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Research Article

Efficacy of Proprioceptive and Strengthening Exercise on Functional Ability in Osteoarthritis (OA) Knee: Quasi Experimental Study

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Abstract

Background: Proprioceptive training improves knee function in Osteoarthritis (OA) patients and quadriceps muscle strengthening is known to mitigate the symptoms of knee OA and improve knee function. Proprioceptive neuromuscular facilitation of the afflicted area is closely related to deteriorated mobility and pain and restoring proprioceptive neuromuscular function is essential during the final stage of a rehabilitation program.

Aim & objective of the study: The aim of this study is to find the effect of proprioceptive exercise with strengthening exercise on functional ability in patients with Knee Osteoarthritis.

Data Analysis and Results: This study results shows that there is statistically significant improvement in the variables of pain in VAS and pain free knee extension ROM (Range of Motion) between pre and post mean values in both control and experimental group with $p<0.001$. The Post mean values of pain in VAS and pain free knee extension ROM shows significant improvement with P-Values $p<0.001$ in Experimental Group when compared to Control Group.

Conclusion: There was statistically significant improvement pain in Visual Analog Scale (VAS) and pain free knee extension ROM in both the groups. This study concluded that proprioceptive exercises along with strengthening exercises shows a significant improvement on pain in VAS and pain free knee extension ROM when compared to strengthening exercise alone in patient's osteoarthritis of knee.

Keywords: Osteoarthritis (OA) Knee; Visual Analog Scale; Knee Extension ROM; Proprioceptive Exercises; Strengthening Exercises; Activities of Daily Living

Introduction

One of the most disabling chronic degenerative diseases affecting the elderly is osteoarthritis [1]. The knee is the most commonly affecting weight bearing joint [2]. The main symptoms are pain, morning stiffness of short duration, oedema, movement loss, muscle weakness, proprioception and balance dysfunctions and physical dysfunctions in the Activities of Daily Living (ADL) [3]. Proprioception is composed of several different biomechanical components including joint position sense, velocity, movement detection and force [4].

Proprioceptive sensation is derived from mechanoreceptors in muscle, joint capsule, tendon, ligaments and skin [5]. Motion stimulates Mechanoreceptors to provide proprioceptive sensation essential for undertaking coordinated normal activities of daily living and more physically demanding tasks [6]. Proprioceptive training improves knee function in OA patients and quadriceps muscle strengthening is known to mitigate the symptoms of knee OA and improve knee function [7]. Proprioceptive neuromuscular facilitation of the afflicted area is closely related to deteriorated mobility and pain and restoring proprioceptive neuromuscular function is essential during the final stage of a rehabilitation program [8].

A circuit exercise applies the concept of circuit training to resisted exercise. The advantages of circuit exercise are reduced muscle fatigue, which is generally observed during resistance exercise and improve exercise efficiency by minimization of recovery times between exercise sets [9]. Trauma and pathological processes can impact on these feedback system this may increase subsequent susceptibility to injury with reduced motor control [10-12].

Proprioceptive acuity has been demonstrated to be reduced in those with knee OA when compared to age-gender and body mass-matched controls [13-15]. It has been hypothesized that exercise can improve knee proprioception [16]. The facilitation of dynamic joint stabilization to retain altered afferent pathways, thus enhancing proprioception and improving patient function [17,18]. The main aim of this study is to find the effect of proprioceptive exercise with strengthening exercise on functional ability in patients with Knee Osteoarthritis.

Materials and Methods

This quasi experimental study was done with subjects had osteoarthritis of knee referred to Abhinav Physiotherapy Clinic, Balaji Nagar, Kalainagar Extension, Madurai. Ethical approval was taken from Institutional Review Board (IRB), Santosh College of Physiotherapy (SCP/Phy/2023/03/002), Madurai, Tamilnadu. This study was conducted from March 2023 to February 2024. 60 subjects who fulfilled the selection criteria (Table 1) were selected. All the patients were examined by orthopaedician and a senior physiotherapist. A clear explanation was given to every subject about the procedures and written consent was obtained. Subjects were assigned into two groups through lottery method. Demographic data was recorded. Control groups underwent proprioceptive exercise along with strengthening exercise for 3 sessions a week of 30 minutes per session for 8 weeks. Experimental group underwent strengthening exercise alone thrice a week of thirty minutes per session for eight weeks. Outcomes measures of pain in Visual Analogue Scale (VAS) and pain free knee extension ROM were taken. Pre and post intervention data was recorded and documented for statistical analysis. Data was analyzed with suitable statistical method with IBM SPSS 25.0 for windows.

Inclusion Criteria	Exclusion Criteria
• Patient diagnosed with primary osteoarthritis of the knee by orthopedics physician. • Patients with unilateral osteoarthritis of knee. • Both sexes were included • Age group 55-65 years • Patients who are able to perform the exercises. • Patients who are willing to participate in the study.	• Knee pain attributable to a cause other than primary osteoarthritis. • Including fibromyalgia • Bursitis • Tendonitis • Rupture or tear in the articular cartilage (evidences by a positive Mc Murray sign). • Pain in the lower back, hips or ankles. • Any contra indication for exercise. • Cardiomyopathy severe enough to compromise cardiac functioning. • Any patients who were currently participating in an organized exercise program or exercised more than 1 hour per week.

Table 1: Criteria of selection.

Data Analysis and Results

After intervention in both control and experimental group, baseline and post intervention values were documented. Normality of data was done with Shapiro Wilk test. Data was normally distributed. Thus parametric t test was used for analyzing the data. Paired sample t test was used to analyze pre and post intervention mean values comparison within the control and experimental group (Table 2). There was statistically significant difference in post intervention mean values in both control and experimental groups with $p \leq 0.001^{***}$ (Fig. 1,2). Independent sample t-test was used to analyze the comparison between pre and post intervention mean values in control and experimental group (Table 4). The baseline values were homogenous (Table 3). There was statistically significant difference in post intervention mean values (Table 4) in experimental group when compared to control group with $p \leq 0.001^{***}$ (Fig. 1,2).

Group	Variables	Mean±SD		T-Value	P-Value
		Pre	Post		
Control	Pain in VAS	8.92±0.32	3.94±0.32	19.70	0.001***
	Knee Extension ROM	12.0±6.67	6.52±5.83	4.92	0.001***
Experimental Group	Pain in VAS	9.04±0.22	1.54±0.72	24.40	0.001***
	Knee Extension ROM	11.82±6.34	2.08±6.67	8.66	0.001***

Table 2: Comparison of Pre and Post Mean, Standard Deviation, 't' value and 'p' value of Pain in VAS and Pain Free Knee Extension Range ROM in Control Group (n=30) and Experimental Group (n=30).

Variables	Pre Mean Value		T-Value	P-Value
	Control	Experimental		
Pain in VAS	8.92±0.32	9.04±0.22	-0.42	0.33
Knee Extension ROM	11.82±6.34	12.0±6.67	0.34	0.50

Table 3: Comparison of Pre Mean, Standard Deviation, 't' Value and 'p' value of Pain in VAS and Pain Free Knee Extension Range ROM between Control and Experimental Group to check homogeneity (n=60).

Variables	Post Mean Value		T-Value	P-Value
	Con	Exp		
Pain in VAS	3.94±0.32	1.54±0.72	7.43	0.001***
Knee Extension ROM	6.52±5.83	2.08±6.67	4.02	0.001***

Table 4: Comparison of Post Mean, Standard Deviation, 't' value and 'p' value of Pain in VAS and Pain Free Knee Extension Range ROM between Control and Experimental Group to check significance (n=60).

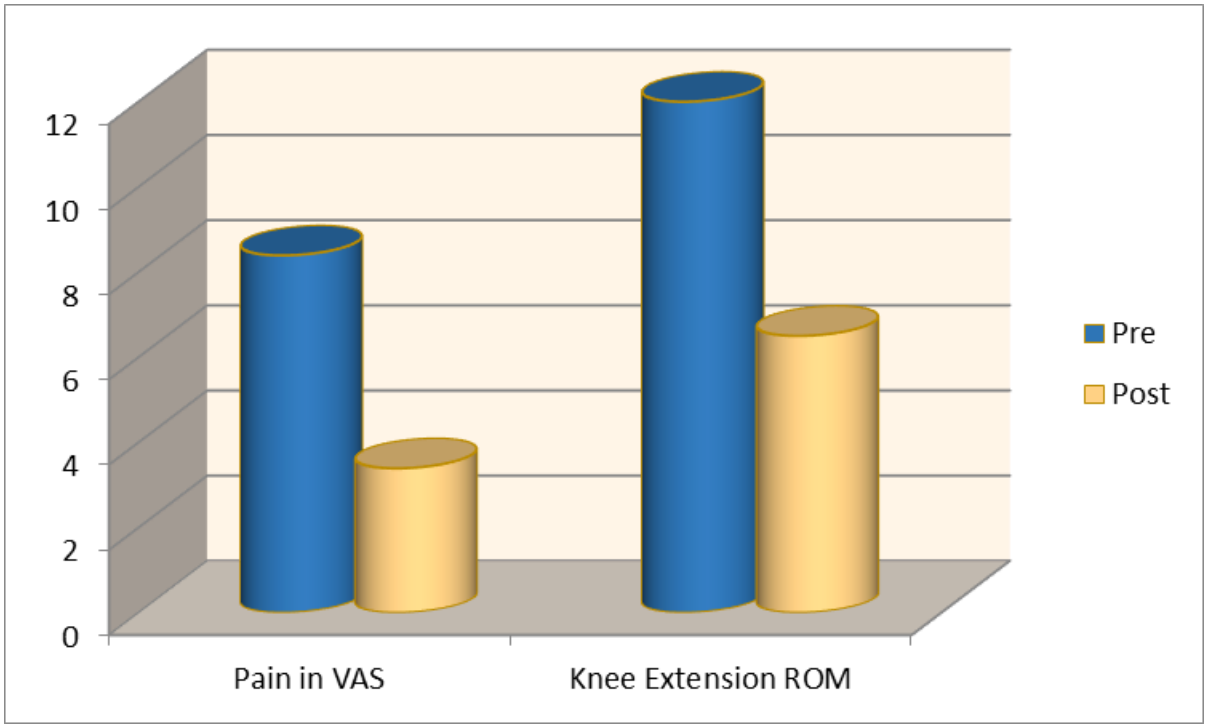

Figure 1: Comparison of pre and post mean value of pain in VAS and pain free knee extension range ROM in control group.

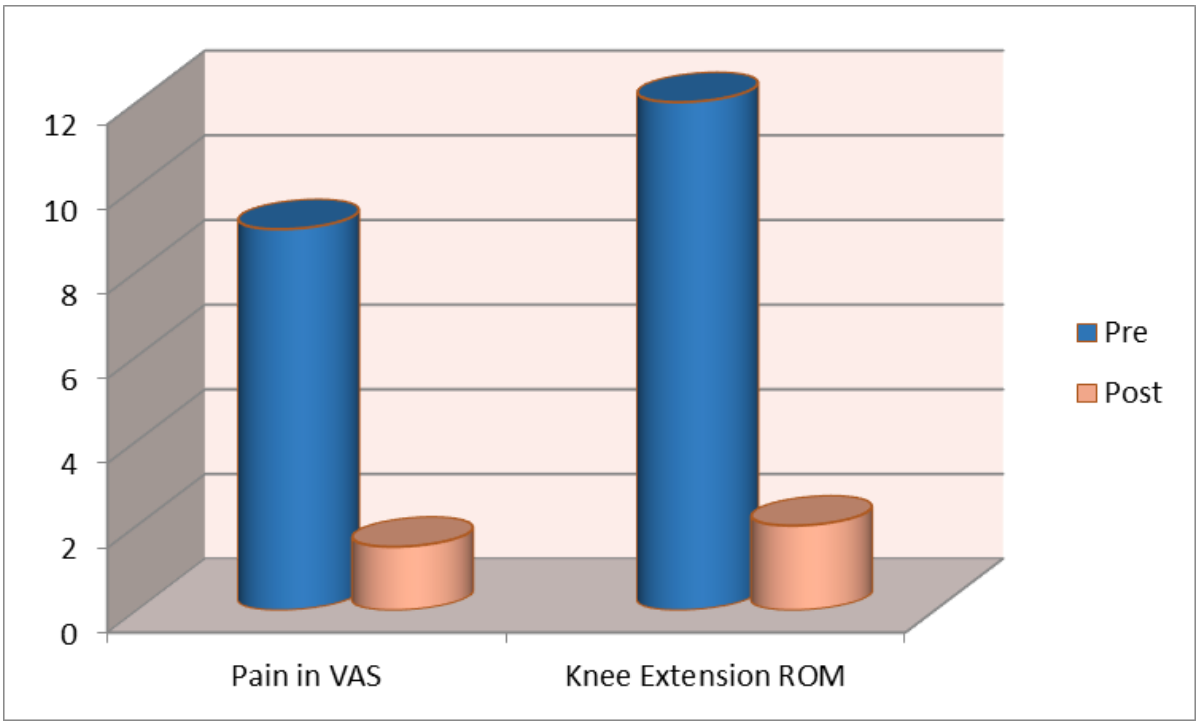

Figure 2: Comparison of pre and post mean value of pain in VAS and pain free knee extension range ROM in experimental group.

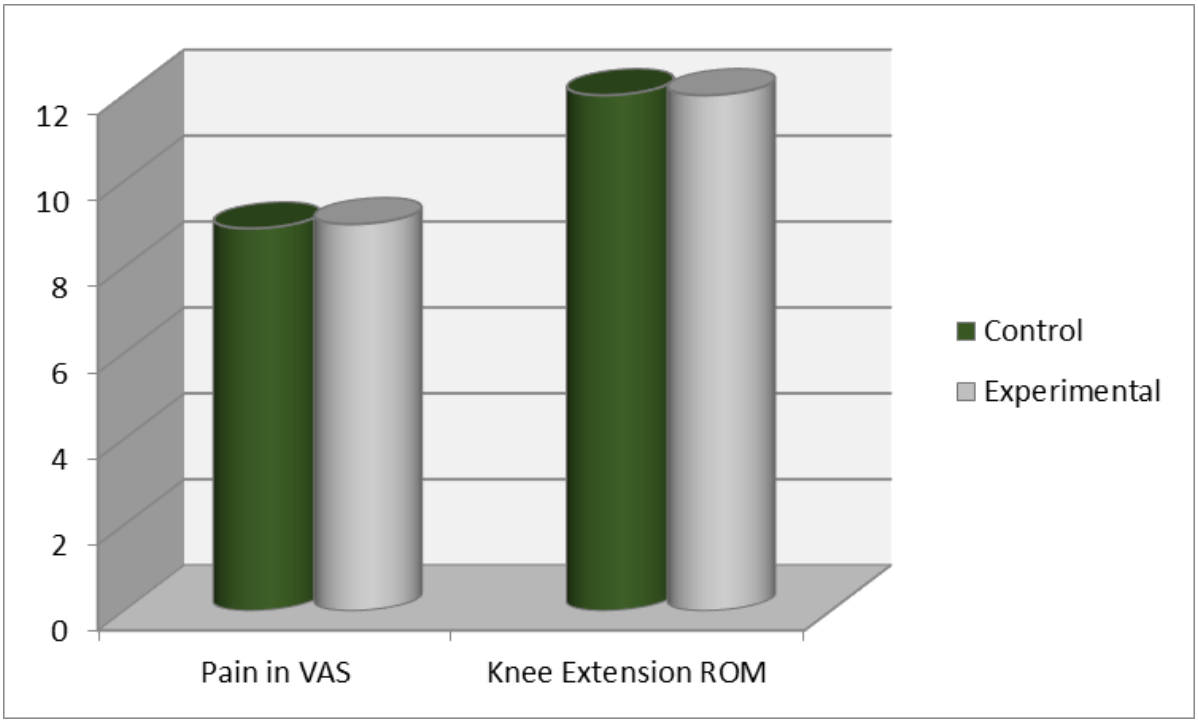

Figure 3: Comparison of pre mean values of pain in VAS and pain free knee extension range ROM between control and experimental group to check homogeneity.

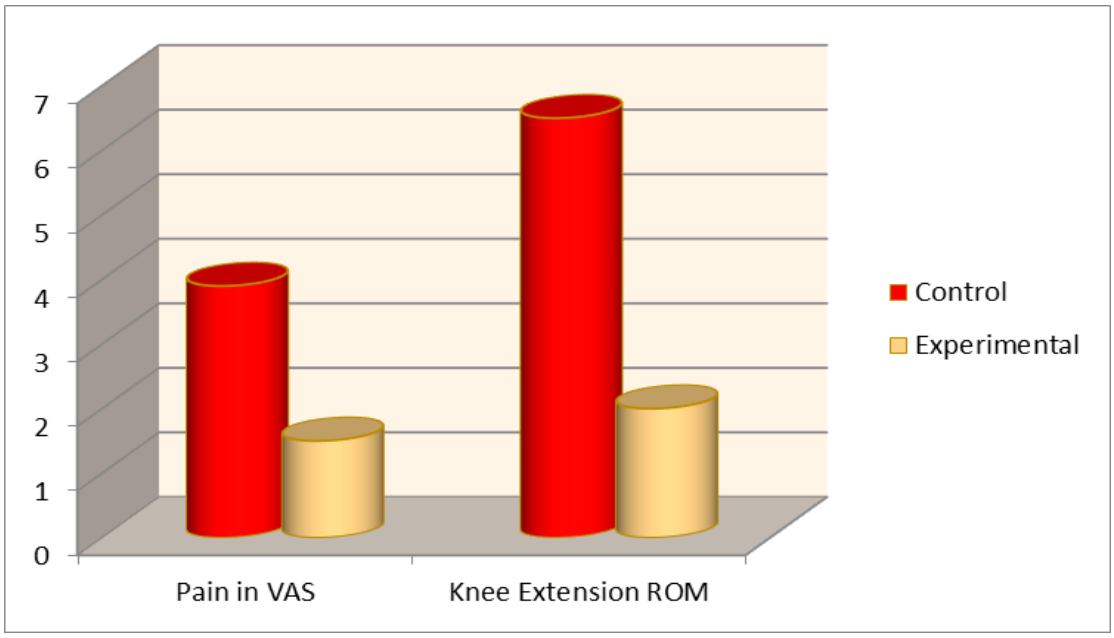

Figure 4: Comparison of post mean value of pain in VAS and pain free knee extension range ROM between control and experimental group to check significance.

Discussion

This study results shows that there is statistically significant improvement in the variables of pain in VAS and pain free knee extension ROM between pre and post mean values in both control and experimental group (Table 1) with $p<0.001$***. There is homogenous of variables in pre values of variables of pain in VAS and pain free knee extension ROM between control and experimental groups (Table 3). The Post mean values of pain in VAS and pain free knee extension ROM shows significant improvement with P-values $p<0.001$*** in Experimental Group when compared to Control Group (Table 4). Thus null hypothesis has been rejected and alternate hypothesis has been accepted for this study. There is statistically significant improvement in the variable of pain in VAS and pain free knee extension ROM in both groups due to proprioceptive exercises and strengthening exercises which improves the joint flexibility and reduces muscle stiffness. This physiological change helps in improving the pain free knee extension joint ROM in experimental group where interventions of proprioceptive exercises were given. Pain reduction in VAS and pain free knee extension range ROM is the result of improved proprioceptive and kinaesthetic sensation.

This study results are strengthened the view of Hee Seong Jeong, et al., stated that among people with knee OA, proprioceptive training may relieve pain and improve physical function during activities of daily living. This training should include neuromuscular-control elements, with coordinated trunk and lower extremity strengthening, at an average frequency of 3 to 4 times per week for 30 to 40 minutes per session. Under these conditions, proprioceptive training may improve the physical function of patients with knee OA [19].

This study results reflected the concept of Kelley Fitzgerald, et al., studied on agility and perturbation training technique in exercise therapy for reducing pain and improving function in people with knee osteoarthritis. They concluded that both intervention groups exhibited some moderate improvements in self-reported outcome measures; there was no additive benefit from including agility and perturbation training techniques in a standard exercise program for their participants with knee Osteoarthritis [20].

Limitations:

- Study was done with less number of patients
- Study was done in short duration and follow up was done
- Study not analyzing the inter rater or Intra rater reliability
- Biasness in the exercises programme couldn't be controlled
- Measurement of knee joint proprioception was not considered in the study
- Certain factors like Medications, Life style, sleeping pattern are not modified by the patient

Future Recommendations

- Future study should focus on other forms of exercise which improves proprioception and balance
- Similar type of study can be advised for the OA Hip joint
- Future study should include other different techniques like MET's or Maitland
- Long term follow-up should be made to find out the effect of the treatment
- Randomized control trail can be done

Conclusion

There was a significant improvement pain in VAS and pain free knee extension ROM in both the groups. When compared with Experimental Group, Control Group shows statistically less significant improvement in functional ability. So, this study concluded that proprioceptive exercises along with strengthening exercises shows a significant improvement on pain in VAS and pain free knee extension ROM when compared to strengthening exercise alone in patient's osteoarthritis of knee.

Conflict of Interests

The author declares no conflict of interest.

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