

EFFECTIVENESS OF PROPRIOCEPTIVE NEUROMUSCULAR FACILITATION VERSUS CONVENTIONAL THERAPEUTIC EXERCISES IN KNEE OSTEOARTHRITIS

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ABSTRACT

AIM The aim of this study is to compare effectiveness of two different therapeutic interventions in the management of knee OA that is Proprioceptive Neuromuscular Facilitation (PNF) and conventional therapeutic exercises.

METHODS A randomized controlled trial was conducted to determine the effectiveness of PNF and conventional therapeutic exercises for the management of Knee Osteoarthritis OA. A total of 30 patients (including both male and female) of age (56 ± 9.3) diagnosed with knee OA were selected in the study. Patients were recruited through consecutive sampling. A baseline assessment of all the patients was done before allocation. The assessment was based on self reported outcome measures of pain and functional activity level. Patients were then randomly allocated to two of the intervention groups- PNF and Conventional Exercise group. Each patient got 3 sessions per week for a period of 4 weeks.

RESULTS Both of the groups were equally significant in improving pain and functional activity level. The effectiveness of both PNF and conventional therapeutic exercises showed a significant reduction in pain intensity ($p=0.00$). Similarly, functional activity level was also improved significantly in both PNF & Conventional exercise group ($p=0.00$).

CONCLUSION Both physical therapy regimes produced a clinically important improvement in pain and functional activity level, it is concluded that the selection of technique for the management of knee OA should be based on the individual needs.

KEY WORDS Knee OA, Proprioceptive neuromuscular facilitation, Knee pain.

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INTRODUCTION

Osteoarthritis (OA) is a progressive joint disorder. It is caused by gradual loss of cartilage that results in a clinical syndrome with predominant symptoms like inflammation, pain, stiffness, limited movement, peri articular muscle weakness and possible deformity of the joint.¹

On the basis of radiological findings OA refers to a partial or full thickness loss of articular cartilage,

articular bone sclerosis, and appearance of osteophytes and thickening of the joint capsule. Although radiological changes of OA continuously occurs with advancing age, clinical picture of OA, do not always correlate with radiological findings. So both Clinical and Radiographic findings are important for the diagnosis of OA.^{2,3}

Joints of lower extremity are known to be mostly affected by OA. Knee OA is the most frequent form of

the OA of the lower limb. It may be attributed to the fact that there is a pathological joint impact and joint shear forces at the knee joint and also the systemic and biomechanical risk factors, all of these can cause early degeneration of cartilage and "joint aging".¹

Knee OA is characterized by quadriceps muscle weakness,^{4,5} hamstrings weakness, possible joint stiffness, effusion, loss of proprioception and knee pain.^{6,7} Patients with symptomatic knee OA show a decrease level of activity that is they have reduced functional mobility, they take longer to climb stairs, more use of assistive walking devices, and have slower gait velocities.⁸

For knee OA management, a large number of treatments are available. These interventions are aimed to de-

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crease pain, enhance physical function, prevent disability in patients with knee OA.⁹ The treatment options may include anti-inflammatory drugs, pain relievers, weight loss, low intensity aerobic or fitness exercises, range of movement or flexibility exercises, strengthening of quadriceps and hamstrings, thermal therapy, bracing and finally total or partial knee replacement surgery.^{10,11}

The clinical outcome of any treatment for knee OA is based on improvement in pain, activity or functional level of the patient and quality of life. It is not based on the improvement in the radiographic changes of the patients with OA as the morphological changes that has occurred in the joint are irreversible.

According to the OA Research Society International (OARSI) optimal OA management combines both non pharmacologic and pharmacologic modalities. OARSI and the American Academy of Orthopedic Surgeons suggest a variety of physical therapy interventions. These interventions include low-impact aerobic exercises, flexibility exercises, quadriceps strengthening and patellar taping.¹¹ Researches show that irrespective of age, co morbidities, severity of pain, or disability exercise should be an important part of the treatment for people with OA.¹⁰

Researches have proven that Proprioceptive Neuromuscular Facilitation (PNF) can be used in the treatment of neuromusculoskeletal disorders. PNF induces alterations in muscle fibre type,¹² increase range of motion, muscle strength, endurance and improves medio lateral postural stability.¹³

Similarly Conventional therapeutic Exercise Interventions have proven to be very effective decreasing pain and improving level of function in patients with lower extremity OA. Specially strengthening exercises and the exercises that aimed at increasing range of motion and enhance aerobic capacity seem to be the "best" exercise options for treating OA lower limb.¹⁴

Literature suggests that knee OA does not involve only joint degeneration and muscular imbalance but also it affects the proprioception and neuromuscular control of the joint. Research also suggests that PNF is an effective therapeutic intervention in enhancing dynamic control and proprioception. Therefore PNF can be used in the management of knee OA in order to enhance strength, power and proprioception. There are also very scant evidences present in the literature to support the effectiveness of PNF in the management of knee OA. This study will help to estimate the effectiveness of PNF for the management of knee OA by using validated measurements of pain and function.

METHODS

A Randomized controlled trial of 30 patients was conducted through Consecutive Sampling. Prior to undertaking study all patients were selected through consecutive sampling. Posteroanterior (PA view) radiographs of the involved knees in standing position were taken. Subjects were classified into different grades according to Kellgren & Lawrence classification system for knee OA on the basis of PA knee joint radiographs. The subjects were physically examined for any effusion and tenderness of their knee joints, local warmth, and bony enlargement at the knee region.

Mean age in both of the groups was 56 ± 9.3 years. Patients who were willing to participate in the exercise program and to travel independently to the hospital/clinic from home were included. Patients with Inflammatory arthritis including rheumatoid arthritis, gout, psoriatic arthritis, ankylosing spondylitis, reactive arthritis, Systemic Diseases, Neuropathies, Knee arthroplasty, Osteonecrosis, Osteoporosis, Congenital Anomalies and Acute knee injuries of the "study limb" (during last 1 year) were excluded. Patients presenting with history of Unstable Angina / MI (during the past 1 month), Heart rate > 120, Hypertension with

Systolic Pressure of 180 mmHg/ Diastolic Pressure 100 mmHg were also excluded. After complete subjective and objective examination, each participant received an information sheet and a consent form. Time was allocated for each participant to read the information sheet, sign the consent form and ask further questions. Participants were then randomly assigned to 2 groups by placing 1st, 3rd, 5th, 7th to 29th in to PNF group and every 2nd, 4th, 6th, 8th up to 30th in conventional exercise group. All the participants underwent initial assessment. The patients assigned to the groups were blinded to the treatment. While the therapists administering the treatment was aware of the patient's allocation.

Patients in both the groups were focused on quadriceps and hamstrings muscle flexibility, strengthening and co-contraction. While hot pack was applied as an adjunct for painful periarticular structures for 20 minutes.

PNF techniques were administered to group 1 while patients in group 2 received conventional exercises for the same period. Both the groups received therapy 3 times per week for 4 weeks.

Conventional exercises were done by the patients themselves under the supervision of two therapists. Final assessment was done by the same therapists.

The effectiveness of each intervention was evaluated by changes in pain and improvement in functional level.

Pain was evaluated with Visual analogue scale VAS while Functional level of patients with knee OA was evaluated with Western Ontario and McMaster Universities Osteoarthritis (WOMAC) Index

RESULTS

There were no significant differences at baseline between the groups on the basis of age, gender, pain intensity, physical activity level and radiographic findings (K&L score).

Patients in PNF group showed a marked improvement in pain [$p < 0.05$ ($p = 0.00$)] from a mean pre intervention VAS score of 7 ± 1 to a mean post intervention VAS score 3 ± 1 . This indicates a reduction of 4 degrees from the initial assessment. Thus showing that PNF is highly effective in reducing pain among people with knee OA.

Moreover comparing the effects of PNF treatment on disability index WOMAC scale shows a significant difference between pre and post intervention assessment. The p value is 0.04 ($p < 0.05$) that is the mean WOMAC score has reduced from a baseline score of 64.3 ± 10 to 29 ± 10 . Thus PNF techniques are helpful in improving level of activity upto 35 % measured on WOMAC index.

Comparing the effect of Conventional exercises on the VAS, it is concluded that there is a significant difference between the pre and post intervention $p = 0.00$. The value of VAS reduced from 7 ± 1 to 3 ± 1 . Thus a reduction of 4 degrees from initial assessment is reported.

The WOMAC index for conventional exercises pre and post intervention shows a difference from 61 ± 12 to 28 ± 10 . Thus an improvement of 34 % in functional activity of the patient and a p value of 0.00 (< 0.05). It is also noticed that patient with moderate Kellgren & Lawrence grading (grade 2 and 3) in PNF and conventional exercise group showed

a marked reduction in pain and improvement in disability.

Both groups show statistically significant difference in pre and post intervention scores on VAS and WOMAC scale. Thus both groups are effective in improving pain and disability in patients with knee OA.

DISCUSSION

The purpose of the study was to evaluate the effectiveness of Proprioceptive Neuromuscular Facilitation versus Conventional therapeutic exercises in managing knee OA. In this study, both treatment groups obtained successful outcomes that is improvement in pain and physical activity level, as measured by significant reductions in WOMAC scores and Visual Analogue Scale.

Results of this study showed the following:

Both groups produce similar significant improvement in pain and disability with for PNF $p = 0.00$ & Conventional Exercise group $p = 0.00$

During the study it was noted that hamstrings and calf show quick response (increase in muscle length) after the second sessions as compared to static active stretching.

Researches have been done to show effectiveness of PNF techniques in altering muscle strength and flexibility. The finding of this study can be somehow supported by the work done by Merek et

al who conducted a study in which they have compared PNF and static stretching techniques on 10 females and 9 males. The results showed a decrease in peak torque, power output. While significant increase in active range of motion ($p < 0.001$) and passive range of motion ($p = 0.001$) was observed in both groups.¹⁵

Female population of both of the groups showed a more decrease in pain (Mean decrease in pain was 5 degree from the baseline)

Caplan et al conducted a study to determine the effect of PNF vs static stretching on high velocity running. Stretch training resulted in improvement $p < 0.05$ in Hip flexion for the static stretch=4.9% and PNF=7.6% groups. In conclusion, both Static Stretch and PNF training improved Hip joint flexion, knee joint extension, increase range of motion and a high running velocity.¹⁶

Falconer et al found improvements in motion (11%), pain (33%), and gait speed (11%) after 12 treatments of stretching, strengthening, and mobility exercises combined with manual therapy procedures performed in a physical therapy clinic over 4 to 6 weeks.¹⁷

In a controlled, randomized, single-blinded study, Deyle et al ,demonstrated that manual therapy techniques and exercises applied by physical therapists for 8 clinical visits produced averaged 56% improvement in self-reports of functional ability 54%, stiffness 54%, and pain 60% as measured by the Western Ontario and McMaster Universities OA Index (WOMAC) scale and a 12% improvement in 6-minute walk test scores. A placebo control group that received equal clinical attention showed no improvement in WOMAC scores or 6-minute walk test scores. They concluded that a combination of manual physical therapy and supervised exercise is more effective than no treatment in improving walking distance and decreasing pain, dysfunction, and stiffness in patients with OA of the knee.¹⁸

Patients with moderate knee OA (grade 2 of Kellgren & Lawrence grading system) showed a better re-

TABLE 1

| | Group | N | Mean | SD |
|-----------------------------------|------------------------------|----|-------|--------|
| Age | Group PNF | 15 | 57.73 | 9.331 |
| | Group Conventional Exercises | 15 | 56.60 | 9.709 |
| Baseline VAS score | Group PNF | 15 | 7.27 | 1.163 |
| | Group Conventional Exercises | 15 | 7.27 | 1.163 |
| Follow up VAS score | Group PNF | 15 | 3.40 | 1.298 |
| | Group Conventional Exercises | 15 | 3.53 | 1.457 |
| Baseline WOMAC score | Group PNF | 15 | 64.33 | 10.547 |
| | Group Conventional Exercises | 15 | 60.60 | 12.310 |
| Follow up WOMAC score | Group PNF | 15 | 29.00 | 10.036 |
| | Group Conventional Exercises | 15 | 28.47 | 10.467 |
| Kellgren & Lawrence Grading Scale | Group PNF | 15 | 2.27 | .458 |
| | Group Conventional Exercises | 15 | 2.13 | .516 |

sponse to both of the treatments.

The major limitations were that the sample size was very small and study duration was of short period (6 Months). This study shows only short term effects of the treatments being administered. There was no follow up after the cession of each intervention. So the long term effects of the interventions could not be determined. Treatment in different groups were administered by separate physiotherapists.

Further it was a single blinded study, so the biasness in the outcome measures can be expected

The patients were recruited from multi-center settings so the results are more generalizable. No study is done yet that directly compares PNF techniques with conventional therapeutic exercises in order to see their effectiveness in knee OA management. Patients were diagnosed with knee OA on the basis of both radiological and clinical findings by using standard measures i-e X-rays & ACR-criteria (with high sensitivity and specificity). All the patients were randomly allocated to the treatment groups.

A larger sample size will produce more generalizable results. As the study was done for a period of 4 weeks for each patient with no follow up; a study with prolong duration like 6-8 weeks with a follow up is recommended which would yield greater insight into the long term effects of the treatments.

CONCLUSION

Both proprioceptive neuromuscular facilitation and conventional exercises can be used in patients with knee OA. As both physical therapy regimes produced a clinically important improvement in pain and disability index. The selection of technique can be based according to the individual needs.

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NOTES ON CONTRIBUTORS

The study was part of SG Bachelors in Physical Therapy Education. DAK, MR supervised the dissertation, and were involved in every part of the analysis, idea's development, and write-up.

CONFLICT OF INTEREST

Authors declare no conflict of interest.

ETHICS APPROVAL

The approval/permission was obtained from Khyber Medical University Research and Ethics Board.

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