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Research Article

Effects of Quadriceps Combined with Abductor Strengthening Verses Quadriceps Combined with Hamstring Strengthening in Treating Knee Osteoarthritis

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Abstract

Background: Osteoarthritis a common disease of aged population and one of the leading causes of Joints disability. Knee Osteoarthritis is one of the most prevalent joint diseases with a prevalence of 22% to 39% in India. Worldwide OA is estimated to be the 4th leading cause of Joint disability, in which 10% are the male and 13% are the female. Early intervention is considered important for ameliorating the long-term effects of disease. Several studies have shown that quadriceps strengthening exercises may ameliorate joint pain in subjects with knee Osteoarthritis. Strengthening exercise are effective and helpful for reducing pain in knee osteoarthritis.

Aim: The aim of this study is to evaluate the effect of quadriceps and hip abductor muscles strengthening versus effects of quadriceps and hamstring muscles strengthening in treating knee Osteoarthritis.

Materials and Method: Seventy subjects selected as per inclusion criteria who diagnosed with knee Osteoarthritis. Subjects were divided into group -1 and group-2. The first group received strengthening exercise for the quadriceps and abductor components. The second group received strengthening exercise for the quadriceps and hamstring components and the treatment lasted for 6-7 weeks and the primary outcome will be the Western Ontario and McMaster universities osteoarthritis index (WOMAC) scale.

Results: A Wilcoxon test was used for intragroup pre-treatment and post- treatment comparison of WOMAC and Mann Whitney U test was used for intergroup Post-treatment of WOMAC. The P value is 0.001. The mean for the group-A Post WOMAC score is 47.1143 which is less than the group-B Post WOMAC score, so it suggests an improvement. So there is sufficient information to reject and accept the type of hypothesis.

Conclusion: It is generally seen in many clinical set ups for treatment of OA of knee that exercises are often prescribed only for strengthening of quadriceps components but rarely for abductor so this study will helpful to design and describe the exercises to strengthen abductor muscles components also and help to improve Pain, disability and function activities in better way.

Keywords: Quadriceps; Abductor Strengthening; Hamstring Strengthening; Osteoarthritis

Introduction

The knee joint is a large compound type of synovial joint and conceptualized as 2 joints-tibiofemoral and patellofemoral joint. The tibiofemoral joint during weight bearing allows to transmission of weight from femur to tibia while providing like hinge and during sagittal plane a joint rotation along with small degree of tibial axial rotation [1].

The knee is hinge type of modified complex joint with the greatest movement in flexion and extension in sagittal plane, as well as varus and valgus rotation in the frontal plane. The knee joint also maintains stability during a weight bearing and loading situations.

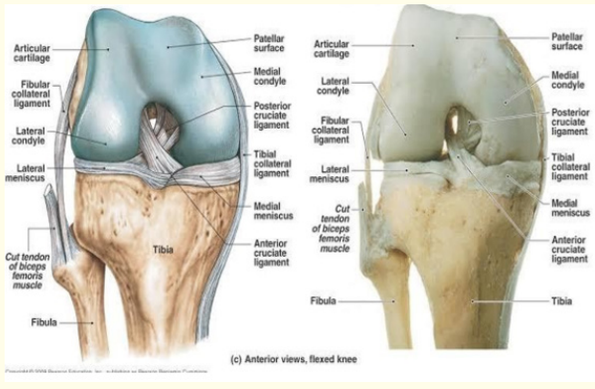


Figure 1

Osteoarthritis and most common joint disease of aged population and one of the leading causes of Joint disability. Osteoarthritis is common chronic conditionresulting in pain, stiffness, crackle sound, fatigue, functional limitations, increased healthcare utilization and high economic costs to society [2,3].

It's also known as degenerative joint disease or arthritis also. There are two types of osteoarthritis: primary and secondary.

Primary osteoarthritis is chronic degenerative disease that is related but not caused by age related. As a person ages, the water content of their cartilage reduce so they provided weakness of cartilage and making cartilage less resilient or more susceptible to degradation. There strong indications that genetic inheritance is an factor as up to 60% of all Osteoarthritis cases are thought result from genetic factors.

Secondary arthritis tends to specific cause such as injury, job that requires kneeling or squatting for extended amounts most of time, diabetes, or obesity. But though the etiology is different than primary Osteoarthritis, the resulting symptoms and pathology are the same [4].

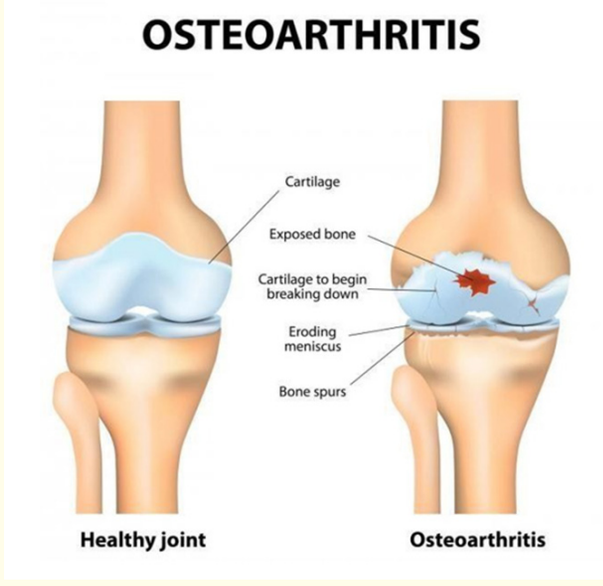


Figure 2

Knee OA is most prevalent joint disease and its prevalence associates with age related and gender. Knee Osteoarthritis prevalence mostly increases with age, so that about 11% of all women over the age of 52 -60 years has symptoms show to knee Osteoarthritis. Global statistics reveals over 100 million people worldwide suffer from OA, which is one of the most common causes of disability. The World Health Organization (WHO) forecasted that Osteoarthritis will become the fourth primary cause of disability by the year 2020.

Sports participation, injury to the joint, obesity, and genetic susceptibility predispose adolescent athletes to development of premature osteoarthritis. Previous knee trauma increases the risk of knee Osteoarthritis 3.86 times [5-7]. Old age, female gender, overweight and obesity, knee injury, repetitive usage joints, bone density, muscle weakness, and joint laxity this all plays roles in the development of joint Osteoarthritis Determination of risk factors [8,9]. Two factors of kneeling and squatting are considered the main primary risk factors in correlation with knee disorders. Frequent squatting predispose people to development of knee Osteoarthritis.

The symptoms of knee Osteoarthritis include pain, joint stiffness and reduced quadriceps strength, causing physical disability [10-12].

Osteoarthritis is viewed as metabolically active, dynamic process, including both cartilage destruction.

Several muscle groups support the knee joint. The two main muscle groups which controls knee mobility and stability are the quadriceps and the hamstrings.

Early intervention is quite important for ameliorating the long-term effects of disease. Conservative non-surgical treatment is primarily aimed for symptom relief, improving joint mobility, and optimizing consumer quality of life. This includes the use of both non-pharmacological (NP) and pharmacological interventions. Knee replacement is usually advocated as the last option for Knee Osteoarthritis patients which is costly intervention for people with severe Osteoarthritis [13-20]. therefore, long-term effects of early to moderate Knee Osteoarthritis can managed through non-surgical interventions viz. prescribing various medicines which generally include a nutraceutical (glucosamine, diacerin), an mild analgesic (Paracetamol), NSAIDS, proton pump inhibitors (Pantoprazole), Vitamin D and calcium tablets etc. patients are also prescribed physical rehabilitation exercises and electrotherapy modalities [21].

For Knee Osteoarthritis patients, the common symptoms are pain, stiffness, and physical dysfunction, which also affect quality of life [22]. The Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) is an self- report questionnaire for Osteoarthritis of the hip or knee, with higher scores indicating more serious pain, poorer physical function, and increased joint stiffness.

It has been widely used as a tool clinically to assess patients with Knee Osteoarthritis. Since it was published in 1988, it has been translated and validated various languages [23,24]. The reliability, validity, and sensitivity to the change in the physical condition of Knee Osteoarthritis patients has been proven. Focusing on those important aspects of clinical outcomes, I have performed an updated systematic review and meta-analysis to critically evaluate the effectiveness for Knee Osteoarthritis [23,24].

Although several studies have shown that quadriceps strengthening exercises may increase joint pain in subjects with knee Osteoarthritis, whether weakness plays an etiologic role in this disease has been considered. However, the quadriceps muscle stabilizes the knee joint, and it is reasonable that a reduction in the ability of this muscle to respond rapidly to mechanical stresses and to changes in the position of the joint could reduce its efficiency as an shock absorber and its ability to protect the joint from stress [25].

Xie., *et al.* (2017) studied that quadriceps combined with hip abductor strengthening in treating knee osteoarthritis, a review concluded the improvement of symptoms and quality of life in knee Osteoarthritis patients [26].

Ahmed H Al-johani., *et al*. (2014) studied that comparative study of hamstring and quadriceps strengthening treatment in management of knee osteoarthritis review and data analysis concluded the strengthening of the hamstring in addition to strengthening of quadriceps was shown to be beneficial for improving subjective knee pain, range of motion and decreasing the limitation of functional performance of patients with knee Osteoarthritis [27].

The aim of this study is to evaluate the effect of quadriceps and hip abductor muscles strengthening versus effects of quadriceps and hamstring muscles strengthening in treating knee Osteoarthritis.

Need of study

It is commonly seen that therapists use to teach and instruct the quadriceps exercises to treat the osteoarthritis of knee joint but studies state that decrease strength in quadriceps as well as hamstrings.. The exercise programs for Osteoarthritis knee have been focused on Quadriceps strengthening but role of Hip abductor and hamstring is less researched so there is a need to evaluate the effect of hamstring and Hip Abductor muscles along with the Quadriceps muscles.

Materials and Methods

Methodology

- **Study design:** Comparative study.
- **Study Setting:** Sir. Takhtahsinhji Govt. General Hospital Bhavnagar.
- **Sampling Technique**: Convenient sampling
- **Study Population:** Patients suffering from Knee Osteoarthritis.
- **Study Sample:** 70 subjects with knee Osteoarthritis.
- **Study Duration:** Training duration – 6 Week.

Inclusion criteria

- Male or female diagnosed with knee osteoarthritis.
- Age between 50 to 70 years in both gender.
- Patients with unilateral tibiofemoral joint osteoarthritis.

Exclusion criteria

Any Neurological and other musculoskeletal or joint diseases that may affects the lower limb function.

Materials

- Pencil
- Pen
- Paper
- Plinth.

Method

The trial was registered in clinical trials registry (REF/2018/10/021855) and ethical clearance was taken from ethical committee, School of Physiotherapy, R K University.

Design

The current study is a controlled trial in which patients with knee Osteoarthritis was randomly divided into two groups. Group-A quadriceps plus abductor strengthening training and Group-B quadriceps plus hamstring strengthening training. For assigning groups, as the data collection starts the participants were divided in the groups according to the convenience of the therapist.

Study population

Seventy subjects selected as per inclusion criteria who were diagnosed with knee Osteoarthritis having Age between 50 to 70 years in both gender. Patients with unilateral tibiofemoral Osteoarthritis knee were included after obtaining informed consent to participate in the study and Patients were recruited from the Sit. Takhtahsihnji General Hospital, Bhavnagar city, (Gujarat, India). Knee Osteoarthritis will be confirmed through medical diagnosis.

Intervention

Knee Osteoarthritis participants in group-A was undergone the quadriceps plus abductor strengthening training composed of two exercise designed to strengthen the quadriceps muscles. The first

exercise is straight leg raise, patient's lies in supine position, keeping their legs straight with an resistance band placed just proximal to the ankle joint of the affected limb. Patients were asked to raise the affected leg to the heel 25-30 cm away from the bed, hold that position for 5-10 s based on their own abilities, and then slowly returned to starting position. The second exercise is multi-angle static exercise. Briefly, patients were seated on their seats with a resistance band positioned proximal to the ankle joint, and asked to contract their quadriceps isometrically for 5-10s when their knees are flexed at the angles of 0°, 30°, 60°, 90° and 120°, respectively. Two exercise were designed to strengthen the abductor muscles. One is lateral leg raise, in brief, the patients were lied down on bed on the unaffected side, with the resistance band positioned around the distal thigh of the affected limb. Later, they were asked to raise the above lower limbs upwards for about 30 degrees, holding it for 5-10 s, and slowly returned to starting position.

Knee Osteoarthritis participants in group-B were undergone the quadriceps plus hamstring strengthening training composed of two exercise designed to strengthen the quadriceps muscles. The first exercise is straight leg raise, patients were lied in supine position, and keep their legs straight with a resistance band placed just proximal to the ankle joint of the affected limb. Afterwards, they raise the affected leg to the heel 25-30 cm away from the bed, holding this position for 5-10 s based on their own abilities, and then slowly returned to starting position. The second exercise is multi-angle static exercise. Briefly, patients were seated on their seats with a resistance band positioned proximal to the ankle joint, and contract their quadriceps isometrically for 5– 10 s when their knees are flexed at the angles of 0°, 30°, 60°, 90° and 120°, respectively. Two exercise designed to strengthen the hamstring muscles. One is Hamstring sets, patients lie flat on your back with knee slightly bend and heel on the floor or mat. Press the back of your heel down and hold for 5-10 seconds and relax. The other exercise is prone knee bending, tie the theraband it forms a loop and hook it round the foot of your good leg. Lie on your stomach with your legs out straight and bring your heel toward your bottom against the theraband and hold for 5-10 seconds.

Patients were required to carry out each exercise for 10 repeats at as a set, for 3 sets each time and twice a day for 6 weeks altogether.

Outcomes

The primary outcome was the Wastern Ontario and McMaster universities osteoarthritis index (WOMAC). Wastern Ontario and McMaster universities osteoarthritis index is comprised of 24 items assessing pain (score 0-20), stiffness (score 0-8), and physical functional including (personal care, walking, sitting, lifting, sleeping, standing, social life and traveling) (score 0- 68). Every item is rated on a scale of 0-5 0 = none 1 = slight 2 = moderate, 3 = very, 4 = extremely. Total score is 96, with a higher score indicating a worse symptom.

Figure 3.1: Straight leg raise.

Figure 3.2: Multi-angle static exercise.

Figure 3.3: Lateral leg raise.

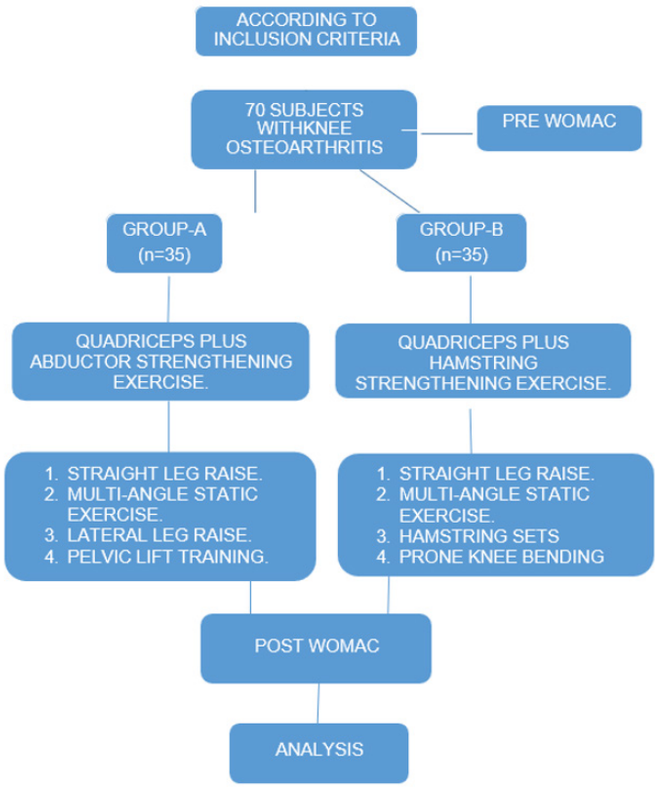
Figure 3.4: Pelvic lift training.

Figure 3.5: Hamstring sets.

Figure 3.6: Prone knee bending.

Results and Discussion

In the present study, 70 subjects with knee osteoarthritis participated in a physical therapy program involving strengthening exercises for quadriceps plus abductor muscles and quadriceps plus hamstring muscles, their ages ranged between 50 to 70 years. Statistical analyses were performed using SPSS software version 20.0. The collected data were statistically analyzed, and the mean and



SD were calculated. A Wilcoxon test was used for intragroup pre-treatment and post-treatment comparison of WOMAC and Mann Whitney U test was used for intergroup Post-treatment of WOMAC. In the first group, there were significant differences in pre and post intervention measures of WOMAC score (from 62.4286 ± 13.46517 to 47.1143 ± 13.58047) In the second group, there were significant differences in pre and post intervention measures of WOMAC score (from 67.6571 ± 10.46828 to 58.4286 ± 10.56433) [28-41].

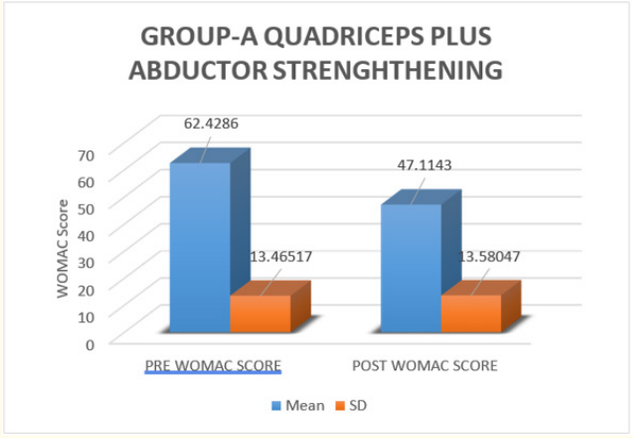
There were differences in the significance of differences between the first group and the second group in WOMAC measures. In the first group, there significant differences in the pre and post intervention measures of WOMAC score p value of 0.001. However, in the second group, the respective value p = 0.003.

Group-a	Pre Womacscore	Post Womacscore	P value
MEAN	62.4286	47.1143	
SD	13.46517	13.58047	.001

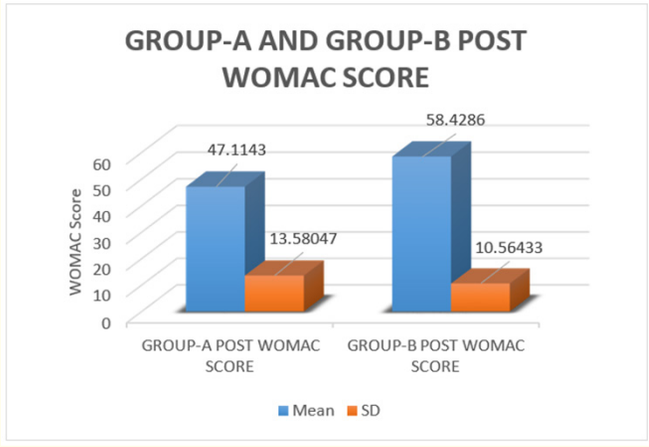
Table 1: Wilcoxon test was used for group-a pre-treatment and post-treatment comparison of Womac.

Conclusion

The analysis of the study suggests that the intervention program is individually effective in both the groups, but the strengthening of hip abductor muscles in comparison to hamstrings is more



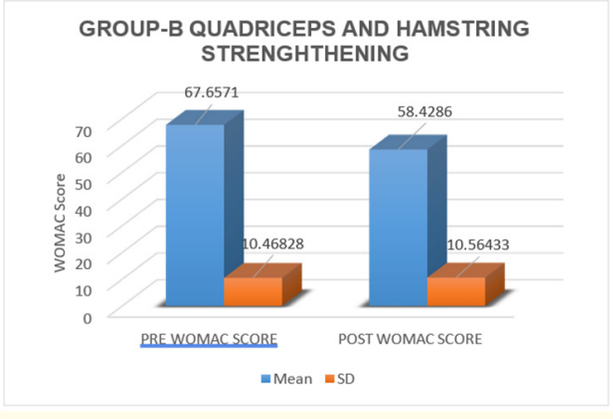
Graph 1: Wilcoxon test was used for group-a pre- treatment and post-treatment comparison of Womac.



Graph 3: Mann Whitney u test for group-a and group-b post-treatment of women.

Group-b	Pre Womac score	Post Womac score	P value
MEAN	67.6571	58.4286	.003
SD	10.46828	10,56433	

Table 2: Wilcoxon test was used for group-b pre-treatment and post-treatment comparison of Womac.



Graph 2: Wilcoxon test was used for group-b pre- treatment and post-treatment comparison of Womac.

Group	Group-apost Womac score	Group-bpost Womac score	P Value
Mean	47.1143	58,4286	.001
SD	13.58047	10.56433	

Table 3: Mann Whitney u test for group-a and group-bpost treatment of Womac.

effective for treating knee osteoarthritis. It is generally seen in many clinical set ups for treatment of OA knee that exercises are often prescribed only for strengthening of quadriceps but rarely for abductor so this study will help to design exercises to strengthen abductor also and help to improve function in better way.

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