

Original Article

Effect of Quadriceps Strengthening Exercise on Reduction of Pain in Knee Osteoarthritis

C M Walid¹, M H Islam², A Z M M Rahman³, M T Islam⁴, M K Hassan⁵, F Sobhan⁶, M A Emran⁷**Abstract:**

Osteoarthritis is the leading cause of musculoskeletal pain and disability. Nonsteroidal anti-inflammatory drugs and physical modalities like Quadriceps muscle strengthening exercise can be used to treat such cases. This Randomized clinical trial study was done in the department of Physical Medicine and Rehabilitation, Sylhet M.A.G Osmani Medical College Hospital Sylhet, to evaluate the role of quadriceps strengthening exercise in knee osteoarthritis. during 1st April 2009 to 31st October 2009. Sixty patients with knee osteoarthritis were selected according to inclusion and exclusion criteria. They were divided in, group A and group B randomly. Group- A was treated with NSAID (Aceclofenac 100mg 12hrly) and group-B with NSAID and quadriceps strengthening exercise 10 repetition 3 times daily. Each patient was followed up every week for four weeks. The mean age was 61.067 ± 8.320 years and male female ratio was 1.4:1. Marked improvement was observed in both the groups assessed by pain score ($p < 0.001$), physicians global assessment ($p < 0.001$) and patients global assessment ($p < 0.001$); and was continued throughout the treatment period of 4 weeks; with significantly marked in group A than group B beginning at 1st week of treatment [pain score ($p < 0.001$), physicians global assessment ($p < 0.040$) and patients global

assessment ($p < 0.034$)] and was continued at the 4th week of treatment [pain score ($p < 0.001$), physicians global assessment ($p < 0.001$) and patients global assessment ($p < 0.001$)]. The overall difference between the groups from baseline to end point of treatment is significant with group A (exercise plus NSAIDs) experienced a faster pain relief than that of group B (Only NSAIDs) ($p = < 0.001$). So from the present study, it may be concluded that quadriceps strengthening exercise is useful in reduction of pain in knee osteoarthritis and may be an adjuvant therapy in knee osteoarthritis.

Keywords: Quadriceps strengthening exercise, Knee osteoarthritis

Introduction:

Knee pain is a major cause of disability and prevalent in those aged over 50. Much of this knee pain is caused by osteoarthritis, and a leading cause of lower limb disability in older people and affecting 9.6% of men and 18.0% of women? 60 years of age worldwide.^{1,2} It is a major cause of pain and functional impairment including difficulty with several activities of daily living.³ It is seen mostly in middle and advanced age groups and its frequency increases with age. Although its frequency is similar in both sexes below the age of 55, there is an increase in women after the age of 55.⁴

Risk factors for knee osteoarthritis include age, female sex, obesity, trauma, and quadriceps weakness. Among these, quadriceps weakness may be the most amenable to treatment for the prevention of knee osteoarthritis.⁵ Mechanical loading and weakness of the peripheral muscles accelerate joint degeneration. In time the symptoms get aggravated and the activities of daily living become restricted.⁶ The main pathologies are damage of the joint cartilage and reactive hypertrophy of the subchondral bone. There may be synovitis in the flare-ups of the disease.⁴ Pain, local sensitivity, limitation of joint motion, atrophy due to inactivity, crepitation and local inflammation with different degree can be seen during the course of the disease.^{7,8} Knee pains cause spasm of the adjacent muscles. Muscle spasm increases joint loading and can cause limitation in the movement. Pain causes progressive loss of function and muscle atrophy through reflex mechanism.⁹

Weakness of the quadriceps muscle is well documented in subjects with knee osteoarthritis is strongly associated with both greater pain, and impaired physical function.¹⁰ Degenerative changes in the joint may damage articular mechanoreceptors that lead to abnormal processing of sensory information and inhibition of muscle activation. This, in turn, predisposes the quadriceps to weaken which increases risk for more joint damage.^{11,3}

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Treatment is generally aimed at reducing pain, maintenance of range of motion, prevent contractures and preserve knee functions, increase muscle strength and absorb compressive loading. Analgesics, nonsteroidal anti-inflammatory drugs, physical modalities, like superficial and deep heating and low frequency currents and quadriceps muscle strengthening exercise can be used. Isometric exercise and neuromuscular electrical stimulation are just some of the specific methods of muscle strengthening.^{12,13} Isometric, isotonic and isokinetic exercise are used to increase muscle strength and endurance. Exercise increases the compliance with therapy and decreases the pain and spasm and can be used in combination with physical therapy agent.¹⁴

This study was designed to evaluate the effect of quadriceps strengthening exercise on reduction of pain in knee osteoarthritis.

Methods:

A Randomized clinical trial study was done in the department of Physical Medicine and Rehabilitation, Sylhet M.A.G Osmani Medical College Hospital, Sylhet from 1st April 2009 to 31st October 2009. Sixty patients with knee osteoarthritis were selected according to inclusion and exclusion criteria. The diagnosis of knee osteoarthritis was confirmed by history, clinical examination, laboratory and radiological findings according to American College of Rheumatology clinical classification criteria. Patients with knee pain, both sexes over 50 years, less than 30 minutes morning stiffness were included in this study. Patients with inflammatory arthritis, crystal deposition disease and traumatic knee pain were excluded from the study. They were divided into two groups, group A and group B randomly. Group- A was treated with NSAID (Aceclofenac 100mg 12hrly) and group-B with NSAID and quadriceps strengthening exercise 10 repetition 3 times daily. Each patient was followed up every week for four weeks. Patients assessment was done by visual analogue scale (0-10), Physicians global assessment, Patients global assessment. The data were compiled and coded properly. The numerical data were analyzed statistically by using statistical package for social science (SPSS-16). The results were expressed as percentage and mean ± SD and p < 0.05 was considered as significant. Students 't' test and Chi-square test were done to see the level of significance as required.

Results:

The patients were ranging from 50 to 85 years with the mean age 61.067 ± 8.320 years. In group A, mean age of 63.033 ± 9.441 years; whereas in the group B mean age 59.100 ± 6.609 years. (Table 1)

Table 1: Distribution of age of the patients

Age Group	Group A (n=30)	Group B (n=30)	*p value
50-54 Years	5 (16.7)	5 (16.7)	0.406
55-59 Years	6 (20.0)	12 (40.0)	
60-64 Years	6 (20.0)	6 (20.0)	
65-69 Years	6 (20.0)	4 (13.3)	
70 or more Years	7(23.3)	3 (10.0)	
Mean ± SD	63.033 ± 9.441	59.100 ± 6.609	0.605

*?2 (Chi- square) Test was employed to analyze the data.

Figure in the parenthesis denote corresponding percentage. SD: Standard deviation.

Group A: Exercise plus NSAID group

Group B: NSAID only group

There were 19 (63.3%) male and 11 (36.7%) female in the group A; it was 16 (53.3%) male and 14 (46.7%) female in the group B. The male female ratio was 1.4:1. In occupation distribution group A, 36.7% of patients were house wives, 33.3% farmers, 16.7% business men, 10% day laborer and 3.3% service holders. Where as in group B, 46.7% were house wives, 30% farmers, 10% business men day laborer and service holders each comprises 6.7%%. The baseline characteristics of patients in both groups shown no significant difference between the group in relation to Pain score determined by visual analogue scale (p=0.521), physicians global assessment (p=0.084) and patients global assessment (p=1.000). (Table 2)

Table 2: Baseline characteristics of patients in both groups (n=60).

Assessment Variables	Group A (n=30)	Group B (n=30)	p value
Pain score	8.533±0.571	8.433±0.626	0.521*
Physicians global assessment			
Moderate	0 (0.0)	1 (3.3)	0.084 †
Severe	13 (43.3)	20 (66.7)	
Very severe	17 (56.7)	9 (30.0)	
Patients global assessment			
Severe	13 (43.3)	14 (46.7)	1.000 †
Very severe	17 (56.7)	16 (53.3)	

*Student t test and † ?2 (Chi- square) test were applied to analysis the data.

Improvement was observed in both the groups at the end of 2nd week of treatment; witch was significantly marked in group A than group B [pain score (p<0.001), physicians global assessment (p=0.005) and patients global assessment (p=0.013). (Table 3)

Table 3: Assessment of the patients at the end of 2nd week between the groups

Assessment Variables	Group A (n=30)	Group B (n=30)	p value
Pain score	3.900±0.995	5.600±.0932	<0.001*
Physicians global assessment			
Moderate	18 (60.0)	7 (23.3)	0.005 †
Severe	12 (40.0)	19 (63.3)	
Very severe	0 (0.0)	4 (13.3)	
Patients global assessment			
Asymptomatic	2 (6.7)	0 (0.0)	0.013 †
Mild	15 (50.0)	6 (20.0)	
Moderate	13 (43.3)	21 (70.0)	
Severe	0 (0.0)	3 (10.0)	

*Student t test and † Chi- (?2) square test were applied to analysis the data.

Further improvement was observed in both the groups at 4th week of treatment; which was significantly marked in group A than group B [pain score ($p < 0.001$), physicians global assessment ($p < 0.001$) and patients global assessment ($p < 0.001$).(Table 4)

Table 4: Assessment of the patients at the end of 4th week between the groups

Assessment Variables	Group A (n=30)	Group B (n=30)	p-value
Pain score (VAS)	1.267±0.521	3.633±0.928	<0.001*
Physicians global assessment			
Asymptomatic	29 (96.7)	4 (13.3)	<0.001†
Mild	1 (3.3)	21 (70.0)	
Moderate	0 (0.0)	5 (16.7)	
Patients global assessment			
Asymptomatic	27 (90.0)	4 (13.3)	<0.001†
Mild	3 (10.0)	22 (73.3)	
Moderate	0 (0.0)	4 (13.3)	

*Student t test and † ?2 (Chi- square) test were applied to analysis the data.

Table: 5, shown that In group A the mean pain score was 8.5 at baseline which decreased steeply from baseline to the end of 4 week. In group B the mean pain score was 8.4 at baseline which decreased gradually from baseline to the end of 4 week. The overall difference between the groups from baseline to end point of treatment is significant with group A experienced a faster pain relief than that of group B ($p < 0.001$).

Table 5: Change in of pain score at different time interval estimated by Visual analogue scale (n=60)

Pain score (VAS)	Evaluation at					p† value
	Baseline	In 1 st Wk	In 2 nd Wk	In 3 rd Wk	In 4 th Wk	
Group A (n=30)	8.5±0.6	6.0±1.0	3.9±1.0	2.4±0.9	1.3±0.5	<0.001
Group B (n=30)	8.4±0.6	6.9±0.7	5.6±0.9	4.5±1.0	3.6±0.9	
p value	0.521	<0.001	<0.001*	<0.001*	<0.001*	

*Student "t" test and † "Repeated measure ANOVA" were applied to analysis the data.

Discussion:

In this study, patients was ranging from 50 to 85 years with the mean age of 61.067 ± 8.320 years, which was similar to the previous study¹⁵ where patients ranging from 47 to 74 and mean age was 62.4 ± 1.3 years.

In another study Shakoor et al. (2008) found that the mean age of their series was 61 ± 10 years, which was also similar to this study.¹⁶ The male to female ratio was 1.4:1 which was comparable to other studies^{10,17} where male female ratio were 1.4:1 and 1.5:1 respectively. In occupation study 41.7% house wives, 31.7% farmers, 13.3% business men, 8.3% day laborer and 5.55% service holders. This result was supported by the previous study where majority of the patients with knee osteoarthritis were house wife.¹⁸ In the developing country like Bangladesh, there is significantly increased prevalence of osteoarthritis of the knee in those who engaged in knee bending occupations.¹⁹ In this study among 60 patients, lower class comprises the maximum (48.3%), middle class (31.7%) and upper class (20.0%) which was comparable to other study.²⁰ In this study marked improvement was observed in both the groups assessed by pain score ($p < 0.001$), physicians global assessment ($p < 0.001$) and patients global assessment ($p < 0.001$); throughout the treatment period up to 4th week. Which was significantly marked in group A than group B. The overall difference between the groups from baseline to end point of treatment is significant with group A (exercise plus NSAIDs) experienced a faster pain relief than that of group B (Only NSAIDs) ($p = < 0.001$).

In another study, significant improvement was observed patients with knee osteoarthritis, those who were treated with short wave diathermy plus quadriceps exercise than that short wave diathermy.¹⁷ Quadriceps muscle strengthening exercise is important for increasing of the muscles strength and muscle strengthening exercise improves the condition of the patients with osteoarthritis of the knee.^{21,22,23,24} In a study, it was found that home based exercise program can significantly reduce pain in osteoarthritis of the knee.²⁵ American College of Rheumatology subcommittee (2000) also recommends quadriceps strengthening exercise for osteoarthritis of the knee.⁷ So from the present study, it may be concluded that quadriceps strengthening exercise is useful in reduction of pain in knee osteoarthritis and may be an adjuvant therapy in knee osteoarthritis.

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