

# STUDY ON EFFECTIVENESS OF PROPRIOCEPTIVE NEUROMUSCULAR FACILITATION (PNF) TECHNIQUE AND CONVENTIONAL THERAPY IN TREATING THE PATIENTS WITH CERVICAL SPONDYLOSIS

Seema Gupta <sup>\*1</sup>, Preeti George <sup>2</sup>, Ankita Prajapati <sup>3</sup>.

<sup>\*1</sup> Physiotherapist, Department Of Physiotherapy Ayushman College, Bhopal, (M.P.), India.

<sup>2</sup> Assistant Professor, Department Of Physiotherapy Ayushman College, Bhopal, (M.P.), India.

<sup>3</sup> Associate Professor, Department Of Physiotherapy Ayushman College, Bhopal, (M.P.), India.

## ABSTRACT

**Background:** Proprioceptive Neuromuscular Facilitation (PNF) A wide range of treatment techniques and approaches from different philosophical backgrounds are utilized in Neurological Rehabilitation The aim of this study is to evaluate the effectiveness of proprioceptive neuromuscular facilitation technique and conventional therapy in treating the patients with Cervical Spondylosis by improving the pain and range of motion of neck.

**Subjects and methods:** 40 cervical Spondylosis patients of both the sexes selected on the basis of inclusion and exclusion criteria were included in the study and randomly divided into two groups A and B each of 20 persons. Group A consisting of 10 males and 10 females received PNF (Hold –relax and Contract relax) exercise for 4 weeks, 5 days/ week once in a day and Group B consisting of 11 males and 9 females received conventional therapy for 4 weeks, 5 days/ week once in a day. Variables are measured pre intervention and post intervention after 4 weeks. To evaluate changes in pain, a shortened version of the McGill Questionnaire was used, Range of motion is measured.

**Result:** Group A shows more significant improvement in all variables (Pain, ROM) in cervical spondylosis subjects than Group B.

**Conclusion:** Analysis of the results confirmed that both PNF and conventional therapy had a statistically significant impact on reducing pain and improving the range of motion of neck in subjects suffering from spondylosis, but PNF method proved to be more effective than conventional therapy and McGill score of PNF applied group were more significant.

**KEY WORDS:** Proprioceptive Neuromuscular Facilitation (PNF), Pain, Range of Motion (ROM), Spondylosis, McGill Questionnaire.

**Address for correspondence:** Dr. Seema Gupta. PT., Master of Physiotherapy (Neurology), Department Of Physiotherapy Ayushman College, Bhopal, (M.P.), India.

**E-Mail:** [seema.gupta2007@yahoo.co.in](mailto:seema.gupta2007@yahoo.co.in)

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## INTRODUCTION

Cervical spondylosis is a gradual degenerative disorder present in the cartilage of the cervical joints, or osteoarthritic changes in the synovial

facet joints of spine (apophyseal joints) which may be asymptomatic or can be manifested with pain in the cervical region (Hirpara, Butler 2012) [1].

The prevalence of cervical spondylosis is similar for both sexes, although the degree of severity is greater for males [2]. Which may be asymptomatic or can be manifested with pain in cervical region. Evidence of spondylotic change was found in many asymptomatic adults, with 25% of adults under the age of 40, 50% of adults over the age of 40, and 85% of adults over the age of 60 showing some evidence of disc degeneration [3].

Degeneration of the disc: it begins within the annulus fibrosis in the form of slight tears of the annular fibers and cracks appear at various sites and as a result nuclear herniation through the torn annulus also osteophytes formation and apophyseal joints (facet joints) osteoarthritis [4].

**PNF:** A wide range of treatment techniques and approaches from different philosophical backgrounds are utilized in Neurological Rehabilitation. [5] PNF evolved to a complete rehabilitation approach for a variety of indications of neurological and musculoskeletal origin [6].

Rood developed a system of therapeutic exercises enhanced by cutaneous stimulation for patients with neuromuscular dysfunctions [7]. PNF techniques: (Hold-relax) One PNF technique that Black says can trigger the reflex is commonly called "hold-relax." This involves: Putting a muscle in a stretched position (also called a passive stretch) and holding for a few seconds. Contracting the muscle without moving (also called isometric), such as pushing gently against the stretch without actually moving [8]. This is when the reflex is triggered and there is a "6- to 10-second window of opportunity for a beyond 'normal' stretch," Black says. Relaxing the stretch and then stretching again while exhaling. This second stretch should be deeper than the first [9]. Contract-relax another common PNF technique is the contract-relax stretch. It is almost identical to hold-relax, except that instead of contracting the muscle without moving, the muscle is contracted while moving [10]. This is sometimes called isotonic stretching. For example, in a hamstring stretch, this could mean a trainer provides resistance as an athlete contracts the muscle and pushes the leg down to the floor [11].

PNF stretching has been found to increase ROM in trained, as well as untrained individuals [12]. PNF movement patterns are functional movements which are found in activities of everyday living [10]. The PNF patterns are characterized by three dimensional diagonal movements as a result of synergistic muscle activation [13].

Functional approach is the most effective way to stimulate the patient and to achieve the best therapeutic results [14]. Mainly, this study was to evaluate the effectiveness of PNF methods in the treatment of patients with cervical spondylosis in acute stage especially their efficacy in reducing pain.

Conventional physiotherapy is defined as the treatment of movement disorders caused by impairments of joints and the muscles that move the joints. There are lots of exercises in conventional therapy such as dynamic exercise, static exercises; it is older methods which are applying by physical therapist [13]. A dynamic exercise is any exercise that involves joint movement. When performing dynamic exercises, like the biceps curl, triceps dip or a squat for example, it's important to move through what's called the full ROM [15]. By using the whole ROM, the whole length of the muscle is stimulated.

Static exercises, also known as isometrics are a form of training where the body performs little to no movement while contracting its muscle fibers. Benefits of static exercises training are: increased muscular endurance, improves muscular strength, toning and time saving [16].

## SUBJECTS AND METHODS

This study involved 40 cervical Spondylosis patients. The criteria for subject selection are as follows: Those who were diagnosed with pain and stiffness of neck resulting from a cervical Spondylosis and onset is acute (not more than 1 month). Assessment of pain and ROM of neck is done with the help of McGill questionnaire and universal goniometer respectively. Data was collected pre and post treatment.

**Procedure:** All the subjects were selected on the basis of inclusion and exclusion criteria. Male and female both were included and the consent is taken from them. And then, they were

divided randomly into two group i.e. Group A and group B.

**Group A (n=20)** to which PNF (Hold –relax and Contract relax) exercise given for 15 min., for 4 weeks.

**Group B (n=20)** to which conventional therapy is given such as static exercise and dynamic exercise of neck.

In Group A, PNF technique is given for 4 weeks, 5 days/ week once a day. All subjects are provided with PNF technique in supine lying position then performed neck flexion with rotation to the right and neck extension with rotation to the left.

In Group (B), conventional therapy (Dynamic and static exercise) is given for 4 weeks, 5 days/ week once in a day. Dynamic neck exercises such as ROM exercise with 10 reps. and static neck exercise holding for 10 sec. with 10 reps. were given. Variables are measured pre intervention and post intervention after 4 weeks. Data analysis was performed using SPSS version 20. Parametric statistical test were used. were used.

1. MEAN OR ARTHMETIC MEAN :

$$\text{Formula } \bar{x} = \frac{\sum x}{N}$$

Where  $\bar{x}$  = Arithmetic mean,  $\sum x$ =Sum of the variable, N=the total number of variables.

II. STANDARD DEVIATION (S.D):

$$S.D(\delta) = \sqrt{\frac{\sum(x - \bar{x})^2}{N}} = \frac{\sqrt{d^2}}{H}$$

- X = Value of the Variable
- $\bar{x}$  = Arithmetic Mean
- N = Total Number of Observation

T- test OR Student T-test –

$$t = \frac{\bar{X}_1 - \bar{X}_2}{SE}$$

$\bar{X}_1$  &  $\bar{X}_2$  = Mean; SE = Standard Error

Paired 't' test -

$$t = \frac{\bar{D}}{\frac{\sqrt{SD^2 - (\sum D)^2}}{n-1}}$$

D = Mean Difference ; n = Sample Size

Unpaired't' test:-

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{\sum(X_1 - \bar{X}_1)^2 + \sum(X_2 - \bar{X}_2)^2}{n_1 + n_2 - 2}}}$$

$\bar{X}_1$  = Mean of group A;  $\bar{X}_2$  = Mean of Group B;  
 $n_1$  = Number of Subject in Group A;  $n_2$  = Number of Subject in Group B  
 $n_1 + n_2 - 2$  = Degree of Freedom

**RESULTS**

The present study entitled “Compare the effectiveness of PNF and manual therapy in patients with cervical spondylosis” was conducted on 40 subjects who were randomly allocated into 2 groups. The subjects of group A received PNF (Hold –relax and Contract relax) exercise for 15 min. for 4 weeks whereas Group B subjects received conventional therapy as static exercise and Dynamic exercise of neck to remove pain and to increase range of motion

**Table 1:** Distribution of subjects according to age in two groups.

Groups	Mean	SD	T value	P value
Group A	48.75	6.89	0.726	0.474
Group B	46.45	4.76		

Mean age of subjects of group A was 48.75±6.89 years whereas mean age in group B was 46.45±4.76 years. Test of significance (independent t test) observed no statistical difference between the age of two groups (p>0.05).

**Table 2:** Distribution of subjects according to Gender in two groups.

Groups	Male	Female	T value	P value
Group A	10	10	0.14	0.75
Group B	11	9		

The gender composition in both the groups were comparable in present study (p>0.05)

**Table 3:** Distribution of subjects according to pain in group A.

Pain	Mean	SD	T value	P value
Pre	32.8	2.33	41.4	0.001
Post	12.35	1.37		

Pain was assessed using McGill questionnaire in present study. Mean pre intervention pain in group A was 32.8±2.33 whereas post intervention it was 12.35±1.37 The improvement in pain was statistically highly significant post intervention (p<0.01) in group A subjects.

**Table 4:** Distribution of subjects according to Flexion in group A.

Flexion	Mean	SD	T value	P value
Pre	60.8	6.01	15.06	0.001
Post	83.2	2.91		

In present study, mean and S.D of pre intervention Flexion in group A was 60.80±6.01 whereas post intervention it was 83.20±2.91. The improvement in range of Flexion was statistically highly significant ( $p<0.01$ ) within group A subjects.

**Table 5:** Distribution of subjects according to Extension in group A.

Extension	Mean	SD	T value	P value
Pre	59.4	9.17	2.91	0.009
Post	65.45	2.71		

In present study, mean and S.D of pre intervention Extension in group A was 59.40±9.17 whereas post intervention it was 65.45±2.71. There was statistically highly significant difference in extension before and after intervention ( $p<0.01$ ) within group A subjects.

**Table 6:** Distribution according to lateral flexion in group A.

Lateral flexion	Pre intervention		Post intervention		T value	P value
	Mean	SD	Mean	SD		
Right	30	4.97	37.8	4.2	5.23	0.001
Left	32.1	4.14	38.8	3.56	5.21	0.001

Mean and S.D of pre intervention Lateral Flexion Right and Lateral Flexion Left in group A was 30.00±9.20 and 32.10±4.14 whereas the Mean Lateral Flexion Right and Lateral Flexion Left post intervention was 37.80±4.20 and 38.80±3.56 respectively. Test of significance (paired t test) observed statistically highly significant improvement in Lateral flexion post intervention ( $p<0.01$ ).

**Table 7:** Distribution according to rotation in group A.

Rotation	Pre intervention		Post intervention		T value	P value
	Mean	SD	Mean	SD		
Right	71.85	6.38	85.45	1.09	9.02	0.001
Left	73.53	8.4	85.89	1.09	6.67	0.001

Mean and S.D of pre intervention Rotation Right and Rotation Left in group A was 71.85±6.38 and 73.35±8.40 whereas the Mean Rotation Right and Rotation Left post intervention was 85.45±1.09 and 85.89±1.09 respectively. Test of significance (paired t test) observed statistically

highly significant reduction in Rotation post intervention ( $p<0.01$ ).

**Table 8:** Distribution of subjects according to pain in group B.

Pain	Mean	SD	T value	P value
Pre	34.6	2.08	34.9	0.001
Post	20.34	0.81		

In present study, mean and S.D of pre intervention pain using McGill scale in group B was 34.6±2.08 whereas post intervention it was 20.34±0.81. The improvement in pain was statistically highly significant ( $p<0.01$ ) within group B subjects.

**Table 9:** Distribution of subjects according to Flexion in group B.

Flexion	Mean	SD	T value	P value
Pre	64.45	5.92	6.99	0.001
Post	75.25	2.86		

In present study, mean and S.D of pre intervention Flexion in group B was 64.45±5.92 whereas post intervention it was 72.25±2.86. The improvement in Flexion was statistically highly significant ( $p<0.01$ ) within group B subjects.

**Table 10:** Distribution of subjects according to Extension in group B.

Flexion	Mean	SD	T value	P value
Pre	60.7	7.88	2.15	0.02
Post	70.8	7.54		

In present study, mean and S.D of pre intervention Extension in group B was 60.70±7.88 whereas post intervention it was 70.80±7.54. The improvement in Extension was statistically highly significant ( $p<0.01$ ) in group B subjects post intervention.

**Table 11:** Distribution according to lateral flexion in group B.

Lateral flexion	Pre intervention		Post intervention		T value	P value
	Mean	SD	Mean	SD		
Right	30.55	6.15	34.85	4.33	2.26	0.02
Left	32.45	5.4	36.25	3.67	2.2	0.04

Mean and S.D of pre intervention Lateral Flexion Right and Lateral Flexion Left in group B was 30.55±6.15 and 32.45±5.40 whereas the Mean Lateral Flexion Right and Lateral Flexion Left post intervention was 34.85±4.33 and 36.25±3.67 respectively. Test of significance (paired t test) observed statistically highly significant reduction in Lateral flexion post intervention ( $p<0.01$ ).

**Table 12:** Distribution according to rotation in group B.

Rotation	Pre intervention		Post intervention		T value	P value
	Mean	SD	Mean	SD		
Right	73.65	1.75	77.05	2.23	5.66	0.001
Left	75	1.9	77.85	3.2	3.52	0.002

Mean and S.D of pre intervention Rotation Right and Rotation Left in group B was  $73.65 \pm 1.75$  and  $75.00 \pm 1.90$  whereas the Mean Rotation Right and Rotation Left post intervention was  $77.05 \pm 2.23$  and  $77.85 \pm 3.20$  respectively. Test of significance (paired t test) observed statistically highly significant reduction in Rotation post intervention ( $p < 0.01$ ).

## DISCUSSION

In present study, mean age of subjects of PNF group was  $48.75 \pm 6.89$  years whereas mean age in conventional therapy group was  $46.45 \pm 4.76$  years. The male and female composition of both the groups was almost equal. The age and gender composition in both the groups were comparable in present study ( $p > 0.05$ ). Neck pain is a common problem, 60% to 90% of people in their middle age complain about it [10]. In a similar study by Maicki T et al (2017) [18], mean age of subjects in PNF and manual therapy group were  $56.3 \pm 5.3$  and  $55.8 \pm 6.4$  years respectively and the two groups were comparable [17]. Azemi A et al (2018) in their study involved 60 patients in the age range of 40 to 60 years of both genders [19].

Pain was assessed using McGill questionnaire in present study. Mean pre intervention pain in group A was  $32.8 \pm 2.33$  and post intervention it was  $12.35 \pm 1.37$  whereas mean pre intervention pain in group B was  $34.6 \pm 2.08$  and post intervention it was  $20.34 \pm 0.81$ . The improvement in pain was statistically highly significant ( $p < 0.01$ ) in both the groups. Mean pain in both the groups were comparable before intervention ( $p = 0.06$ ) whereas post intervention, the difference in mean pain between the two groups (independent t test) were statistically significant ( $p = 0.001$ ).

Maicki et al (2017) in their study used McGill questionnaire to assess the pain and stated that in both PNF and conventional therapy group the level of pain experienced by the patients decreased significantly post intervention as compared to before intervention pain. The pain

reduction was significantly greater in PNF group as compared to conventional therapy group ( $p < 0.05$ ) [20].

Falla DL et al (2018) [21] in their study suggested that the activation of the deep flexors is impaired in people with spinal pain in this area. Jull G et al (2002) [22] concluded that the deep neck flexor exercise leads to reduction of pain in the cervical spine whereas Fariba G et al (2016) [23] suggested stabilization exercises have high influence on endurance of deep neck flexors which help in significantly decreasing pain and disability in patients with chronic neck pain [24].

The present study observed statistically significant improvement in mean flexion, extension, lateral flexion and rotation in both the groups post intervention whereas mean range of movements were significantly higher in PNF group as compared to conventional therapy group. Senthil nathan CV et al (2015) [25] in their study also observed similar findings. They observed no significant difference in mean range of movements between the groups before intervention whereas the difference was significant post intervention and the range of movements were significantly greater in PNF group ( $p < 0.01$ ) [26]. Azemi A et al (2017) also observed significant improvement in range of motion (lateral rotation to left and right) in both the group post intervention but higher in PNF group [19].

Smedes F et al (2016) [27] suggested treatment according to PNF goes with general guidelines used for non-specific low back pain and neck pain where the goal is to improve general strength, range of motion and activity more than pain. Ylinen J et al (2003) [28] concluded that long-term benefits such as reducing pain, improvement in range of motion and muscle strength can be achieved if exercises are performed at least 2 times a week for 1 year [29].

## CONCLUSION

Analysis of the results confirmed that rehabilitation of patients using both PNF and conventional therapy had a statistically significant impact on reducing pain and improving the range of motion of neck in subjects suffering from spondylosis. In this study, PNF method proved to be more effective than conventional therapy

and McGill score of PNF applied group were more significant.

**Conflicts of interest: None**

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