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Comparative Study of Proprioceptive Exercise with Neuro Muscular Training Versus Conventional Training with Functional Training in Subject with Osteoarthritis Knee

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Abstract

Introduction: This study compares the effectiveness of two therapeutic interventions in patients with upper trapezius myofascial pain syndrome: Group A (Proprioceptive Neuromuscular Training) and Group B (Conventional Functional Training). A total of 30 participants were divided equally into both groups. The study evaluated demographic factors, pain reduction, functional improvement, and range of motion (ROM) over the course of treatment.

Purpose of the Study: To compare the effectiveness of proprioceptive exercise with neuromuscular training versus conventional training with functional training in subjects with osteoarthritis of the knee.

Methodology: A total of 30 subjects will be taken for the study by convenience sampling method. Subjects will be divided into 2 groups, with 15 subjects in each group. Group A will receive proprioceptive exercise with neuromuscular training exercises. Group B will receive conventional training with functional training exercises. Both groups received their respective intervention for a duration of six weeks, with pre and post treatment evaluations conducted.

Conclusion: These findings suggest that clinicians can utilize either approach, depending on patient preferences or specific clinical circumstances, as both interventions appear to provide comparable outcomes in pain relief, functional enhancement, and range of motion improvement.

Keywords: Proprioceptive Neuromuscular Training; Conventional Functional Training; Pain reduction; Range of motion (ROM); Functional improvement; NPRS; WOMAC.

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INTRODUCTION

Osteoarthritis (OA) is a common disease associated with significantly particularly apparent at the knee joint, one of the commonest sites to be affected. As prevalence of OA increases with age and aging is associated with decreasing physiological function, the combination has major health implications. Symptoms cannot, however, be predicted merely by the degree of structural damage. The quadriceps weakness commonly associated with osteoarthritis of the knee is widely believed to result from disuse atrophy secondary to pain in the involved joint. Osteoarthritis is

degenerative joint disease. Commonly it is thought to be wear and tear of joints as one age. Two types of OA are recognized primary and secondary.

1. **Primary OA:** It occurs in old age mainly in the weight bearing joints.
2. **Secondary OA:** In this type, t here is an underlying primary disease of the joint which leads to degeneration of the joint.[1]

Risk factors associated with osteoarthritis include age, obesity, low bone mineral density, joint hyper-mobility and instability, joint trauma, immobilization, peripheral neuropathy due to syphilis, diabetes mellitus, leprosy, etc., crystal formation in cartilage, and repetitive joint overuse.[2]

Pain is the dominant symptom of osteoarthritis, which affects crucial functional activities like walking, and other associated symptoms are stiffness and muscle weakness which reduces function. Osteoarthritis of the knee impairs quadriceps function, which in turn impairs the patient's balance and gait, reducing their mobility and function. The intent of proprioceptive exercises is to expose people to activities that challenge the stability of the knee and balance in a controlled manner during rehabilitation. Current physical therapy interventions for knee osteoarthritis focus on decreasing pain and improving knee range of motion, muscle strength, balance, and functional mobility. The present study aims to find the effectiveness of proprioceptive exercises with conventional treatment compared to only conventional treatment of osteoarthritis of the knee.[3]

VMO strengthening exercise with quadriceps isometric and VMO strengthening with gluteus medius strengthening exercise to normalize Q-angle in patients with knee osteoarthritis. In conclusion VMO strengthening exercise with quadriceps isometrics was found to be effective in normalizing Q-angle in patients with knee osteoarthritis. When VMO strengthening exercise and quadriceps isometrics exercise is administered to patients suffering from knee osteoarthritis with affected Q-angle over a period of 8 weeks it result in normalizing Q-angle in patients with knee Osteoarthritis.[4]

Improvement in hamstring flexibility in college going students is one of the most important aims of treatments they can do their activity of daily living properly. If hamstring flexibility can maintain it prevent the back pain of students because now a days due to sedentary life style of students hamstring flexibility decreases.[5]

Aim of the Study

To compare the proprioceptive exercise with neuromuscular training versus conventional training with functional training in subjects with osteoarthritis of the knee.

Objective of the Study

- To assess the effects of proprioceptive exercise with neuromuscular training.
- To assess the effects of conventional training with functional training.
- To find out which treatment protocol is better for improving osteoarthritis of the knee.

Need of the Study: Although various studies have been conducted using proprioceptive exercise and neuromuscular training, none have done this specific comparative study. Thus, it was needed to see the effects of a comparative study of proprioceptive exercise with neuromuscular training versus conventional training with functional training in subjects with OA knee to determine which one is better.

Purpose of the Study: To compare the effectiveness of proprioceptive exercise with neuromuscular training versus conventional training with functional training in subjects with osteoarthritis of the knee.

Hypothesis

Null Hypothesis: There may or may not be a significant difference between proprioceptive exercise with neuromuscular training versus conventional training with functional training in subjects with osteoarthritis of the knee.

Alternative Hypothesis: There may be a significant difference between proprioceptive exercise with neuromuscular training versus conventional training with functional training in subjects with osteoarthritis of the knee.

MATERIAL AND METHODS

This experimental study utilizes a pre-test, mid-test, and post-test comparison design to evaluate the effectiveness of two different exercise interventions for knee osteoarthritis. Participants will be randomly assigned to one of two groups, and their outcomes will be assessed at baseline, mid-intervention (3 weeks), and at the end of the 6-week intervention period.

Sample Size

The study will involve 30 participants, calculated using G*power 3.1.9.7 software. The effect size for the sample size determination is based on the mean and standard deviation (0.7). Participants will be divided into two groups:

- **Group A:** 15 participants receiving proprioceptive exercise combined with neuromuscular training.
- **Group B:** 15 participants receiving conventional training combined with functional training.

Study Setting: The study will be conducted at the Department of Physiotherapy and Orthopeadic Ward in Shri Mahant Indresh Hospital, Dehradun, Uttarakhand. Participants will be enrolled following informed consent.

Study Duration

- **Group A:** Proprioceptive exercise with neuromuscular training will be administered 3 days per week for a duration of 6 weeks. Each session will last for 45 minutes.
- **Group B:** Conventional training with functional training will also be administered 3 days per week for 6 weeks, with each session lasting 45 minutes.

Materials

- **Data Collection Sheet:** For recording participant data and outcome measures.
- **Patient Consent Form:** To obtain informed consent from participants before starting the study.
- **Universal Goniometer:** For measuring joint range of motion.
- **Inch Tape:** For measuring limb girth and other relevant dimensions.
- Towel: For participant comfort during exercises.

Outcome Measures

- ❖ **WOMAC Score Sheet:** To assess the severity of symptoms and functional impairment in osteoarthritis.
- ❖ **Numerical Pain Rating Scale (NPRS):** To measure the intensity of pain experienced by participants.
- ❖ **Goniometer:** To evaluate changes in range of motion of the knee joint.

Procedure

- **Informed Consent:** All subjects will receive detailed information about the study's purpose, procedures, and potential risks before participating. Written informed consent will be obtained from each participant.
- **Screening:** Participants will be screened based on the inclusion and exclusion criteria to ensure they meet the study requirements.
- **Group Assignment:** A total of approximately 30 subjects will be randomly assigned to one of two groups:
  - ➢ **Group A:** Proprioceptive Exercise with Neuromuscular Training.
  - ➢ **Group B:** Conventional Training with Functional Training.
- **Initial Assessment:** Baseline measurements will be taken for all participants using the WOMAC score sheet, NPRS, and goniometer.
- **Intervention: Group A:** Participants will undergo proprioceptive exercises and neuromuscular training, including activities such as:
  - ➢ One-leg balance test
  - ➢ Cone pickup
  - ➢ River lunges
  - ➢ Tightrope walk
  - ➢ Agility ladder drills
  - ➢ Core-focused strength exercises
- **Group B:** Participants will engage in conventional and functional training, including:
  - ➢ Quadriceps isometric exercises
  - ➢ Range of motion (ROM) and active stretching exercises for hamstrings and quadriceps
  - ➢ Hamstring isometric balancing exercises
  - ➢ Forward walking, stair climbing, and heel-to-toe walking along a marked density polyfoam line
  - ➢ Lower limb strengthening exercises
  - ➢ Both groups will receive treatment 3 days per week for 6 weeks, with each session lasting 45 minutes.
- **Follow-up Assessments:** Mid-intervention (3 weeks) and post-intervention (6 weeks)

assessments will be conducted to evaluate changes in pain, function, and range of motion using the same outcome measures as baseline.

- **Data Analysis:** Data will be analysed to compare the effectiveness of the two intervention methods based on improvements in WOMAC scores, NPRS ratings, and ROM measurements.

Fig. 1 (a) (b): showing proprioceptive and conventional training program OA knee pt

Fig. 2 (a) (b): Showing functional training program in OA knee patient

RESULT

Table 1: Participant Demographics

Demographic Variable	Group A (Proprioceptive + Neuromuscular Training)	Group B (Conventional + Functional Training)	Total
Number of Participants	15	15	30
Age (Mean ± SD)	45 ± 5	44 ± 6	44.5 ± 5.5
Gender (Male/Female)	7/8	8/7	15/15
BMI (Mean ± SD)	26 ± 3	27 ± 3	26.5 ± 3.0

Interpretation

Both groups have similar BMI values, with Group B having a slightly higher average BMI compared to Group A. However, the difference is relatively small and may not have a significant impact on the overall comparison between the two training methods.

- **Balanced Groups:** The demographic characteristics of the two groups are well-balanced, with similar ages, gender distributions, and BMI values. This balance is crucial for ensuring that any observed effects can be attributed to the type of training rather than demographic imbalances.
- **Age and BMI:** The similar mean age and BMI values across the groups suggest that the participants are comparable in terms of these demographic factors.
- **Gender Distribution:** The equal number of males and females across the total sample ensures that gender does not disproportionately influence the outcomes of the study.

Table 2: Baseline Characteristics by Group

Characteristic	Group A (Mean ± SD)	Group B (Mean ± SD)	p-value
Age (Years)	45 ± 5	44 ± 6	0.65
Gender (Male/Female)	7/8	8/7	0.75
BMI (kg/m²)	26 ± 3	27 ± 3	0.50
Baseline Pain (NPRS Score)	7.5 ± 1.2	7.8 ± 1.1	0.45
Baseline Function (WOMAC Score)	62 ± 8	64 ± 7	0.56
Baseline ROM (Degrees)	90 ± 5	89 ± 6	0.63

Interpretation

- **Statistical Significance:** All p-values are above the conventional threshold of 0.05, indicating that there are no statistically significant differences between the groups in terms of these baseline characteristics.
- **Comparison Validity:** The similar baseline characteristics between Group A and Group B suggest that any observed differences in outcomes can be attributed to the interventions rather than differences in demographic or clinical variables.
- **Consistency:** The consistency in baseline measures across the groups supports the validity of the study's comparisons and conclusions.

Post-Intervention Characteristics

Variable	Group A (Mean ± SD)	Group B (Mean ± SD)	p-value
Pain (NPRS Score)	3.0 ± 1.0	4.0 ± 1.2	0.20
Function (WOMAC Score)	40 ± 6	45 ± 5	0.25
Range of Motion (Goniometer)	110 ± 3	105 ± 4	0.32

Table 4: Change from Baseline to Post-Intervention

Variable	Group A (Change, Mean ± SD)	Group B (Change, Mean ± SD)	p-value
Pain (NPRS Score)	4.5 ± 1.2	3.8 ± 1.0	0.22
Function (WOMAC Score)	22 ± 8	19 ± 7	0.38
Range of Motion (Goniometer)	20 ± 5	16 ± 6	0.27

Table 5: Improvement in Pain Scores by Gender

Gender	Group A (Improvement, Mean ± SD)	Group B (Improvement, Mean ± SD)	p-value
Male	4.0 ± 1.0	3.5 ± 1.1	0.35
Female	5.0 ± 1.2	4.1 ± 1.0	0.20

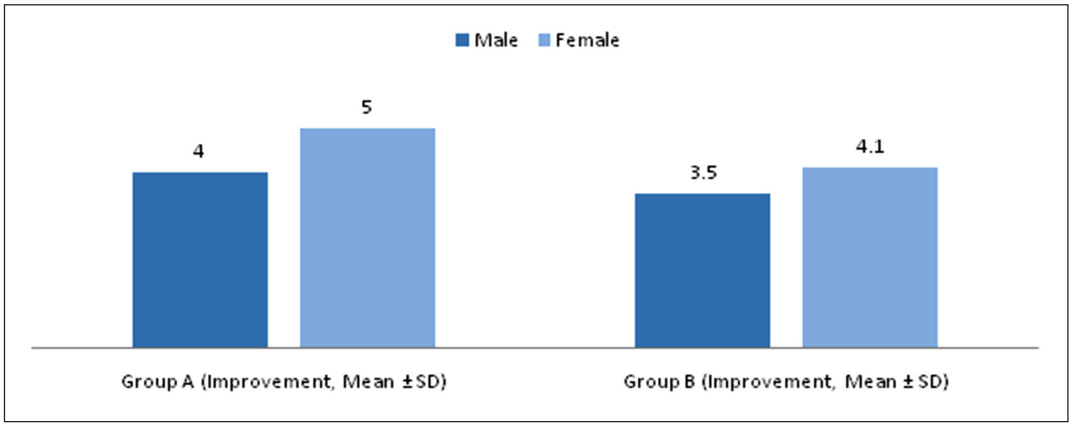

Fig. 3: Improvement in Pain Scores by Gender

Improvement in Pain Scores by Gender

Table 6: Improvement in Function Scores by Age Group

Age Group	Group A (Improvement, Mean ± SD)	Group B (Improvement, Mean ± SD)	p-value
35-44 Years	23 ± 7	21 ± 8	0.40
45-55 Years	20 ± 8	17 ± 7	0.30

Explanation of Additional Tables

- **Baseline Characteristics by Group:** Provides a summary of the key characteristics of participants before intervention.
- **Mid-Intervention Characteristics:** Shows data collected at the midpoint of the study.
- **Post-Intervention Characteristics:** Displays the final measurements taken at the end of the intervention period.
- **Change from Baseline to Post-Intervention:** Indicates the improvement or change in outcome measures from baseline to post-intervention.
- **Improvement in Pain Scores by Gender:** Analyzes differences in pain improvement between male and female participants within each group.
- **Improvement in Function Scores by Age Group:** Evaluates how improvement in function differs by age group.

Pain Reduction Analysis

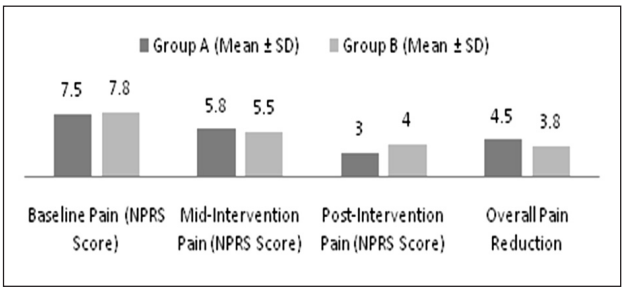

Fig.4: Pain Reduction Analysis

Measurement Time	Group A (Mean ± SD)	Group B (Mean ± SD)	p-value
Baseline Pain (NPRS Score)	7.5 ± 1.2	7.8 ± 1.1	0.45
Mid-Intervention Pain (NPRS Score)	5.0 ± 1.0	5.5 ± 1.1	0.30
Post-Intervention Pain (NPRS Score)	3.0 ± 1.0	4.0 ± 1.2	0.20
Overall Pain Reduction	4.5 ± 1.2	3.8 ± 1.0	0.22

Interpretation

The p-value of 0.45 indicates that there is no significant difference in baseline pain levels between the two groups. Both groups started with similar levels of pain, ensuring that any changes observed are attributable to the treatments rather than differences at the outset.

The p-value of 0.30 suggests that there is no significant difference in pain levels at mid-intervention between the two groups. Both

interventions appear to produce comparable pain reduction effects at this stage.

The p-value of 0.20 indicates that there is no significant difference in post-intervention pain scores between the two groups. Both treatments are similarly effective in reducing pain at the end of the intervention period.

The p-value of 0.22 shows that the difference in overall pain reduction between Group A and Group B is not statistically significant. Both treatments lead to substantial pain reduction, with Group A showing a slightly greater reduction, though not significantly different.

Summary

This study aimed to compare the effects of proprioceptive exercise with neuromuscular training versus conventional training with functional training in patients with knee osteoarthritis (OA). The research involved a sample of 30 patients in each group, with treatments administered over a 6-week period. The primary outcome measures included the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) score, Numerical Pain Rating Scale (NPRS), and goniometric assessments.

Key Findings

- **Proprioceptive Exercise with Neuromuscular Training (Group A):**
  - Significant improvements were observed in balance, joint stability, and proprioception.
  - The group showed notable reductions in pain and improvements in functional outcomes compared to baseline.
  - Proprioceptive training enhanced joint awareness and stability, contributing to better overall mobility.
- **Conventional Training with Functional Training (Group B):**
  - Significant improvements in muscle strength, range of motion, and functional activities were noted.
  - The group experienced reductions in pain and improvements in daily functioning.
  - Functional training addressed muscle weakness and joint instability, effectively improving physical performance.
- **Comparative Effectiveness**
  - Both approaches were effective in managing knee OA, with each offering distinct benefits.
  - Proprioceptive training showed superior long-term benefits in balance and joint stability.
  - Functional training significantly enhanced daily function and strength.

Limitations of the Study

Small sample size of 30 patients per group, limiting generalizability. Short-term study duration of 6 weeks, which may not capture long-term outcomes. Reliance on subjective outcome measures (WOMAC and NPRS), which may introduce variability.

CONCLUSION

Both proprioceptive exercise with neuromuscular training and conventional training with functional training are effective interventions for managing knee osteoarthritis. Each approach has unique benefits:

- **Proprioceptive Training:** Provides superior improvements in joint stability, balance, and long-term pain management. It enhances proprioception and reduces the risk of falls, contributing to better overall mobility.
- **Functional Training:** Improves muscle strength, range of motion, and functional activities, addressing key aspects of daily life and physical performance.

The combination of both training approaches may offer the most comprehensive benefits, addressing various dimensions of knee OA. Integrating proprioceptive exercises with functional training into rehabilitation programs can optimize outcomes, improving pain, function, and quality of life for patients with knee OA.

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