Effect of Pnf Stretching on Proprioception and Physical Function in Individual with Knee Osteoarthritis: An Experimental Study

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Abstract

Background: Osteoarthritis of the knee leads to pain, difficulty in joint, reduced ROM and impaired Proprioceptive accuracy. PNF stretching are used to improve muscle flexibility, pain, ROM. Recently, impaired Proprioceptive accuracy of the knee has been proposed as a local factor in the onset and progression of radiographic knee OA.PNF technique is specifically designed to stimulate mechanoreceptors and Literature show significant effect of static as well as PNF stretching on clinical symptoms of OA knee, but impaired Proprioception is yet not so focused. **Aim**: Aim of the study was to find out the effect of PNF stretching on Proprioception and Physical Function in patients with knee osteoarthritis. **Methodology**: 50 participants were Selected according to selection criteria and randomly divided into PNF and Control Group. in which Outcome Measure for Proprioception by Absolute Angle error with use of universal Goniometer and Physical Function by Gujarati Version of WOMAC(mWOMAC)**Results and Discussion**: The result of the present study shows significant improvement found in the PNF group with p value <0.05 for Proprioception and Physical function. **Conclusion**: Here the study concluded that PNF stretching is statistically and clinically shows significantly effective in Proprioception as well as physical function in OA knee patients. So it can be useful in clinical rehabilitation protocol.

Key Words: *Knee Osteoarthritis, Proprioception, Universal Goniometer, PNF Stretching, Static Stretching, Absolute Angle Error, Modified WOMAC Gujarati Version, Joint Position Sense, HR (Hold Relax)*

Introduction

Osteoarthritis is one of the most common musculoskeletal disorders; from that knee osteoarthritis is the most common type of arthritis. the overall prevalence of knee OA was found to be (22%–39%) 28.7% in India. Symptoms of osteoarthritis includes pain, tenderness in the knee, stiffness ,loss of flexibility, pain in walking ,crepitus , grating sensation.[1] Prevalence of OA was found 3.11% in North Gujarat and it affects three times more common in women than men [9]

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Degenerative changes may result in imbalance in equilibrium between breakdown and repair process of joint tissue. [7] Impaired Proprioceptive accuracy of the knee is a local factor in the onset and progression of radiographic knee osteoarthritis. Additionally Proprioceptive impairments could be a cause of knee pain or activity limitations in knee OA patients.[4, 5]

Degenerative changes can affect the function of these proprioceptive accuracy, limb position as well as limb function are compromised [13] knee OA leads limited range of motion because of pain, damaged articular cartilage, loss of extensibility of capsule and muscle acting over the joint may affect the flexibility of muscle.[7]

Proprioceptive Neuromuscular Facilitation (PNF) stretching technique is utilized to improve muscle elasticity and also shown positive effect on active and

passive range of motion.[2] Hamstring and Hip adductor muscle tightness may result in many conditions related to knee. [3]

Absolute Angle Error assessed by measurement of knee ROM which is assessed by Universal Goniometer. and for assessment of physical function of patient with OA knee assessed by Gujarati version of WOMAC.

Methods

After approval from Institutional Ethical committee and CTRI registration process 50 subjects were selected Based on the inclusion and exclusion criteria. The whole procedure of the study was explained to all the subjects and written informed consent was taken. Prior and after to treatment both the outcome measures, Absolute Angle Error and Gujarati mWOMAC were measured. Intervention in the form of PNF Stretching with Conventional physiotherapy were given alternate 3 sessions per week for 6 weeks.

Materials used in study

- Consent Form
- Assessment Form
- Pen
- Paper
- Universal Goniometer
- Modified Gujarati WOMAC scale,
- Towels
- Short Wave Diathermy

Study Design: An Experimental Study

Study Setting: Sub District Hospital, Mandvi – Kachchh.

Sampling Technique: Purposive Sampling

Study Population: OA Knee Patients

Study Sample: 50

Study Duration: 6 Months

Inclusion Criteria:[7, 10]

- Patient diagnosed as a case of Primary knee osteoarthritis.
- Radiographic evidence of Grade II or III of Kellgren and Lawrence criteria for knee osteoarthritis.
- Age above 40 - 65 Year.
- Both Gender
- Patients who are able to perform the exercises.
- Patients who are willing to participate in the study

Exclusion Criteria:[7, 10]

- Subjects with a Secondary osteoarthritis
- Knee pain attributable to a cause other than primary osteoarthritis.
- Pain or any other pathology in the lower back, hips or ankles.
- Any contraindication for exercise.
- Un- co operative patients

Intervention:

Intervention is given to Patient in Form of PNF Stretching for Hip Adductors & Hamstring Muscle for once a day for 3 days a week for 6 weeks to

PNF Stretching for Hip Adductors[3, 7, 8]: Supine lying Position. The therapist should abduct the subject's leg until a very mild stretching sensation is felt by subject in adductor muscles. Then subject adducts the thigh for 10 sec which is followed by stretching of adductors for 30sec with 30 sec rest in between two seasons.(Figure 1)

PNF Stretching of Hamstring[10]: The patient was in the supine position with hip in 90° of flexion. The therapist extends the subject's knee until a very mild stretching sensation is felt by subject in hamstring muscles. The patients do knee flexion for 10 sec against resistance of therapist and then 30 sec stretch by doing knee extension with 30 sec rest in between.(Figure 6)

Conventional therapy

Conventional therapy was given in form of Isometric quadriceps exercises, High sitting knee extension,

Straight leg raise, Hip abduction, hip extension, Along with short-wave diathermy for 10 min, With 10 repetitions for each exercise were given once a day for 5 consecutive days a week for 6 weeks.[1]

Result & Statistics

Statistical analysis was done by the Statistical Package for the Social Sciences (IBM SPSS) version21 for windows. Microsoft Word and Excel were used to generate graphs and tables The variables were assessed for Normality of data was checked by using Kolmogorov Smirnov test and Q-Q plot. Mean was calculated as a measure of central tendency for Absolute Angle Error and Gujarati mWOMAC scale.

Level of significance was kept at P≤0.05 and confidence interval 95% and Paired t Test is used for Intergroup analysis in both outcome and for intergroup analysis of both outcomes was done by independent sample t test.

TABLE 1: CHANGES IN INTRA GROUP COMPARISION OF MEAN ABSOLUTE ANGLE ERROR IN BOTH GROUP

GROUPS	Pre Treatment		Post Treatment		't' value	'p' value
	Mean	±SD	Mean	±SD		
CONTROL GROUP	59.78	10.389	54.38	12.673	3.299	0.003
PNFGROUP	57.64	13.355	47.66	11.272	7.051	0.000

Intergroup comparison of Absolute Angle Error shows a significant difference ($p<0.05$) in PNF group , It is statistically significant for PNF groups and Only PNF group improved after intervention

TABLE 2: CHANGES IN INTRA GROUP COMPARISION OF MEAN mWOMAC IN BOTH GROUPS

GROUPS	Pre Treatment		Post Treatment		't' value	'p' value
	Mean	±SD	Mean	±SD		
CONTROL GROUP	36.36	8.112	35.84	8.00	1.502	0.146
PNF GROUP	40.3	7.0538	37.85	5.77	5.407	.000

mWOMAC shows a significant difference ($p<0.05$) for Both group so It is statistically significant for both the groups.

TABLE 3: INTER GROUPCOMPARISON OFMEAN DIFFERENCE IN ABSOLUTE ANGLE ERROR

Difference in ABSOLUTE ANGLE ERROR	CONTROL GROUP	PNF GROUP	't' value	'p' value
Mean	0.521	2.410	-3.343	0.001
±SD	1.735	2.229		

TABLE 4 SHOWS INTERGROUP ANALYSIS – MEAN OF mWOMAC

	mWOMAC		t value	P value
	CONTROL	PNF	-2.120	0.04
MEAN	5.398	9.986		
SD	8.182	7.080		

Here the alternative hypothesis is accepted which shows the p value 0.04 of mWOMAC shows significant difference and shows improvement in Physical Function of PNF group as compare to control group.

Hence, the result of the present study rejects the Null Hypothesis (H0) as significant improvement found in the PNF group regarding Proprioception and Physical function

Discussion

The intent of the study was to find out the effectiveness of PNF stretching on Proprioception and Physical Function in Osteoarthritis of knee along with conventional physiotherapy.

the present Study, Result shows improvement in physical function in both the groups. But Proprioception is improved in PNF group only. When compared to control group result shows significant difference in both the outcome in PNF group. This shows improvement in Proprioception and Physical Function in PNF group as compared to control group.

PNF stretching positively affects Proprioception by activation of Golgi tendon organ which inhibits muscle excitement and provides muscle relaxation. Autogenic inhibition, stress relaxation, muscle tendons and Mechanoreceptors stimulation which is embedded in skin, joint capsule and surrounding connective tissue this all leads to improve in Proprioception. [2, 3] improved ROM post PNF stretching could be attributed to the mechanism of Sarcomere Give and Autogenic Mechanism. Autogenic Inhibition: During stretching tension develops, Golgi tendon organs fires, afferent stimuli are sent via 2β fibers, inhibiting α-motor activity and thus decrease tension in the muscle and thus relaxing and lengthening.[22]

Proprioception was not improved in control group when applied conventional physiotherapy. It improves flexibility, ROM, reduces tightness of muscles, moves the joint passively as well as actively.2 Randomized control trial by Mandeepkaur(2014) shows that static stretching does not improves Proprioception because it causes Plastic stretching which results in irreversible tissue elongation7 but in PNF stretching Proprioception Improves because Similar article to this study by Ali Ghanbari (2013) studied and conclude that PNF stretching technique focuses on Active components and it improves in Proprioception by activation of mechanoreceptors and Golgi Tendon Organ. [3]

Physical function which assessed by Gujarati version of WOMAC in both groups but significant improvement was observed with PNF Stretching. Reason behind that is when PNF stretching is applied it works on mechanism of autogenic inhibition which decreases the neural activity of the stretched muscle so it is more susceptible to stretching by reduction in muscle excitability and that is because of activation of GTO.

PNF stretching improves Physical Function because study by FatihKaya(2018) has review on Positive Effects of Proprioceptive Neuromuscular Facilitation Stretching on Sports Performance and researches reveal that PNF stretching can increase athletic performance in the long-term.[20] And also research by Dan Funk et al (2003) reported that PNF stretching improves ROM [2,7]and it improves physical performance of patient because. De Deus Gomes et al. (2014)found that PNF Stretching does significant increase in muscle performance.

Conventional physiotherapy also improves physical function by exercises which reduce Pain; increase ROM, active and passive movements [1].but in comparison with PNF stretching along with conventional physiotherapy shows better improvement because of additional benefits of PNF stretching

PNF Stretching with hold component (hold relax-PNF) is effective because it provides stretch to muscle and at the same time provides isometric resistance to the same muscle which cause neural inhibition and reduces reflex activity and this inhibitory neuron reduces a motor neuron activity which results in muscle relaxation and decreased resistance to stretch and leads to changes in blood flow and increased motor activity affects vascular function .[3] the muscle activation release vasoactive substances which results in vascular dilatation.[3, 7] resultant vascular dilatation wash out the pain producing substances which is reducing pain this findings is according to Ali Ghanbari(2013) who demonstrated significant improvement after implementation of structured stretching Protocol. [3,7]

Here in the study PNF Stretching improves both Proprioception and Physical Function in Comparison with Only conventional Physiotherapy because PNF stretching does more amount of active movement in joint. Because Active movement is responsible for improvement in joint Proprioception, Muscle Flexibility, ROM, muscle strength, Proprioception, activation of GTO, mechanoreceptors, muscle tendon unit activation are improved more significantly with PNF stretching.[3]

So PNF stretching is beneficial for the rehabilitation protocol of OA knee patients along with conventional physiotherapy for improvement in Proprioception and Physical function in clinical day to day Practice

Further Recommendation

Study can be done with other outcome measurement:

EMG, ROM, MUSCLE STRENGTH

Study can be done with advance strengthening protocol along with PNF stretching

Conclusion

So, Here the study concluded that PNF stretching is statistically and clinically shows significantly effective in Proprioception as well as physical function in OA knee patients. So it can be useful in clinical rehabilitation protocol.

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