



Original Article

Effect of Neuromuscular Exercises on Pain, Quadriceps Strength and Physical Function among Patients with Unilateral Knee Osteoarthritis. -a Single Group Reversal Design

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Abstract

Background: Osteoarthritis is a progressive disease of the synovial joint. The structural damage results in collapse of the cartilage and subchondral bone leading to symptoms of pain, stiffness and dysfunction. Physiotherapy interventions not only reduce the symptoms but also slows down the disease progression. Neuromuscular Exercise is typically performed in functional weight bearing position and emphasizes the quality of movement and physical function. The aim was to find out the Effect of Neuromuscular Exercises on Pain, Quadriceps strength and Physical function among patients with Osteoarthritis. **Methodology:** 27 patients with OA were selected and underwent Neuromuscular Exercise along with Conventional Quadriceps strengthening exercises, primary outcomes of Quadriceps strength was measured using Handheld dynamometer and Physical function was measured using WOMAC Scale. **Results:** The statistical analysis was made using ANOVA method, the patients who received Neuromuscular Exercises showed decrease in pain, improvement in Quadriceps strength and Physical Function. The Data analysis was done using ANOVA, and SPSS software v 22.0. The Statistical Analysis showed a significant improvement in Pain after the Neuromuscular Exercises. Pain and Physical function (WOMAC: $p < 0.05$; $p = 0.01$) and Quadriceps strength (Dynamometer: $p < 0.05$; $p = 0.03$). **Conclusion:** The study concluded that Neuromuscular exercises along with conventional therapy was effective in reducing Pain and improving Quadriceps strength and Physical function among patients with Knee Osteoarthritis.

Keywords: Osteoarthritis; Neuromuscular Exercise; Quadriceps Strength; Physical Function

Introduction

Knee Osteoarthritis is a chronic degenerative joint disease which involves synovial membrane and articular cartilage degeneration. The primary clinical features of Osteoarthritis are pain, decreased joint space and osteophyte formation. The progression of the disease results in various structural and functional declines in the joint ([Favero et al, 2015](#)). The occurrence of Osteoarthritis is higher in women than men, where the prevalence ratio is 2:1. Obesity is one of the major causes of osteoarthritis ([O'Neill, McCabe & McBeth, 2018](#)) Age group above 40 years are more prone to osteoarthritis ([Pal et al, 2016](#)).

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Degeneration restricting the Range of motion completely needs surgical replacement of the knee joints. Physiotherapy interventions help to slow down the progression of the disease. Conventional Physiotherapy involves strengthening of Quadriceps which helps in absorption of the force Neuromuscular exercises are performed in functional weight bearing positions which improve the sensory input and helps in improved functional activities of daily life and physical function ([Anwer & Alghadir, 2014](#)).

Methodology

This study design was a Single Subject Group Reversal Design ABA type. The study was conducted at the K.G Pain Relief Centre, Coimbatore, Tamil Nadu. The duration of the study was 6 weeks. A total sample of 27 subjects demographic data in Table 1, both male and female patients were included of age group 45 to 60 years, who had unilateral knee osteoarthritis with 1-3 radiographic grades on Kallgren Lawrence Scale ([Kellgren & Lawrence 1957](#)) and excluded patients with history of any knee surgeries, neurological disorders, any intra articular injections, patients who received physiotherapy in the last 3 months and impaired lower limb function due to joint stiffness.

The Outcome measures used were WOMAC for Pain ([Moiz et al., 2019](#)) and Physical Function and Quadriceps strength was measured using Handheld Dynamometer ([Lesnak et al., 2019](#)) The Data was Analyzed by using Repeated ANOVA and SPSS Software version 22.0.

Table 1: Demographic Data

Characteristics	Patients	Number	Percentage %
Age		52 ± 5.2	
Gender	Female	16	59.26
	Male	11	40.74
BMI		31.7 ± 0.92	

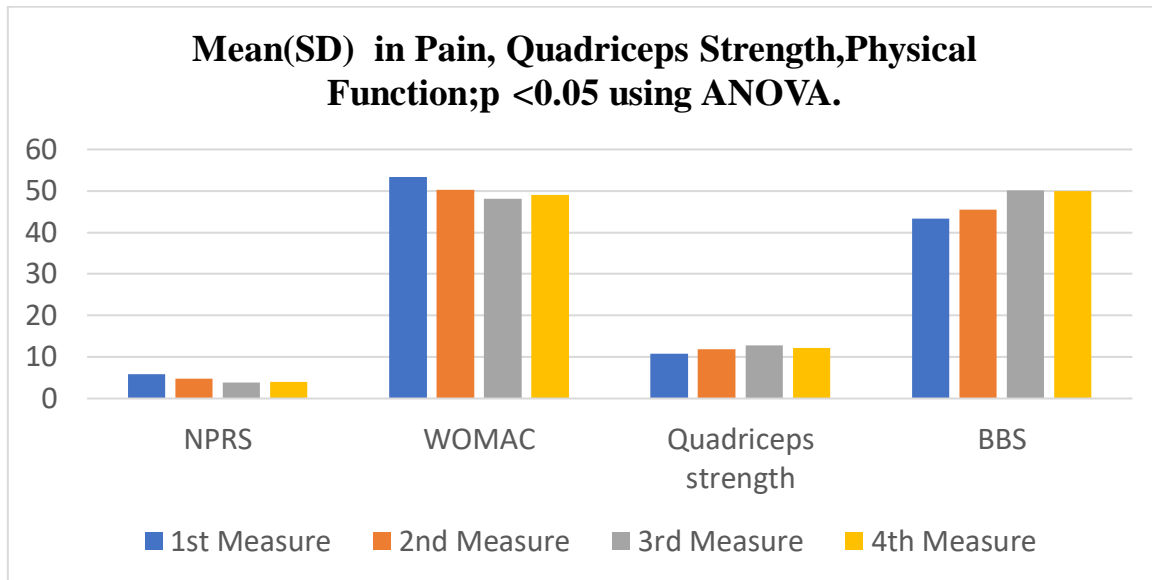
Results

The aim of this study was to find out the effect of Neuromuscular exercises on Pain, Quadriceps strength and Physical function among patients with Knee osteoarthritis. The Outcome Measurements were divided into four measurements; every measurement was taken after 2 weeks when the intervention got over. 1) The baseline assessment which is the First measure (Pain: SD = 5.9, Quadriceps strength: SD =10.8; WOMAC: SD=53.3) was taken before the interventions were started. 2) Then patients underwent Quadriceps strengthening exercises (A) given for 2 weeks. After 2 weeks the Second measure was taken for all the outcome measures which showed significant improvement (Pain: SD = 4.8, Quadriceps strength: SD =11.9; WOMAC: SD=50.2). 3) Then patients underwent Neuromuscular exercises (B) was given for 2 weeks after the second measure was taken, after the intervention program got over Third measure was taken which showed greater significant improvement compared to the first and second measures. (Pain: SD = 3.9, Quadriceps strength: SD =12.8; WOMAC: SD=48.1) 4) Then, the patients received Quadriceps strengthening (A) again for 2 weeks according to the Reversal Design after that which the Fourth measure was taken which showed mild decrease in the outcome measures compared to the Third measure. (Pain: SD =4, Quadriceps strength: SD =12.2; WOMAC: SD=49) which are represented in table 2. The Data analysis was done using Repeated ANOVA, and SPSS software v 22.0. The Statistical Analysis showed a significant improvement in Pain and Physical function (WOMAC: $p < 0.05$; $p = 0.01$) and Quadriceps strength (Hand held Dynamometer: $p < 0.05$; $p = 0.03$) after the Neuromuscular Exercises (Table 2). The Table 3 shows the 4 weeks improvement in the outcome measures.

Table 2: Statistical Data

VARIABLES	MEAN (SD)				ANOVA P
	1 ST MEASURE	2 ND MEASURE	3 RD MEASURE	4 TH MEASURE	
NPRS	5.9	4.8	3.9*	4.0	0.04*
QUADRICEPS STRENGTH	10.8	11.9	12.8	12.2	0.03*
WOMAC	53.3	50.2	48.1	49	0.01*

Table 3: Graphical representation



Discussion

The knee joint load is influenced by functional alignment of the trunk, pelvis and lower limb segments. Neuromuscular Exercises can influence knee joint load and decrease pain, improve balance, muscle activation, functional alignment and functional knee stability (Lee Kim & Koo, 2015). Neuromuscular exercise and Hip Abduction: KOCH’ s Static Model of Hip Biomechanics states that “Gluteus Medius must generate force twice the weight of the body during single leg stance” to prevent the body from leaning towards the unsupported side. In this mode, Gluteus Medius is the only muscle that provides resistance to the loads exerted on the femur (Lee Kim & Koo, 2015) In single-limb stance, the ground reaction force applies an addition moment to the stance hip, tending to rotate the whole lower extremity medially.

Out of the four muscles of Quadriceps Rectus femoris, Vastus intermedius moves the patella parallel to the axis of the patella and Vastus lateralis directs the patella laterally. Vastus medialis is the only muscle which establishes balance between the other three muscle by directing the patella medially. (DeVita et al., 2018) During getting up from the chair, part of daily activity the strength of the Quadriceps is very essential for great moment arm, hence the Quadriceps strengthening is very essential for patients with knee OA.(Caravaggi et al., 2021) Studies shows that Quadriceps helps in prevention of joint degeneration by stabilizing the joint through absorbing and generating forces and preventing the transmission of force to the joint

The Neuromuscular Exercises establishes a co contraction of these two opposite group muscles and emphasizes a good sensorimotor control along with neutral joint position thus decreasing the load to the joint. Therefore, these exercises stabilize the joint in proper alignment and provides the muscle to generate great force ([Rashid et al., 2022](#)).

Conclusion

In this study there is no control group therefore it is not appropriate to say only Neuromuscular Exercises improved Pain, Quadriceps strength and Physical Function. Therefore, the study is concluded that, Neuromuscular Exercises along with Quadriceps strengthening exercises is very much effective in improving Pain, Quadriceps strength and Physical function.

Conflicts of Interest

The authors declare no conflict of interest

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