

Efficacy of Close Kinetic Chain Exercises Versus Aquatic Exercises on Muscle Performance in Osteoarthritis of Knee

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Keywords

Osteoarthritis, Close kinetic chain exercises, Aquatic exercises, Manual muscle testing, WOMAC scale, muscle performance.

Abstract

Background:

Osteoarthritis (OA) is the most common degenerative disease of joint and some pathological changes seen in joints includes increasing loss and destruction of articular cartilage, thickening of the subchondral bone and formation of osteophytes. It is common degenerative joint disease mostly affecting 15% to 40% of people above age of 40 years. The aim of the study is to determine the efficacy of close kinetic chain exercises versus aquatic exercises on muscle performance with osteoarthritis of knee.

Objective: To determine the efficacy of close kinetic chain exercises versus aquatic exercises on muscle performance with osteoarthritis of knee.

Material and Methodology: The purpose and the study were explained to the participants, a consent form was filled by the participants. 60 patients with knee OA were divided into 2 groups. Subjects in Group A received close kinetic chain exercise (CKCE) and group B received aquatic exercises. The treatment period was of 3 weeks for both groups. Comparison of pre and post muscle performance was done in both groups.

Conclusion: Findings of the study have shown that both aquatic exercises and close kinetic chain exercises are effective on muscle performance in patient with osteoarthritis of knee. But among both aquatic exercises are proven to be more beneficial as compared to that of close kinetic chain exercises on muscle performance in patient with osteoarthritis of knee.

1. Introduction

Osteoarthritis (OA) is the most common degenerative disease of joint.¹ It primarily affecting the articular cartilage, increase in water content and depletion of proteoglycans from cartilage matrix. The hip joint is commonly affected in people with western living habits while knee joint

is commonly affected in people with Asian living habits i.e. the habit of sitting cross legged.¹

It is common degenerative joint disease mostly affecting 15% to 40% of people above the age of 40 years.² OA is the second most common rheumatologic problem and the most common joint

disease in INDIA, with prevalence ranging from 22% to 39%.^[34] Prevalence of OA increases with age, and women show higher prevalence estimate in the frequency more severe symptoms than men.⁵

The main symptom of OA is pain; however joint stiffness, instability and weakness are observed; all those symptoms are result in limitation of daily living and also difficulty in performing activities.⁶ Strengthening around the Muscles of knee joint is an important element, it improves cartilage quality, nerve activation and coordination between muscles.⁷ The development of OA is determined by age, genetic predisposition, previous trauma, Chronic injury across the joint and abnormal mechanical forces caused primary by obesity.^[8,9]

Isolated quadricep muscle weakness has been associated with radiographic knee OA in descriptive study has demonstrated that decreased lower extremity strength was clearly associated with increased disability in people with OA.¹⁰

In geriatric population OA can occur in all joints, but its commonly seen in weight bearing joints like hip, knee, spine, etc.¹¹ Knee OA is also known as gonarthrosis because it's growing slowly and generalized pathology, there is loss of function, pain, stiffness and instability.¹² OA is associated with decrease physical function and poor quality of life in the geriatric people.^{13,14}

Other predisposing factors of knee OA can be muscular imbalance, trauma, aging, obesity, hormonal imbalance, joint

surgery, bone density, hereditary and nutrition.¹⁵

Patient suffering from OA have reduced muscle strength and functional capacity and the functional consequences of knee OA are associated with lower extremity mobility limitation.¹⁶

Aquatic therapy is suggested to the patients with knee OA because water provides many benefits like pain reduction, reduction of oedema and decreases load on weight bearing joints.¹⁷ The hot water helps to reduced swelling around the knee joint and also improves circulation. Water exercises gives early mobilization and dynamic strengthening.¹⁸ Buoyancy of water reduces weight bearing stress on the joints, muscles and bones.¹⁹

In CKC exercises, lower extremity is typically performed with feet fixed on stable subject that produces compressive forces in the knee. The distal segment of body part remains stable on the ground for eg. Exercises include leg press exercises and squat.²⁰

Patient suffering from knee OA have shown improvement in close kinetic chain exercises and aquatic exercises.²¹

The main purpose of the study is to implement and evaluate the efficacy of CKC exercises versus aquatic exercise program designed specifically on muscle performance in individuals with osteoarthritis of knee.

2. Material and Methods

The participants were taken on the basis of inclusion and exclusion criteria. The participants were made aware about the study. The proper consent from the participants was taken. Each participant was taken into isolation to respect their privacy.

Pre -test assessment: manual muscle testing and WOMAC scale will be used to assess the patient. WOMAC scale was given to participants and asked to fill it. Wall slides, Step- up and step-down with weight, Mini squats – 30⁰ knee flexion, Standing on one foot for 10 seconds, Active stretching exercise for hamstring muscle for 15 seconds, Single toe raise, Wall push in the supine position – all CKC exercises are performed in group A. To perform these exercises for 3 weeks/days for 30 minutes.

- Double leg squats, Double leg calf raise, Single leg stance, Dynamic lunge, Single leg stance-contralateral knee flexion/extension, contralateral hip abduction/adduction, Step-ups, Step-downs – all aquatic exercises are performed in group B. To perform these exercises for 3 weeks/days for 30 minutes.

Post -test assessment: manual muscle testing and range of motion will be used to assess the patient. 60 subjects will be divided into 2 groups based on the conclusion and exclusion criteria using simple random sampling.

3. Result

Total 60 participants were analyzed during this study. Among these 17 of them are male and 43 were females. The number of subjects included in 46 to 55 age group are 28%, 56 to 65 age group are 49% and in 66 to 75 age group are 29%. Maximum number of participants were in the age of years 56 to 65. The statistical analysis of this study was done by using Instat software. Comparison of the post vs post values of MMT score for patients with osteoarthritis of knee, for knee flexors p value is very significant ($p=0.0027$) and for knee extensors p value is considered significant (0.0309). The post and post values of WOMAC score for patient with osteoarthritis of knee, for comparison of both group A and B is very significant ($p=0.0020$).

1. Comparison of MMT scores pre and post within the group.

Table no. 1

MMT(knee)	Pre test	Post test	Mean diff	p – value
Knee flexors				
Group A	3.067± 0.6397	3.467± 0.5074	-0.4000	0.0117
Group B	3.133± 0.5713	3.933± 0.697	-0.8000	<0.0001

Knee Extensors				
Group A	3.200± 0.6644	3.633± 0.6644	-0.4333	0.0015
Group B	3.633± 0.4901	4.000± 0.5252	-0.3667	0.0055

Table no.2:

Comparison of pre and post Womac scale within group

WOMAC scale	Pre	Post	Mean diff	P- value
Group A	56.767± 9.616	47.133± 7.917	20.500	< 0.0001
Group B	61.267± 7.728	40.767± 7.610	9.633	< 0.0001

Table no.3

Comparison of post and post MMT scores

MMT (Post)	Group A	Group B	P-value
Knee flexors	3.467± 0.5044	3.933± 0.6397	0.0027
Knee extensors	3.633± 0.4901	4.000± 0.5252	0.0309

Table no.4

Comparison of post and post Womac scale values

WOMAC scale	Post (Group A)	Post (Group B)	P- value
Group A vs Group B	47.133± 7.917	40.767± 7.610	0.0020

Discussion:The result of this study demonstrated that the exercise program structured for patients with osteoarthritis of knee have been effective in improving

muscle performance. In subjects with knee OA, pain is usually increased by load and relieved by rest.

Age is primary risk factor for the developing OA. OA is common disorder in people over 60 years of age and can significantly affect the quality of life. The prevalence of OA rises dramatically with age.

40% woman are more likely to develop knee OA than men. Women are more susceptible to OA may be related to hormone levels. Increased hormone levels during certain stages of the menstrual cycle may increase joint laxity which is associated with joint instability and injury. In women risk of developing OA increases significantly after menopause.³⁰ Extra weight puts more stress on load-bearing joints and this can lead to damaging friction between the bones of joints.²²

Both intervention groups demonstrated a improves in the values of the MMT at the end of session. The total WOMAC scores improved significantly in both study group as well. This functional results agree with several studies that also observed a significant improvement in muscle performance, assessed by the WOMAC Questionnaires and manual muscle testing.

Prior studies have shown that, both the gym based and water-based resistance exercise program successfully improved physical function. The close kinetic chain exercises group reported significant improvement in muscle function; in contrast, the aquatic exercises group reported that extremely significant improvement in performance of muscle function. Patients with OA typically have low cardiovascular fitness therefore it is expected that aquatic therapy program

possibly produced increase in aerobic capacity, explaining the significant increase in physical function.

A systemic review of randomized trials of therapeutic exercise can significantly reduce pain, improve physical function and quality of life. Reduction of pain and the consequent improvement in function following quadriceps strengthening exercise have been linked to increased stability of the knee joint which is enhanced by improvement in the quadriceps muscle strength. Moreover, quadriceps weakness may precede and serve as a risk factor for incidental radiographic changes of knee OA.

In a study 60 adults over the age of 46 years who are reported chronic knee pain. Total 60 subjects were taken into 2 groups, group A (CKCE) and group B (aquatic exercises). From this study we can state that there is significant difference between CKC and aquatic group for improving functional ability in patients with osteoarthritis of knee. This findings follow the line of thinking of Franssen et al., who reported that kinesiotherapeutic exercises in individuals with knee OA reduce pain and improve muscle function.²³ However, Wyatt et al. reported in their studies that aquatic exercises demonstrate a superior response to muscle performance when compared to ground exercises.²⁴

Due to the lack of studies in the literature comparing the effectiveness of program of exercises performed in water and close kinetic chain exercises for patients with knee osteoarthritis. We study the benefits of muscle performance on CKC and

aquatic exercises for this population. In subjects with OA, pain is usually increased by load and relieved by rest.

Future research can be carried out with increase number of sample size and also increased time duration for treatment protocol.

4. Conclusion

Our study compared two popular community-based exercise programs. Physiotherapist are encouraged by the findings from this study to use both treatment protocol for improve muscle function. Findings of the study have shown that both aquatic exercises and close kinetic chain exercises are effective on muscle performance in patient with osteoarthritis of knee. But among both aquatic exercises are proven to be more beneficial as compared to that of close kinetic chain exercises on muscle performance in patient with osteoarthritis of knee.

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