

Symptomatic improvement of osteoarthritic knee by quadriceps exercise

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Abstract

Objective: To assess the role of quadriceps isometric and strengthening exercises in symptomatic osteoarthritis knee joint.

Material and Methods: This two centers, descriptive, randomized, using convenience sampling technique study was carried out at the out patients department of the Orthopedic Units of the Jinnah Medical College Hospital, Karachi and Dow University Hospital- Ojha Campus Karachi from February 2018 - March 2020. A total of one hundred patients in the age group of 40-65 years and suffering from mild to moderate symptomatic (Grade II and III) Osteoarthritis of the knee joint were enrolled in the study. Participants were divided into 2-groups: Group I received drug therapy and physiotherapy in the form of quadriceps (isometric and strengthening) exercises and group-II received drug therapy only. Data was recorded on a proforma designed to assess symptomatic relief after two weeks, and six weeks and eight weeks.

Results: Participants in group-I with exercise program showed relief in knee pain, stiffness and improvement in function, more than that of participants in group-II. It was observed by the significant improvement of Visual Analogue Scale (VAS) and Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC).

Conclusions: We conclude that there is a relationship quadriceps exercise with osteoarthritis of knee. Moderate quadriceps exercise is a safe and effective in osteoarthritis of knee joints.

Keywords: Isometric exercise, visual analogue scale, McMaster Universities Osteoarthritis index (WOMAC), Osteoarthritis knee

Introduction:

Osteoarthritis (OA) of knee is the most prevalent chronic joint condition.^{1,2} Its prevalence in Pakistan is between 25% to 28%.³ In India and Bangladesh it is reported to be 5.78% and 10.20% respectively.^{4,5} It is a degenerative joint disease caused by progressive loss of articular cartilage leading to a variety of sign and symptoms including pain, joint effusion, stiffness, instability and decreased range of movement.⁶ It is strongly associated with ageing,⁷ obesity and with heavy occupational activity.⁸ It leads to the decrease in activities of daily living (ADL) in elderly dependent population of the society. The mainstay of osteoarthritis knee treatments comprises of physical therapy, medications and

surgery. Physiotherapy (especially quadriceps exercises) plays an important role and it is highly recommended by American College of Rheumatology (ACR) in the conservative treatment of osteoarthritis knee.^{9,10}

There are three types of basic quadriceps exercise: isotonic, isokinetic, and isometric exercise. Of these isometric exercise might be the most appropriate and easy to understand by the patients. It can be safely performed at home to rapidly improve strength.¹¹ Further, isometric exercise causes the least intraarticular inflammation, pressure, and bone destruction. Line et al and Bennel et al confirmed by systemic reviews that quadriceps strengthening may improve pain,

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Table 1: Demographic attributes including age, weight, height and BMI index

Characteristics	Group-I n=50	Group-II n=50
Age (M/F)	50 (2.0)/48 (1.5)	52 (2.5)/ 49 (2.0)
Sex (Male/ Female)	20/30	18/32
Body Mass Index (BMI)	26 (2.2)/29 (1.9)	27 (1.1)/ 28 (1.2)

Table 2: Comparative improvement between Group I and Group II (Pain, Stiffness and Functional status by VAS and reduced WOMAC index)

Groups	Baseline mean (SD)	Sixth Week mean (SD)	Difference Mean (SD)	Variables
Group I	7.05 (0.86)	2.24 (0.76)	4.81 (0.10)	Visual Analogue Scale (VAS)
Group II	6.95 (1.11)	5.24 (0.88)	1.71 (0.23)	
Group I	23.71 (3.42)	7.05 (2.33)	15.56 (1.09)	Western Ontario and McMaster Osteoarthritis Index (WOMAC)
Group II	23.52 (4.43)	17.05 (4.30)	5.47 (0.13)	

function and quality of life.^{12,13}

The aim of this study was to examine the associations between quadriceps isometric and strengthening exercise and knee pain, stiffness and disability in a community derived population.

Material and Methods:

All adults' patients attending the outpatients department of the aforesaid hospitals, between March 1, 2018 and March 31, 2019; suffering from mild to moderate osteoarthritis of knee joint' were eligible to participate in the study. Participation required giving informed consent to record data regarding their medical history, treatment and follow-up. For inclusion participant should be a diagnosed case of primary osteoarthritis of knee joints with radiological evidence of grade 3 or less on the Kellgren Lawrence scale.¹⁴ Participants age were between 40–65 years with unilateral or bilateral knee involvement. Those participants were excluded who had any deformity of the knee, hip or back, any type neuropathy, received any intra-articular injection within the previous 6-months, and received physiotherapy treatment in the past six months. Patients who met the inclusion criteria were randomly assigned to one of two groups (Fig. 1).

All the participants in the group I performed

exercises (isometric quadriceps and quadriceps strengthening) as well along with non-steroidal anti-inflammatory drugs. The participants of group-II received non-steroidal anti-inflammatory drug therapy only. The participants in the group-I performed the following sets of exercise for 4 weeks, first two weeks under supervision of physiotherapist, followed by home program for next 4 weeks. All exercises were performed in sets of 10 repetitions; up to 3 times a day.

Isometric Quadriceps Exercise: Patients sit on the floor with leg straight out. A rolled up towel was put beneath the knee. They were instructed to maximally tighten their thigh muscles by pressing their knee and hold the contraction for 5 seconds, then rest up to 10 seconds.

Quadriceps Strengthening Exercise: Patients sit in a chair with leg hanging down. They were asked to straighten their legs and hold for 5 seconds. Then lower their legs and rest for up to 10 seconds.

The findings were recorded at first visit and follow up was done twice weekly for eight weeks. The parameters (improvements in pain, stiffness and physical function) used for comparing the treatment are Visual Analogue Scale (VAS) and reduced Western Ontario and McMaster Osteoarthritis Index (WOMAC).¹⁵ The numerical data were analyzed statistically by SPSS.

Results:

A total of 110-subjects were eligible for the study. 10-patients refused or lost to follow up, so were excluded. 100-participants were enrolled in the study, with 50-subjects divided in each group, randomly using convenience sampling technique. After recording the demographic details, medical histories; radiographs of the affected knee in standing position were taken. These variables showed no significant difference between the two groups ($p > 0.05$). The participants demographic attributes including age, weight, height and BMI index were shown in Table-I.

There was marked improvement after treatment in both the groups comparison between two groups ($p=0.001$). At first visit there is no significant difference between two groups. More improvement was found in group-I (physiotherapy group) than group-II (drugs only) at 6th week and they maintain improvement on visit at 8th week.

After the 6-weeks treatment period the mean (SD) significant improvement of pain on Visual Analogue Scale (VAS) of group-I and group-II were noted (4.81 and 1.71). At the end of 6 weeks treatment period the mean (SD) improvement in WOMAC score in group-I and group-II were calculated to be 15.56 (1.09) and 5.47 (0.13) respectively as shown in table-II

Discussion:

The aim of the study was to assess whether isometric quadriceps and quadriceps strengthening exercises has positive effect in osteoarthritic knee. The results of the study showed that the 6-weeks isometric and strengthening exercise programs brought about a significant reduction in pain, stiffness and improvement in function. The findings are consistent with the findings of earlier researchers.^{16,17} Kaya ME et al¹⁸ Alghadir AH et al¹⁹ and Xie Y et al²⁰ noted the same beneficial effects of quadriceps exercise programs on pain and functional improvement.

It is well versed facts in the literature that quadriceps strength has been found to be the single most important predictor of osteoarthritic knee.²¹ The strong quadriceps muscles maintain the joint alignment and spread the impact force on a wider area. So in the study population reduction in pain and functional improvement may be linked to quadriceps muscle strength.^{22,23}

It is noteworthy that the beneficial effects of this short term exercise programs have many confounding factors: effect of decrease weight due to exercise, release of endorphins during exercise, effect of attention during exercise in elderly population and role of improvement in cardiovascular capacity.^{24,25} A large parametric studies

are needed to consolidate these findings.

Conclusion:

We conclude that the 6-week of isometric and quadriceps strengthening exercise program for patients with knee osteoarthritis showed beneficial effects on quadriceps muscle strength, pain, and function but future studies are needed with larger subject sample to confirm this finding.

Limitation of the study: The sample size was small.

Consent: Informed written consent was obtained prior to any diagnostic procedures or treatment and also prior to publication of case details.

Conflict of interest: None

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Role and contribution of authors:

Dr Syed Abdur Rub Abidi, collected the data, references and did the initial writeup

Dr Shaikh Naeem-ul-Haq, collected the data and helped in introduction writing.

Dr Abdullah Muttaqi, manuscript writer/ Editing

Dr Muhammad Farooq Umer, helped in data collection and critically review the article and made the final changes.

Dr Syed Wasif Ali, Data collection

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