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Comparison of Lower Limb Strength in Middle Age Subjects with and Without Osteoarthritis Knee

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ABSTRACT

Background: Aging leads to degeneration of joints (osteoarthritis) and decrease in strength of muscles which may affect daily activities. The aim of this study was to compare the functional strength of lower limb in participants with and without osteoarthritis (OA) and to find the relation between strength and intensity of pain.
Methodology: An observational analytical study was conducted on males and females aged 40 to 65 years using convenience sampling. One group included participants with OA knee diagnosed by orthopaedic surgeon and the other group had age and gender matched participants without any complaints of OA knee. People with other severe medical conditions were excluded. Strength of lower limb was assessed using 5 times sit to stand test (5STS) and pain in knee was assessed using NPRS among participants with OA. Data was analysed using SPSS V20. Level of significance was kept at 5%.
Result: 101 participants participated. Mann Whitney test was used to analyse difference in 5STS between individuals with and without OA which showed statistically significant differences (U=85.5, p=0.0001). Spearman's correlation r=0.44, p=0.001) was found between pain and lower limb strength in individuals with OA knee.
Conclusion: Participants with osteoarthritis knee have decreased lower limb strength compared to participants without OA of the knee. There was moderate correlation between functional strength and intensity of pain in people with OA.

Keywords: Osteoarthritis knee, lower limb strength, 5STS

INTRODUCTION

Osteoarthritis is a common arthritis disease among the elderly. Osteoarthritis is a painful, chronic joint disorder that primarily affects not only the knees but also the hands, hips, and spine. The intensity of the symptoms varies for each individual and usually progresses slowly. It comes in two types: primary and secondary. The cartilage gets abraded by the grinding mechanism at work at the points of contact between the opposing articular surfaces, until eventually the underlying bone is exposed. With further rubbing, the subchondral bone becomes hard and glossy (eburnated). Meanwhile, the bone at the margins of the joint hypertrophies to form a rim of projecting spurs known as osteophytes.[1]

Patients with knee osteoarthritis (KOA), one of the main causes of disability, account for 40% of the elderly with osteoarthritis over 65 years old. KOA, commonly known as degenerative joint disease, is frequently brought on by wear-and-tear and articular cartilage loss that occurs over time. The formation of subchondral sclerosis, loose flakes of cartilage incite synovial inflammation and thickening of the capsule,

lead to deformity and stiffness of the joint. Often, one compartment of a joint is affected more than the other. In the knee joint, the medial compartment is affected more than the lateral, leading to a varus deformity (genu varum).[2]

Common clinical symptoms include knee pain that is gradual in onset and worsens with activity, Knee stiffness and swelling, Pain after prolonged sitting or resting, Crepitus, or a cracking sound with joint movement, muscle weakness (e.g., hamstrings, quadriceps, calf muscles, etc.), pain are the principal symptoms in knee OA, and the reduction in muscle strength was found to be related to the pain intensity. Knee pain significantly reduced knee extension and flexion muscle strength, indicating generalised muscle inhibition augmented by higher pain intensities.[3] The quadriceps weakness commonly associated with osteoarthritis of the knee is widely believed to result from disuse atrophy secondary to pain in the involved joint. However, quadriceps weakness may be an etiologic factor in the development of osteoarthritis.[4]

The aim of this study was to compare the functional strength of lower limb using the 5 times sit to stand test in participants with and without osteoarthritis (OA) and to find the relation between strength and intensity of pain in OA participants.

MATERIALS & METHODS

An observational analytical study was conducted among middle-aged people using convenience sampling. Males and females aged 40 to 65 years were explained about the study, and written informed consent to participate was taken. Participants diagnosed with osteoarthritis of the knee at the orthopaedic OPD were included in the study in group A. After screening for the inclusion and exclusion criteria, a detailed assessment was done. They were included in group A, and age- and gender-matched individuals without any complaints of OA knees were included in group B. People with severe medical conditions related to the musculoskeletal system or other systems were excluded.

The strength of the lower limb was assessed using the 5-times sit-to-stand test (5STS). The 5STS rating is determined by how quickly a person can move five times from a seated to a standing position and back to a sitting position. In 5STS, a chair with a straight back that is of regular height (43–45 cm, 17–18 inches high) was used. Participants were told to cross their arms over their chests and perform five sit-to-stands as quickly as they can, starting at the count of go, without putting their back or leg on the chair in between each repeat. The shorter the time to complete the test, the better the outcome of the test.[5]

Pain in the knee was assessed using NPRS among participants with OA. The Numerical Rating Scale (NPRS-11) is an 11-point scale for self-reported pain. It is the most used unidimensional pain scale. The participants select a whole number (integers 0–10) that best reflects the intensity: 0 = no pain, and 10 = extreme pain or the worst possible pain.[6]

Data was analysed using SPSS V20. Level of significance was kept at 5%.

RESULT

101 participants completed the study (51 with OA and 50 without OA). Table 1 shows the mean values for 5STS in both groups. Group A had people with osteoarthritis of the knee, and group B had people without osteoarthritis of the knee. Time taken in 5STS for group A was (22.13±6.1s) and for group B was (13.25±1.9s). Mean NPRS scores in group A was (4.11±1.46). Spearman's correlation ($r = 0.44$, $p = 0.001$) was found between pain and lower limb strength in individuals with OA knees.

Table 1: Mean values for 5STS in both groups.

GROUP	MEAN±SD	U VALUE	P VALUE
A	22.13±6.1	85.5	0.0001
B	13.25±1.9		

DISCUSSION

The present study showed significant differences in muscle strength using 5STS test, between individuals with and without OA. A moderate correlation was found between pain and lower limb strength in individuals with OA knees. Not many studies have been done on a similar population.

Knee extensor strength was found reduced in this study. Similarly, a study by Xini Zhang et al., on elderly women with knee osteoarthritis found that knee muscle strength decreased significantly, especially the extensor strength. They also added that the quadriceps muscle and the rear-thigh muscles, maintain the stability of knee joints during rehabilitation training.[7]

Andrew Hislop et al. also found that hip and knee strength (especially in the sagittal and frontal planes) and dynamic balance are lower bilaterally in people with KOA compared to controls. They also added that knee extension strength, hip strength, and dynamic balance are lower bilaterally in people with unilateral KOA. Difference in unilateral versus bilateral KOA was not analysed in the present study. Anthony et al. found that subjects with knee OA have significant muscle impairments. These muscle impairments affect physical function, and greater vastus medialis intramuscular fat was associated with lower quadriceps muscle strength in patients with knee OA.[8] Neil A. Segal et al. found that lower limb strength differed by sex. In men, no strength measure differed between groups, whereas in women, hip abductor strength on the more affected side differed between groups.[9] Gender differences were not analyzed in this study.

Other limitations of this study were that effect of obesity and range of motion of knee in patients with OA was not seen. Further studies can be designed on interventions to improve strength of knee in participants with OA can be carried out to see the effect on daily activities and function.

CONCLUSION

Participants with osteoarthritis knee have decreased lower limb strength compared to participants without OA of the knee. There was moderate correlation between functional strength and intensity of pain in people with OA.

Declaration by Authors

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