



## “Effect of Proprioceptive Neuromuscular Facilitation on Pain and Function in Patients with Osteoarthritis of Knee”

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### Abstract

**Background:** Osteoarthritis of the knee is considered a major public health problem with impaired functions that reduces quality of life owing to musculoskeletal pain and disability and muscle weakness. Thus, effective modality for pain relief and also muscle strengthening is needed. To reduce such effects, proprioceptive neuromuscular facilitation can be used. Thus the aim of the study is to find out the effect of proprioceptive neuromuscular facilitation on pain and function in patients with Osteoarthritis of knee.

**Materials and Methods:** 30 individuals between the age group of 55-70 years diagnosed with osteoarthritis of knee were included in the study. Pain and functional activities of the participants were assessed using Numeric Pain Rating Scale (NPRS) and Knee Injury and Osteoarthritis Outcome Score (KOOS) on the first day and last day. Subjects received Proprioceptive Neuromuscular Facilitation (PNF) of lower limb along with conventional physiotherapy treatment for two weeks.

**Results:** The results showed highly significant difference in the NPRS as well as KOOS scores ( $P < 0.001$ ) pre and post treatment.

**Conclusion:** The study concluded PNF can be considered as an adjunct therapy to conventional treatment for individuals with knee Osteoarthritis.

**Keywords:** Knee Joint; NPRS; KOOS Scale

### Abbreviations

OA: Osteoarthritis; WHO: World Health Organization; PNF: Proprioceptive Neuromuscular Facilitation; ROM: Range of Motion; NPRS: Numeric Pain Rating Scale

### Introduction

The knee joint is the largest and the most complex joint in the body. The complexity is the result of fusion of three joints in one. It is formed by the fusion of lateral femorotibial, medial femorotibial and femoro-patellar joints. It is a condylar synovial joint, incorporating two condylar joints between the condyles of the femur and tibia, and one saddle joint between femur and the patella [1]. Rohit Yadav, et al. (2022) stated that the overall prevalence of Knee Osteoarthritis was 33.2% in big cities, 19.3% in small cities, 18.3% in

towns, and 29.2% in villages. In the study, it was seen that 32.7% of the population in the big city had a sedentary lifestyle as compared to 28.7% in villages and 18.1% in towns [2].

The knee joint is supported by the ligaments of Fibrous capsule, Ligamentum patellae, Tibial collateral or medial ligament, Fibular collateral or lateral ligament, Oblique popliteal ligament, Arcuate popliteal ligament, Anterior cruciate ligament, Posterior cruciate ligament, Medial meniscus, Lateral meniscus and Transverse ligament and also by muscles [3]. As given by WHO Osteoarthritis (OA) is regarded a major public health problem with impaired functions that reduces quality of life [4]. Osteoarthritis causes much musculoskeletal pain and disability [5]. Osteoarthritis (OA) is one of the leading causes of musculoskeletal pain and disability and is the third leading cause of life years lost due to disability [6].

Osteoarthritis is a chronic, degenerative progressive musculo-skeletal disorder primarily affecting the articular cartilage of the synovial joints, with eventual bony remodelling and overgrowth at the margins of the joint (spurs and lipping) due to increased bone density. There is also progression of synovial and capsular thickening and joint effusion. Population ageing and increase in related factors such as obesity, sedentary life style, and weakness of the quadriceps muscles, joint impact, or sports with repetitive impact and twisting, and occupational activities such as jobs that require kneeling and squatting with heavy weight lifting leads to increased prevalence of OA knee [7].

There is a gradual loss of cartilage in joints which leads to bones rubbing together and creating stiffness, pain, and impaired movement. The most commonly affected joints are knees, hips, hands, feet, and spine [8].

Researchers have established many links between OA and osteoporosis. OA has a strong connection with Osteoporosis.

Osteoarthritis can be classified into two groups Primary Osteoarthritis and Secondary Osteoarthritis. Primary osteoarthritis is a chronic degenerative disease which is related to aging. The water content of the cartilages reduces as the age increases, thus making them more susceptible to degradation. While Secondary Osteoarthritis usually affects the joints earlier in life due to specific causes that include injury during a job requiring frequent kneeling or squatting for long duration, diabetes and obesity [8].

Osteoarthritis primarily affects the elderly population. It is a main cause of disability in older adults worldwide. According to World Health Organization (WHO) 9.6% of men and 18.0% of women aged over 60 years has symptomatic osteoarthritis worldwide. 80% of the individuals with osteoarthritis have limitations in movement, and 25% cannot perform their major daily activities of life [9].

The muscles around the knee, especially quadriceps and hamstring, mainly act as dynamic stabilizer and also require for stabilization of the posture and for even distribution of shock and the stress during the physical motion. Quadriceps muscle weakness is a common clinical sign associated with osteoarthritis. Capsular damage and muscle weakness, and impairment of knee proprio-

ception can be caused by Loss of hyaline articular cartilage and impairment of bony remodelling which has been related to individuals with knee osteoarthritis. Weakness of knee flexor and extensor muscles could lead to a reduced joint stability and decreased biomechanical efficiency. Hence there is a need of an effective modality for pain and also for muscle strengthening [10].

To reduce such effects, Proprioceptive Neuromuscular Facilitation (PNF) can be used as it improves perfusion, strength and stability. Proprioceptive neuromuscular facilitation is a method that uses diagonal and spiral movements which aims at facilitating, strengthening and gaining stability and co-ordination and this in turn activates the proprioceptors which are located in the joints, tendons and muscles of the body which help in improving the function [11].

Knee osteoarthritis is now one of the leading joint diseases that may cause pain, stiffness, loss of physical function in the joint and other adverse effects among adults. The burden on health care resources and on the economy caused by knee osteoarthritis are substantial.5,8 Also OA knee causes muscle imbalance leading to decreased quality of life. To reduce such effects, proprioceptive neuromuscular facilitation can be used as it improves perfusion, strength and stability.

Different techniques of emphasis of PNF are used to correct imbalances and restore the patient's ability to perform a coordinated movement. repeated contractions; one of the technique of emphasis can be used to increase the muscle strength [12]. Hence this study aims to find out the effect of proprioceptive neuromuscular facilitation on pain and function in patients with Osteoarthritis of knee to give maximum benefit of the treatment and thus the best therapy for the condition so as to avoid surgery.

## Materials and Methods

The project was conducted after the approval of ethical committee of Dr D. Y. Patil College of Physiotherapy. The individuals were informed in detail about the study and the procedure. Informed consent was obtained from the recruited patients participating in the study.

Pre-post experimental study was conducted in individuals with in 55-70 years of age with unilateral osteoarthritis of knee having

positive clark’s test. The individuals consulting a physiotherapist for the treatment of any injury in the knee, having Knee surgery in the past 12 months, past history of lower limb joint replacement and any other kind of fracture or injury to the knee were excluded. Pre - assessment for pain and functional activities were done using Numeric Pain Rating Scale (NPRS) and Knee injury and Osteoarthritis Outcome Score (KOOS) scale. Then the samples were given lower limb PNF exercises along with conventional exercises.

Conventional Physiotherapy included strengthening and ROM exercises for lower limb. Five sessions of PNF exercises were given. Each session lasted for 30 minutes where D1, D2 Flexion and Extension movement patterns for the affected limb were executed using repeated contraction technique of PNF.

The PNF exercise program consisted of 5 sessions per week for 2 weeks. Each session lasted about 30 minutes where 4 different movement patterns were used they were executed on the affected limb. Repeated contraction technique of PNF was given: D1-flexion: Hip flexion, adduction and external rotation, Knee extension, Ankle dorsiflexion and inversion, Finger extension.

- **D1-extension:** Hip extension, abduction, and internal rotation, Knee extension, Ankle plantarflexion and eversion, Finger flexion.
- **D2-flexion:** Hip flexion, adduction and external rotation, Knee flexion, Ankle dorsiflexion and inversion, Finger extension.
- **D2-extension:** Hip extension, abduction and internal rotation, Knee flexion, Ankle plantarflexion and eversion, Finger flexion.

**Application of repeated contraction**

In supine lying position the samples were asked to move the limb in desired pattern according to their capacity, quick stretch was given initially, followed by maximum resistance in order to obtain isometric type of muscle contraction. After that resistance was reduced and the samples were instructed to move further in order to gain new range without resistance, then again quick stretch was applied to facilitate movement throughout the remainder of range along with progressing the resistance and the same procedure was repeated till the fatigue was evident.

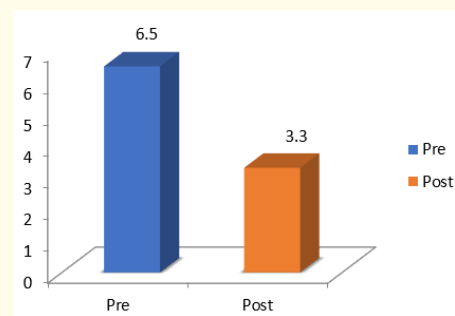
After the treatment session assessment for pain and functional activities were done using NPRS and KOOS scale.

**Data analysis**

Statistical analysis was done using MedCalc v18.2.1 software. Paired t test was used to check for significance between pre and post observations within the same group.

Group	Count	NPRS		t-value	p-value
		Mean	SD		
1 Pre	30	6.5	1.167	14.777	< 0.001
2 Post	30	3.3	1.149		

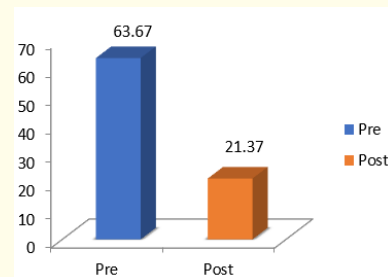
**Table 1:** Pre and Post NPRS scores.



**Figure 1:** Pre and post NPRS score.

Group	Count	KOOS		T value	p value
		Mean	SD		
1 (Pre)	30	63.67	7.599	26.443	<0.001
2 (Post)	30	21.37	4.476		

**Table 2:** Pre and Post assessment of KOOS scores.



**Figure 2:** Pre and post KOOS score of the study group.

## Result

Figure 1 and table 1 shows that there is significant decrease in pain pre and post treatment ( $p < 0.001$ ) suggesting that there is decrease in pain intensity.

Figure 2 and table 2 shows significant difference in KOOS score pre and post treatment ( $p < 0.001$ ) suggesting that there is increase in the ability to do ADL's.

## Discussion

This study was conducted to find out the effect of lower limb PNF exercise on pain and function in patients with osteoarthritis of knee being one of the leading causes of musculoskeletal pain and disability and is the third leading cause of life years lost due to disability [6].

PNF techniques are classified under three broad categories as Directed to the Agonist, Reversal of Antagonist and to promote relaxation. In this study repeated contraction technique which comes under directed to agonist category. Paul R. Surburg conducted a survey to determine if Proprioceptive Neuromuscular Facilitation (PNF) techniques are being implemented in the same manner; they concluded that various techniques are used such as Rhythmic - Initiation, repeated contraction, slow reversal, contract relax, contract - Relax - contract, Rhythmic stabilization, Slow reversal, Contract - Relax- Contract for different joints like Knee, Shoulder, Hip [13].

A total of 30 participants were included in the study diagnosed with Knee Osteoarthritis. All participants were given lower limb PNF exercises along with conventional exercises for 2 weeks and a total of 10 sessions were conducted in the course of 2 weeks. As seen from the results, all the participants showed significant reduction in pain and showed increase in the ability to do activities of daily living on NPRS and KOOS scales respectively.

Patients with Osteoarthritis of knee show reduced quadriceps strength and a decline in proprioception. Reduced proprioception weakens thigh muscles and limit their walking ability and impairs balance. Also, joint pain may have harmful effects on muscle function and muscle activation hence, an exercise program was developed to strengthen the thigh muscles, enhance proprioception and to reduce pain in patients with osteoarthritis [14].

A study conducted by Sung-Bum Ju et.al showed increased knee joint muscle function and decrease in pain in the group which underwent proprioceptive neuromuscular facilitation exercise program. The 2 week PNF program improved isokinetic strength which led to increased ankle joint stability and combining resistance with PNF exercises resulted in greater muscle hypertrophy which supports and improves knee joint muscle function. This study showed improved knee joint muscle function and a decrease in pain in the group that underwent the PNF training program [14].

PNF exercises are accompanied by great sensory and proprioceptive stimulation. They use stretch reflex, manual contact, visual and verbal stimulation with diagonal patterns which stimulate functional movements [11].

The present study result shows that all the 30 subjects had significant reduction in pain and function. Pain relief was obtained because of repeated contraction technique of PNF in which repetitive activity of weaker muscles, reinforcement and timing for emphasis are used together also the repeated contractions leads to building up the strength and endurance of weaker muscles and results in coordinated activity of weak and strong components of same pattern. As the strength of the weaker muscle increased' it caused reduction in the pain [12].

Chae-Woo Lee., et al. conducted a study to see Effects of Combination Patterns of Proprioceptive Neuromuscular Facilitation and Ball Exercise on Pain and Muscle Activity of Chronic Low Back Pain Patients. The study showed that PNF combination pattern training was more effective for reducing pain and improving muscle activity in patients with low back pain [15].

A study carried out by Kofotolis and Kellis examined changes in the ability to perform functional activities following PNF techniques for 86 patients. They reported significant increases in a group which performed an exercise program with PNF techniques.

It can be considered that the increases in functional activities found in the present study occurred because the exercise program performed with PNF exercises stimulated both the myoreceptors and the exteroceptors, it also promoted motor-skill memory and triggered neurophysiological changes. In addition, the functional activities must have increased by more accurate control of muscle

activities and surrounding structures which occur due to neuro-physiological changes [16].

There was also a study carried out by Moon et.al that compared the effects of Functional Electrical Stimulus (FES) treatment and PNF exercises in 30 patients and it was observed that there was great improvement of upper limb functions in the group which received PNF exercises and good enhancement of upper limb functions was observed in the group which received PNF treatment [17].

### Conclusion

Subjects who underwent PNF Hold relax stretching showed significant improvement in reduction of pain and improvement in function at the end of 2 weeks. Therefore, application of PNF can be considered as an adjunct therapy to conventional treatment for individuals with knee osteoarthritis.

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