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Research Article

Effect of Resistance Training of Quadriceps Muscle in Patients with Knee Osteoarthritis: A Randomized Control Trial

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ABSTRACT

Objective: To determine the effects of resistance training in quadriceps muscle in patients with knee osteoarthritis attending tertiary care hospital, Karachi.

Materials and methods: This was a single blinded randomized control trial study with probability simple random sampling technique. Sampling was done in physiotherapy department of Al-Khidmat Hospital Korangi, Karachi from May to December 2018. The required sample size was found to be 74 (37 in experimental group and 37 in control group). Inclusion criteria for patients was age >45 years, moderate degree pain, ability to walk 20 to 30 meters, subject without any walking aid and chronic osteoarthritis of knee diagnosed on radiograph. Variables were observed using the Numerical Rating Scale (NRS), Western Ontario and McMaster Universities Osteoarthritis (WOMAC) index, and a strength gauge device, respectively. All observations were taken at baseline and after a week. SPSS version 23.0 was used for data analysis.

Results: A total of 74 patients were recruited in this study. There were two groups Experimental and Control 37 patients were taken in each group. Strengthening of quadriceps exercises was assessed at baseline 9.13 ± 1.39 and after a week 11.36 ± 1.22 with statistically significant P-value of 0.041 in experimental group. In control group there was no statistical (difference observed at baseline and after a week routine checkup.

Conclusion: Quadriceps strengthening exercises have a positive impact found in patients with knee OA. Experimental group patients gradually showed improvement after exercises of one week with good physical health status.

Keywords: Isometric exercises; Muscle strengthening; Knee osteoarthritis

INTRODUCTION

Physical activity consists of many subgroups which involves exercises too. Exercises are scheduled controlled and has repetitions which has transitional objective for the enhancement and maintenance of physical fitness

Routinely exercises make people more active and efficient than those who do any exercise or any other physical activity. Exercise on regular basis had and emphasize on cardiopulmonary system which helps oxygen to deliver more to the body.

One of the basic types of exercise is isometric exercise. Isometric exercise were those exercises in which length of muscles remains same but tone changes [1-3]. Exercises are performed in a static position in which no visible movement is noticed but tension in muscle changes. Principally, work in muscles were done through three ways, muscle smoothening (concentric), increase in muscle length (eccentric) and no change in muscle length but tone changes are isometric. Most of the core stability exercises, Pilates and yoga postures were done isometrically [4-7].

Exercise is one of the best methods to treat osteoarthritis. From the literature review it is quite evident that isometric exercises are beneficial to improve the functional mobility of joints and reduce

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pain an old age people. When the mobility increases, intensity of joint pain decreases [8]. The isometric exercises do not take much time, requires no special equipment's, except a comfortable place to do the exercises. It is a simplest technique, which is considered to be appropriate for the low socio-economic status, and easily applicable for the old age people [9,10].

Osteoarthritis is the leading musculosketal disorder which directly effect on health of adults. More than 50 years of age population was affected from the knee pain which leads to disability [11]. Worldwide it has been proved that older peoples are affecting from lower limb disability 9.6% in men and 18.0% in women. Due to functional disability in OA daily living activities disturbs their life. Increasing age is the common factor towards OA [12].

There were different treatments available regarding knee osteoarthritis, education is also an important factor for treatment. Hydrotherapy, footwear and walking aids, other rehabilitation measures, physical therapy (SWD, UST, TENS, galvanic current, exercises etc.), systemic drug therapy, intraarticular drug therapy and surgery are also use to treat osteoarthritis patients [13-15]. Epidemiology of knee OA varies in Pakistan it was reported that 28% urban and 25% rural population has knee OA. Prevalence of knee OA in China it varies from 7.5% to 10.9%, Bangladesh 10.2% and India 5.78% respectively. This study was designed to determine to determine the effects of resistance training in quadriceps muscle in patients with knee osteoarthritis attending tertiary care hospital, Karachi.

METHODOLOGY

This was a single blinded randomized control trial study with probability simple random sampling technique. Sampling was done in physiotherapy department of Al-Khidmat Hospital Korangi, Karachi from May to December 2018. Ethical approval was taken from the institute before initiation of study. Sample size was calculated from online software openepi.com by taking hypothesized prevalence of knee osteoarthritis in Pakistan 28%. Confidence interval of 95% considered with 5% margin of error. The required sample size was found to be 74 (37 in experimental group and 37 in control group).

Inclusion criteria for patients was age >45 years, moderate degree pain, ability to walk 20 to 30 meters, subject without any walking aid and chronic osteoarthritis of knee diagnosed on radiograph. Exclusion criteria were patients who were currently fractured their legs, skin allergy reactions, major depressive illness, renal dialysis, lower limb amputation, varicose vein, variable ulceration in calf, major head trauma, dislocated/subluxation at knee joint, osteomyelitis of lower limbs and malignancy of lower limbs. Manual muscle testing chart was used for collection of data.

Patients were divided into two groups randomly. This was single blind randomized control trial so none of the group was aware regarding treatment. A single physiotherapist performed all the control and experimental group treatment for minimum error bias.

Data collection procedure in experimental group was patient having bilateral osteoarthritis encourage to perform exercises before exercises super facial and deep heating modalities was used for joint. Exercises includes active isometric, close chain knee terminal exercises, free weight mechanical workout. Time duration session of exercises was half hour per day for a week. Variables were observed using the Numerical Rating Scale (NRS), Western Ontario and McMaster Universities Osteoarthritis (WOMAC) index, and a strength gauge device, respectively. All observations were taken at baseline and after a week.

In Control group, ultrasound therapy was done with intensity of 1.5 watts cm2 for 7 minutes around knee joint position. There was no exercise suggested to them and advised to do normal daily activities.

Statistical Analysis was done using SPSS version 23.0. All the continuous variables were presented as mean ± SD. All categorical variables were showed in frequency and percentages. Normality of data was assessed by using for comparison of pre and post assessment paired sample t test was applied. P-value ≤ 0.05 considered to be statistically significant.

RESULTS

A total of 74 patients were recruited in this study. There were two groups Experimental and Control 37 patients were taken in each group. Mean age of study participants in experimental group was 58.45 ± 10.2 and control group was 55.35 ± 9.5 with range of (45-75) years. There were 27 (73.0%) male and 10 (27.0%) female in experimental group whereas in control group 25 (67.56%) male and 12 (32.43%) female were found in this study. Lost to follow-up ratio was observed in both groups after baseline. Missing follow-up in experimental group were seen in 4 patients and 7 patients in control group.

Strengthening of quadriceps exercises was assessed at baseline 9.13 ± 1.39 and after a week 11.36 ± 1.22 with statistically significant P-value of 0.041 in experimental group. In control group there was no statistical (difference observed at baseline and after a week routine checkup (Table 1).

Table 1: Comparison of isometric quadriceps strengthening exercises after a week.

Experimental group		Control group	
Baseline (n=37)	9.13 ± 1.39	Baseline (n=37)	8.33 ± 1.42
After a week (n=33)	11.36 ± 1.22	After a week (n=30)	8.15 ± 1.32
p-value	0.041	p-value	0.556

Numerical Rating Scale (NRS) showed differences in readings after a week follow-up. Experimental group baseline results were 6.55 ± 1.11 after exercise of 1 week 2.23 ± 1.20 with significant p-value of 0.001. In control group insignificant p-value=0.550 was seen 4.86 ± 0.86 at baseline and 5.12 ± 0.94 after one-week follow-up (Figure 1).

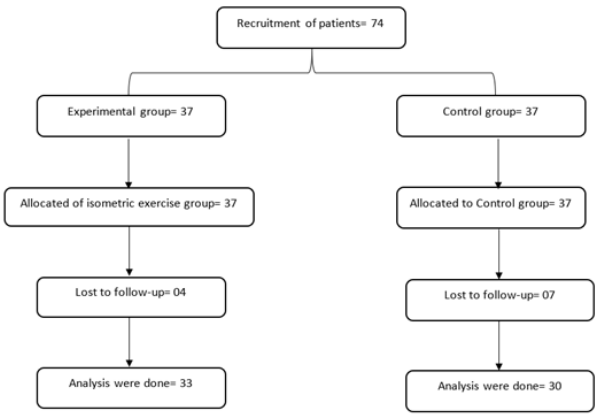

Figure 1: Consort diagram of study participants.

WOMAC index was also seen in both groups. Experimental group incredible improves from baseline 22.86 ± 3.36 after one-week exercises 11.12 ± 4.55 with significant p-value of 0.004. In control group there was no change seen in baseline and after a week with non-significant p-value of 0.763 (Figure 2).

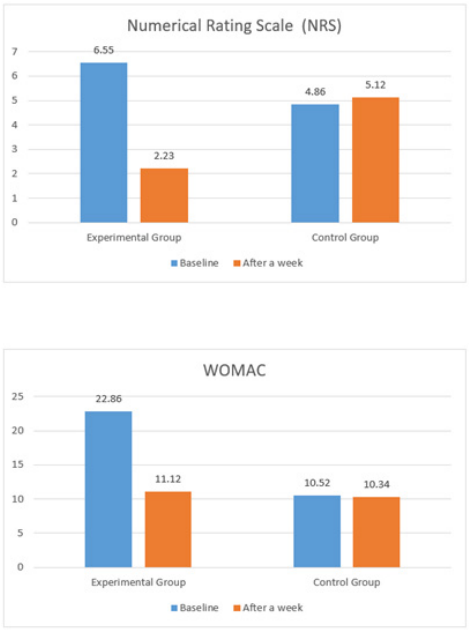

Figure 2: In control group there were no change seen in baseline and after a week with non-significant p-value of 0.763.

DISCUSSION

In evidence-based medicine the best clinical practice suggestions for treatment of knee Osteoarthritis. OA can be treated when physiotherapist play an important role in reduction of pain or movement due to knee OA. According to American college of Rheumatology (ACR) in 2012 recommendations for knee OA patients was muscle strengthening, aerobic and Isometric exercises in order to decrease pain and improves physical disabilities. Moreover towards recommendation by Osteoarthritis Research Society International (OARSI) is that knee OA patient should perform muscle strengthening and range of motion exercises [16,17].

Present study was designed to determine the effects of isometric quadriceps exercise on muscle strength in patients with knee osteoarthritis patients [18]. The results of this study showed improvement in patients with knee OA after completing isometric quadriceps exercises after a week assessment. In Experimental group improvements were seen in significant manner and no significant differences were observed in control groups. Literature supports that muscle strengthening are crucial in patients of knee OA [19].

Follow-up drop rate was also seen in this study there were 4 (10.8%) in experimental group and 7 (18.9%) in control group. Nejati et al. [20] reported compliance of patients in exercise therapy was 14.2%.

In present study, strengthening of quadriceps exercises was assessed at baseline 9.13±1.39 and after a week 11.36 ± 1.22 with statistically significant P-value of 0.041 in experimental group. In control group there was no statistical difference observed at baseline and after a week routine checkup reported similar results that significant improvement in muscle found after ending phase of their clinical trial [21]. In the similar context a study done by Miyaguchi et al. stated that reduction in pain was observed after 8 weeks isometric quadriceps exercises [22].

Present study showed after one-week intervention of isometric exercises significant improvement observed in knee pain in experimental group. This indicates that strengthening exercises have a high impact on these knee OA patients which further stabilize the knee joint problems. Similar studies also found via literature Lim et al. stated that knee OA patients received functional success after quadriceps strengthening exercises [23]. Another study done by Amin et al. identified that stronger quadriceps exercises resultant in minimum pain whereas least strength exercises have low impact on knee pain [24].

Current study results showed on Numerical Rating Scale (NRS) that significant difference received after a week follow-up. Experimental group baseline results were 6.55 ± 1.11 after exercise of 1 week 2.23 ± 1.20 with significant p-value of 0.001. In control group insignificant p-value=0.550 was seen 4.86 ± 0.86 at baseline and 5.12 ± 0.94 after one-week follow-up. A study done by Centin et al. determined that pain reduction and health improvement status directed from physiotherapy and exercises in knee OA patients [25]. It is recommended that all three exercises, isometric quadriceps exercise, straight leg raising were necessary for the results of this study in terms of successful results in patients with knee OA.

CONCLUSION

Quadriceps strengthening exercises have a positive impact found in patients with knee OA. Experimental group patients gradually showed improvement after exercises of one week with good physical health status.

The limitation of our study was a relatively small sample size for a more detailed analysis of the influence of the examined factors on the outcomes measured. The sample was obtained at a single centre; although it is reflective of this centre, it may differ from the stroke rehabilitation populations at other centres. The adaptation period for the orthosis is less which affects the outcome of the result.

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