetitions
- Crunches : 15 repetitions
- Pelvic rolling : 15 repetitions
- Alternate knee to chest : 15 repetitions
- Prone on elbows : 15 repetitions
- Cat – camel exercise : 15 repetitions
- Quadruped arm/ lower extremity lift (superman position) : 15 repetitions bilaterally.
  Set was repeated 3 times.

Experimental group

All subjects in experimental group were given conventional treatment along with combination of isotonic PNF technique.

- The therapist resist the patient's moving actively through motion (concentric contraction). at the end of motion the therapist tells the patient to stay in that position (isometric contraction), then therapist tells the patient to allow the part to be moved slowly back to the starting position(eccentric contraction) with no relaxation between the muscle activities.
- Bilateral lower extremity extension ,with knee extension for lower trunk extension
- Position at the start
- Position the patient close to the side of the table.
- Body mechanics
- Stand in a stride position facing the diagonal.as the patient's leg move into extension ,step back with forward leg
- Grip distal hand-distal hand holds both of patient's feet with contact on the plantar and lateral surface. Proximal hand-underneath the patient's thighs.
- Elongated position
- Patient's legs are flexed to the right .the right leg is in flexion-abduction-internal rotation with knee flexion .the left leg is in flexion-add-extension rotation with knee flexion .the lower trunk is flexed with rotation and lateral flexion to right,
- Command-toes down, kick down to me.
- Movement-the legs extend together, the left leg into extension-abduction-internal rotation, right leg into extension-add-external rotation. When the legs reach the end of the range, the motion continues as lower trunk elongation with rotation to the left.
- Resistance-distal hand resists trunk and hip rotation with pressure on the feet. Resist knee extension by pushing the patient's heel back towards buttock. Proximal hand resists hip motion.
- End position-lower extremity in extension with lower trunk in rotation to the left.
- Exercises were given 3 days/week for 3 weeks.
- 3 sets of 15 reps of each exercise were given. The sets were repeated at the interval of 60 seconds.
- Post treatment assessment at the end of 3 weeks was done to check trunk muscle endurance and functional ability using ODQ and the results will be compared in both the groups.

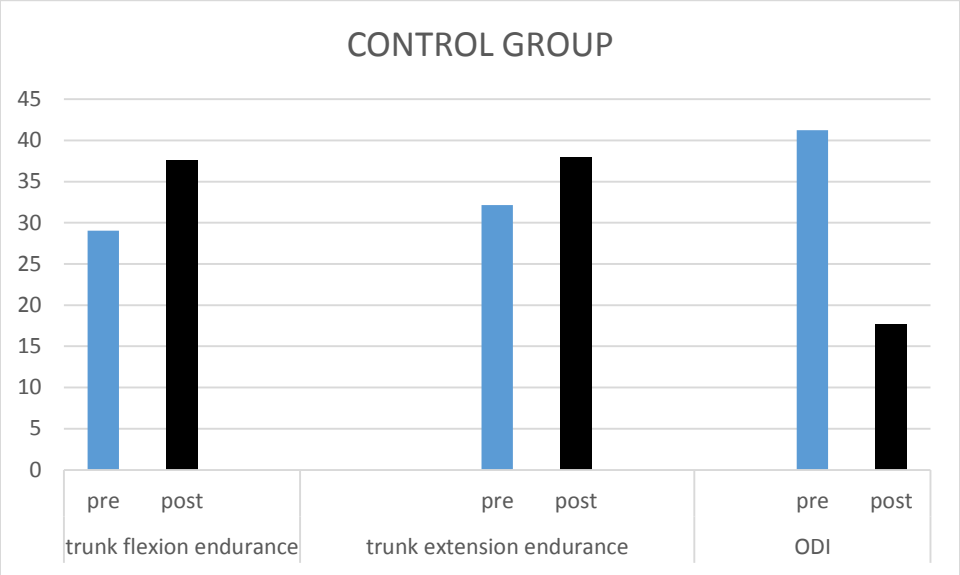
RESULTS

Total of 40 (both males and females) subjects were taken which was divided into two groups, control and experimental. Oswestry low back disability questionnaire, trunk flexion and extension endurance were the outcome measures. Statistical analysis in the group was taken by paired t-test and between the groups by unpaired t-test.

TESTS	GROUPS	MEAN			SD			P VALUE	SIGNIFICANCE
		Pre	Post	Diff	Pre	Post	Diff		
ODI	Control	41.23	17.71	23.52	6.8	9.4	9.16	<0.0001	Extremely significant
	Experimental	35.55	9.46	26.08	4.4	3.1	5.5	<0.0001	Extremely significant
	Difference							0.2912	Not significant
Trunk flexion endurance	Control	29.05	37.5	8.45	6.56	6.12	4.29	<0.0001	Extremely significant
	Experimental	25.7	34.15	8.45	4.82	6.72	5.18	<0.0001	Extremely significant
	Difference							>0.9999	Not significant
Trunk extension endurance	Control	32.15	37.95	5.8	8.46	7.59	2.93	<0.0001	Extremely significant

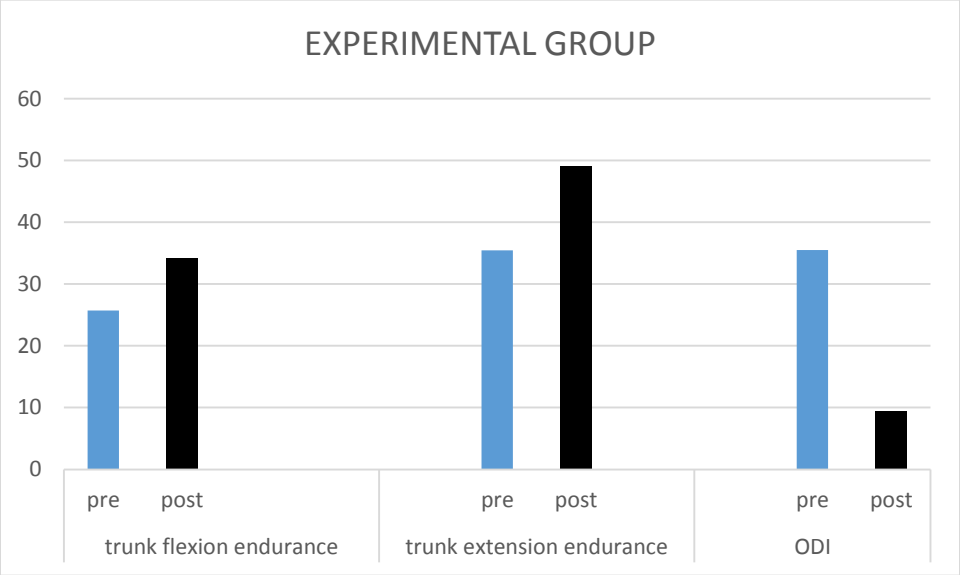
Experimental	35.45	49.2	13.75	13.01	15.52	6.42	<0.0001	Extremely significant
Difference							<0.0001	Extremely significant

Graph 1: shows trunk flexion endurance, trunk extension endurance and Oswestry low back pain disability questionnaire score, comparing mean of pre and post treatment of control group.



There is increase in mean trunk flexion endurance , extension endurance and decrease in ODI score pre and post of control group with p-values as <0.0001 showing extremely significant results post treatment using paired t test.

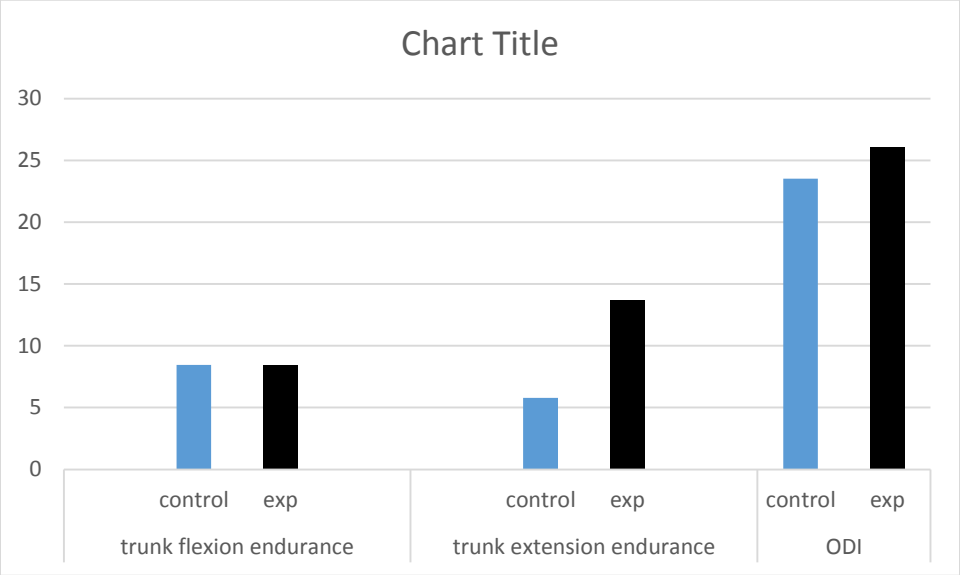
Graph 2: shows trunk flexion endurance, trunk extension endurance and Oswestry low back pain disability questionnaire score comparing mean of pre and post treatment of experimental group.



There is increase in mean trunk flexion endurance , extension endurance and decrease in

ODI score pre and post of control group with p-values as <0.0001 showing extremely significant results post treatment using paired t test.

Graph 3: shows trunk flexion endurance, trunk extension endurance and Oswestry low back pain disability questionnaire score comparing difference of mean of control and experimental group.



There is no significant increase in trunk flexion endurance in difference of mean of control and experimental group with p value >0.9999 showing not significant result.

There is significant increase in trunk extension endurance in difference of mean of control and experimental group with p value <0.0001 showing extremely significant result.

There is no significant decrease in ODI score in difference of mean of control and experimental group with p value 0.2912 showing not significant result.

DISCUSSION

The present experimental study was an attempt to find the added effect of PNF in chronic low back pain. 40 patients participated in the study that fulfilled the inclusion criteria. The study was conducted for duration of 3 weeks. Subjects were assessed for Oswestry low back pain disability questionnaire.

The current study demonstrated that back endurance was improved significantly [p<0.0001] in experimental group compared to the control group after PNF technique.

Nick k at al (2006) showed that 4 weeks of intensive PNF training improves trunk muscle endurance. Dynamic nature of PNF exs i.e. combination of isotonics ,which used all muscle action types (concentric, eccentric, isometric) through a progressively increased range of motion and also to the fact that PNF exercises involves significant muscle work that result in muscle strength and endurance improvement. [5]

In a similar study, **Kofotolis and Ke (2006)** llis directly applied the PNF technique to the shoulder area of the trunk for four weeks. They reported that trunk endurance increased significantly by indirectly inducing the motion of the trunk, giving resistance to the limbs. [8]

In present study, bilateral lower extremity extension, with knee extension for lower trunk extension pattern target back extensors, quadratus lumborum, multifidi and rotators effectively. Hence back endurance was significantly improved.

The present study, intragroup comparison showed significant improvement in trunk flexion endurance both in control and experimental group (p<0.0001) at post treatment level. Intergroup comparison showed no significant difference in trunk flexion endurance (p>0.9999). The possible reason may be the pattern used mainly target back extensors more than abdominals.

In a similar study **Nick Kofotolis, Eleftherios Kellis** concluded that COI group showed

significantly higher gains in trunk muscle endurance than did the RST group, mainly during extension. [6]

In present study, intragroup comparison showed significant improvement in Oswestry low back pain disability questionnaire in both control and experimental group ($p<0.0001$) at post treatment level.

Intergroup comparison showed no significant improvement in Oswestry low back pain disability questionnaire ($p=0.2912$).

Improvement in functional ability could be seen as a result of pain and trunk muscle endurance improvement. [5]

Pain intensity significantly decreased in both group following treatment. The reason was training of unbalanced trunk muscle, which induced an interaction between trunk muscles which reduced pain.

CLBP may lead to development of deconditioning syndrome which includes impairment in back muscle force, endurance, spinal mobilit, so exercises helps in reducing pain by breaking pain spasm pain cycle. [5]

PNF is the technique that controls the proprioception and sensory- motor function to reduce pain further.

Manniche et al, 46 who demonstrated that among patients with low back pain, intensive training had to continue for more than 2 months to achieve significant pain reduction, whereas a 3-week daily intensive training program was found to be equally efficient. [9]

Mechanical low back pain is considered a common problem and one of the causes of pain and restriction in daily functional activities.

A physical therapy programme comprises of trunk stability exercises with PNF technique; with conventional treatment has more beneficial effect.

CONCLUSION

PNF technique has shown significant improvement in trunk extension endurance in patients with chronic mechanical low back pain. Therefore it has got an added effect in trunk extension endurance.

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