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Effectiveness of the quadriceps strengthening exercise on pain and functional ability of the women with Osteoarthritis (OA)

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Abstract

A Quasi experimental design was adopted for this study to find out the effectiveness of quadriceps strengthening exercise program on pain and functional ability of women with knee osteoarthritis (OA). Fifty women with OA were selected in which first 25 women were enrolled in the control group and second 25 women were allotted in the exercise group. Assessments were performed at baseline and at 8 weeks. The functional ability was assessed using the Timed Up and Go (TUG) test and Numerical Rating Scale (NRS) was used to assess the pain level .For the exercise group, quadriceps strengthening exercises were taught and asked the patients to follow the exercise schedule for 8 weeks. The study results show that the pain and functional abilty scores were improved in the exercise group and the difference was statistically significant ($p<0.001$). The study concluded that a simple quadriceps strengthening exercise programme can significantly improve self reported knee pain and functional ability among women with Knee osteoarthritis.

Keywords: Osteoarthritis, Pain, Functional Ability, Exercise, Quadriceps strengthening, Timed Up and Go (TUG) test, Numerical Rating Scale (NRS).

Introduction

Chronic illnesses of the musculoskeletal system are the most common health hazard in the world's population. Osteoarthritis (OA) is a prevalent joint condition and one of the most common rheumatologic health problems. Osteoarthritis (OA) is a joint-related chronic illness that affects one-third of individuals and has a propensity to worsen with age[1]. Knee OA is linked to discomfort, instability, a loss in range of motion (ROM) and as a result, a decline in quality of life and function. The risk of morbidity and mortality increases as a result of this functional restriction. [2,3]

Knee joint discomfort is a chronic condition characterized by gradual articular cartilage loss and a decrease in synovial fluid, which lubricates the joints. It advances slowly, with discomfort and limited range of motion being the most common signs and symptoms.[3] Because of the aging population and the obesity pandemic, the number of persons affected by knee osteoarthritis (OA), a degenerative joint condition, is expected to continue to rise (Heidari, 2011; Lespasio et al., 2017). Also, because of the growing economic burden associated with OA, early diagnosis and adequate treatment are critical (Samut et al., 2015).

Although the pathogenesis of OA is yet unknown, multifactorial factors such as genetics, age, obesity, smoking, joint damage, and metabolic dysfunction have been linked to knee OA (Sandell, 2012; Lespasio et al., 2017). Obesity and smoking are two modifiable risk factors that might be targeted for treatment (Lespasio et al., 2017).

The muscles surrounding the knee joint have been reported to atrophy in persons with knee OA. Quadriceps muscle weakness, regardless of the existence of knee discomfort or muscular atrophy, is common in patients with knee OA (Eyigor et al., 2004). This is because the quadriceps muscle is involved in functional activities such as getting out of a chair, climbing stairs, and walking on a level surface (Maly et al., 2006; Liikavainio et al., 2008; Alnahdi et al., 2012). Exercise that strengthens muscles around the knee joint has been shown to have positive effects in people with knee OA, including a considerable reduction in knee discomfort and an improvement in knee function (Anwer and Alghadir, 2014).

According to the experts, patients with knee OA have lower quadriceps muscular strength than the control group. Because the quadriceps muscle serves as a shock absorber, its weakening reduces joint protection, resulting in increased stress and overload on the knee.[4] In patients with OA of the knee, quadriceps strengthening exercises undertaken over eight weeks were just as efficient in improving function as non-hormonal anti-inflammatory medicines.[5] Furthermore, moderate-intensity exercises have been shown to be an effective treatment not just for symptom relief but also for increasing glycosaminoglycan content. [6] Glycosaminoglycan play a crucial role in the cell signalling process, including regulation of cell growth, proliferation, promotion of cell adhesion, anticoagulation, and wound repair[6].

In addition to the physical benefits, the exercises improved the emotional health of people with knee OA. As a result, because reduced mobility is one of the key reasons contributing to functional limitations and a decline in quality of life in patients with knee OA, it is critical to undertake intervention research using an appropriate methodology, targeting the improvement of the functionality and quality of life of these patients.[4] Hence, the objective of this study is to assess the effectiveness of the quadriceps strengthening exercise on pain and functional ability of the women with Osteoarthritis(OA).

Methodology

Design: With the quantitative research approach, the quasi experimental design was adopted to find out the effectiveness of the quadriceps strengthening exercise on pain and functional ability of the women with Osteoarthritis (OA).

Sample: The target population of the study were all the female clients with OA. The accessible population was the female clients with OA who attended the ortho clinics of the selected hospital. Inclusion criteria include females between the ages of 50 and 70 were eligible if they had a diagnosis of knee OA and had experienced fewer than 30 minutes of morning stiffness and crepitation in active movement in the previous 12 months and willing to participate in the study. Patients with fibromyalgia, an unstable cardiac condition, more than twice-weekly physical activity, inability to pedal a stationary bicycle, or previous knee arthroplasty were excluded.

Fifty women with knee OA were selected in which first 25 women were enrolled in the control group and second 25 women were allotted in the exercise group.

Tools/instruments: Assessments were performed at baseline and after 8 weeks. There were three components in the tool: Part 1: Demographic data about the female clients; Part 2: The functional ability assessment was conducted using the Timed Up and Go (TUG) test and Part 3: Numerical Rating Scale (NRS) was used to assess the pain level. The questionnaire was pretested during the pilot study. Content validity of the tool was obtained from the experts from Nursing and Orthopaedics. The internal consistency of the tool was assessed after the pilot study with Cronbach Alpha test. The reliability (‘r’) value of the tool was 0.82.

Intervention: For the exercise group, the following exercises were taught and instructed the women to follow the exercise for 8 weeks. The patients in the exercise group participated in group sessions that lasted 30 to 40 minutes which was held twice a week. They employed a 10-minute stationary bike warm-up, ischiotibial stretching exercises, and three sets of 15 repetitions of knee extension exercises to strengthen the quadriceps muscle. The time between series ranged between 30 and 45 seconds. The weight utilized in the workout was gradually increased as tolerance was reached. The patient was seated in a chair with 90 degrees of knee and hip flexion for the exercise. During the intervention phase, the patients' medications were standardized and kept the same. If they experience any pain while exercising, paracetamol tablet was suggested as an analgesic.

Exercises were taught by one of the investigators and the patients were monitored for tolerance as well as any adverse effects. Once the patients were confident and good in following the regime, they were encouraged to follow it at home on a daily basis in addition to the in-person sessions of twice a week. Daily phone calls were made to ensure the compliance of the exercise regime. The control group received no special treatment and was not visited in between assessments.

Procedures of data collection: TUG is a low-cost, easy-to-use test that evaluates a patient's functional mobility in daily activities[7]. The following movements are included in this test: getting out of the chair, walking three meters, turning around, and sitting back down in the chair. Before and after treatment, the time it takes the patient to complete the movement sequence is recorded. The best time recorded from three attempts was used for analysis[7].

Ethical consideration: Official Permission from the Medical Director was obtained as well as ethical permission was obtained from the Institutional ethical committee. A written consent from the participants were collected before the study by explaining the purpose of the study, the role of the participants, confidentiality of the information and their right to withdraw from the study at any point of time of the study. The written consent from both the exercise and control group was obtained by explaining the study protocol. The control group were given two group sessions of the exercise at the end of the data collection for ethical reasons. An orthopedician approved the exercise plan for ethical considerations of no harm to the study participants.

Statistical analysis:

The socio demographic data, functional ability and pain of the participants were analyzed using frequencies, percentage distribution and mean and standard deviation. Inferential statistics was used to find the relationship between functional ability and pain with selected socio-demographic characteristics using Chi-square test. The paired t-test was used for the assessment between the pre and post-intervention.

Results and Discussion

The analysis revealed that the mean age of the study participants were 53.24 ±8.16 and 54.13±8.87 for study and control group respectively. The weight of the patients was 71.0 ± 16.7 and 72.21± 17.20 for study and control group respectively. Regarding the TUG and NRS score, both the groups had more or less similar scores (Table -1). All subjects were advised on the importance of losing weight or not becoming overweight as general advice. The other demographic variables include 60% of them had primary education, 17% of them were unmarried, 80% of them were non-vegetarian, 63% had normal BMI, and 70% of them were having illness for 5-10 years, 77% of the senior citizens were having systolic blood pressure between 120-129 mm Hg and 83% of them were having diastolic blood pressure between 80-89 mm Hg.

Table 1: Baseline data of the patients

Variables	Study Group		Control Group	
	Mean	SD	Mean	SD
Age	53.24	8.16	54.13	8.87
Weight	71.0	16.7	72.21	17.20
Pain (NRC)	6.57	2.73	6.91	2.82
TUG Function Score	10.08	2.45	9.85	3.71

Table 2: Comparison of difference among groups on Pain and functional ability in pre and post test

Variable	Groups	Pre	Post	Mean difference	p-value
Pain (NRS)	Control	6.91±2.82	5.74 ± 3.14	-0.91	0.07
	Exercise	6.57 ±2.73	4.27 ± 2.45	-2.17	<.001*
TUG	Control	9.85 ±3.71	9.22 ± 3.31	-0.61	0.08
	Exercise	10.08±2.45	7.42 ± 1.70	-2.48	<.001*

Table 2 shows the difference among groups on pain and functional ability in pre and post test scores. The pain and functional ability scores were improved in the exercise group and the difference was statistically significant (p<0.001). The exercise group had the posttest mean score of pain (NRS) was 4.27 with the SD of 2.45 compared to 5.74 with the SD of 3.14 of control group. The reduction in the pain score was significant in the exercise at p=0.001 level. Similarly, the functional ability of the exercise group according to TUG score was improved as compared to control group with the significance of p=0.001 level.

Table 3: Comparison of difference between the mean score of groups on Pain and Functional Ability

Variables	Difference between the means of both groups	Effect size CI (95 %)	p-value
Pain (NRS)	1.47	0.69	0.001*
TUG	1.80	0.83	0.001*

Table 3 shows the mean difference between the exercise and control group in pain and functional ability. There is a significant difference in both the variables among the groups which was significant at p=0.001.A similar finding was reported in a study on the effect of a home based exercise programme, designed to improve quadriceps strength, on knee pain and disability which concluded that a simple programme of home quadriceps exercises can significantly improve self reported knee pain and function[8]. Another study by Jan, M. H. et al.(2019)[9], concluded that when compared to the control group, simple knee flexion and extension exercises (weight bearing and non-weight bearing) done over eight weeks resulted in substantial improvements on the WOMAC function scale and knee strength. It's possible that non-weight bearing training alone will be enough to increase function and muscle strength[10, 11]. This results infer that the home based exercise program improve the pain and functional score of the patients with OA of the knees.

Hence, it is important to educate the patient with OA to perform regular physical exercise, especially, quadriceps strengthening exercise to reduce pain, improve functional ability as well as their quality of life. The health care practitioners, especially the nurses should take every opportunity to teach about the importance of exercises to the women and should provide continuous motivation to the women with OA so that, it can enhance their quality of life.

Conclusion

Aging is a natural physiological process in which people's functional ability deteriorates as a result of osteoarthritis. Non-pharmacological therapies are low-cost, non-invasive, safe, and simple to use. The quadriceps strengthening exercise is proved to be one of the effective non-pharmacological interventions in reducing pain and enhancing functional ability to perform their day to day activities. The study findings conclude that quadriceps strengthening exercise was very effective in gaining the physical strength and improvement in women with OA.

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Declaration of Conflicting Interests

The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

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References

1. Felson DT. Developments in the clinical understanding of osteoarthritis. Arthritis Res Ther. 2009; 11(1):203.
2. Maurer BT, Stern AG, Kinossian B, Cook KD, Schumacher HR Jr. Osteoarthritis of the knee: isokinetic quadriceps exercise versus an educational intervention. Arch Phys Med Rehabil. 1999; 80(10):1293-9.
3. Fidelix TS, Soares BG, Trevisani VF. Diacerein for osteoarthritis. Cochrane Database Syst Rev. 2006; (1):CD005117.
4. Hurley MV. The role of muscle weakness in the pathogenesis of osteoarthritis. Rheum Dis Clin North Am. 1999; 25(2):283-98.
5. Doi T, Akai M, Fujino K, Iwaya T, Kurosawa H, Hayashi K et al. Effect of home exercise of quadriceps on knee osteoarthritis compared with nonsteroidal antiinflammatory drugs: a randomized controlled trial. Am J Phys Med Rehabil. 2008; 87(4):258-69.
6. Roos EM, Dahlberg L. Positive effects of moderate exercise on glycosaminoglycan content in knee cartilage: a four-month, randomized, controlled trial in patients at

risk of osteoarthritis. Arthritis Rheum. 2005; 52(11):3507-14.
7. Podsiadlo D, Richardson S. The timed "Up & Go": a test of basic functional mobility for frail elderly persons. J Am Geriatr Soc. 1991; 39(2):142-8.
8. Lin DH, Lin YF, Chai HM, Han YC, Jan MH. Comparison of proprioceptive functions between computerized proprioception facilitation exercise and closed kinetic chain exercise in participants with knee osteoarthritis. Clin Rheumatol 2007; 26:520-8.
9. Jan, M.-H., Lin, C.-H., Lin, Y.-F., Lin, J.-J., & Lin, D.-H. (2019). Effects of Weight-Bearing Versus Nonweight-Bearing Exercise on Function, Walking Speed, and Position Sense in Participants With Knee Osteoarthritis: A Randomized Controlled Trial. Archives of Physical Medicine and Rehabilitation, 90(6), 897–904. doi:10.1016/j.apmr.2008.11.018
10. Topp, R, Woolley, S, Hornyak, J, Khuder S, Kahaleh B., (2020). The effect of dynamic versus isometric resistance training on pain and functioning among adults with osteoarthritis of the knee. Arch Phys Med Rehabil; 83:1187–119
11. O'Reilly SC, Muir KR, Doherty M., Effectiveness of home exercise on pain and disability from osteoarthritis of the knee: a randomised controlled trial Annals of the Rheumatic Diseases 1999; 58:15-19.

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