International Journal of Health Sciences and Research
www.ijhsr.org ISSN: 2249-9571

Original Research Article

Comparative Study of Movement Control Tests between Subjects of Knee Osteoarthritis and Healthy Controls

Dr. Purti Haral[1], Niyati Doshi[2]

[1]Associate Professor, School of Physiotherapy, D.Y. Patil University, Nerul, Navi Mumbai.
[2]Intern, School of Physiotherapy, D.Y. Patil University, Nerul, Navi Mumbai.

Corresponding Author: Niyati Doshi

ABSTRACT

Objectives: 1) To assess the Movement control (MC) tests amongst healthy controls and knee Osteoarthritis and study their comparison in Mumbai and Navi Mumbai population.
Method: 30 subjects of OA knees [Mean age 59(S.D.=7.91)years] and 30 subjects of healthy control [Mean age 59(S.D.=9.5) years]were assessed for both the knees on their performance of the 6 MC tests and WOMAC scale. The subjects were rated on a 3-point scale as either correct, incorrect, or failed. Level of significance was calculated for the comparison of two groups by using paired and unpaired t-test.
Results: We found that even normal healthy controls performed the tests incorrectly, although the difference for both the groups was not significant (0.2225).
Conclusion: We conclude that OA subjects and normal healthy controls both performed the movement control tests incorrectly in spite of differences in the joint pathology and pain levels.

Key words: Movement control tests, Knee osteoarthritis, Healthy controls, Indian population

INTRODUCTION

Osteoarthritis (OA) is a degenerative and progressive joint disease which mainly involves weight-bearing joints such as hip, knee and ankle. It is one of the chief causes of lower limb disabilities among the elderly population. [1] Degenerative OA affects 30-40% of the worldly population by the age of 65 years. [2] It leads to major loss of function and limitations in daily activities as well as considered as socio-economic burden on the societies and families due to disabilities. [3-6] The Western Ontario and MacMaster Universities Osteoarthritis Index (WOMAC) is used to evaluate knee pain and disability in the OA group. [7] It is an activity-based questionnaire which includes 24 questions (five related to pain, two stiffness, and 17 physical function disability).

Although it is one of the most common diseases, its pathogenesis is not fully understood. Mechanical adaptations on loading of the joint are thought to be leading cause in development and progression of OA. [8] Biomechanical factors, such as reduced muscle strength and joint mal-alignment, have an important role in the initiation and progression of knee OA. There is a research reporting kinematic gait adaptations in people with knee OA which lead to reduced walking speeds, reduced knee flexion during weight acceptance and reduced range of motion at the knee joint. [9-11] People with knee OA experience loss of proprioception. Pain associated with the

osteoarthritic knee may play a role in balance impairments. There might be reflexive inhibition of muscles around the knee due to pain, [12] which could compromise effective and timely motor responses in postural control. It is observed that people with knee OA have altered muscle activation patterns as well as increased activity and co-contraction of thigh muscles during the stance phase of gait. Parameters related to motor control have however received little attention in people with OA.

Normal or ideal movement is difficult to define there is no one correct way to move. It is normal to be able to perform any functional task in a variety of different ways, with a variety of different recruitment strategies. Optimal movement ensures that functional tasks and postural control activities are able to be performed in an efficient way and in a way that minimizes and controls the physiological stresses. Movement dysfunction is representative of multifaceted problems in the movement system. Being a therapist, we need to relate the uncontrolled movements and faults in the movement system to the symptoms and disabilities. Uncontrolled movements lead to abnormal stress or strain over the tissues and the joint system leading to pain and pathology in healthy individuals. Hence, uncontrolled movements need to be identified and corrected to impart a good quality of life in healthy population. [13]

There have been studies done on movement control tests although they have been done with the purpose of knowing the reliabilities of the test. Hence, the aim of this study is to compare and study the difference between the tests in subjects with knee OA and healthy controls.

MATERIALS AND METHODS

Study Subjects:

1) Inclusion criteria: Subjects in the age group of 40-70 years in the following 2 categories: A) Healthy knee, B) Diagnosed knee osteoarthritis.

2) Exclusion criteria:

A)Subjects for OA knees with any kind of low back pain which was radiating down in leg/s or who had undergone any knee surgeries or total knee replacement/s.

B) Subjects with any kind of Neurological deficits.

Sample size: Total=60 individuals [30 healthy controls and 30 subjects of knee OA].

Study material: WOMAC scale

Ethical clearance: Ethical clearance was granted by the institutional ethics committee of School of Physiotherapy, D.Y. Patil medical college, Nerul, Navi Mumbai.

Procedure: The subjects were recruited from Mumbai and Navi Mumbai. They were explained about the study and their consent was taken for participation. Subjects selected were explained the protocol and then they were explained each test before performing and three trails for each test were given. While performing the test subjects were requested to expose their knees so the therapist could accurately rate the subjects. A subject was rated on the basis of 4th attempt to perform the same test as either correct, incorrect or fails to perform for both the knees. It was assumed that right knee will be the index knee for healthy controls and in subjects with bilateral OA the more symptomatic knee will be considered to be their index knee. The other knee for both the categories was their contralateral knee. Test 2 (squat to 90˚ knee flexion) was rated only on the index knee.

Six movement control tests were chosen for this study. The test chosen were: a) Small squat to 30˚ of knee flexion, b) Squat to 90˚ of knee flexion, c) One leg stance, d) Small squat on one leg stance, e) Stepup, and f) Step down. Following instructions were given and subject was rated accordingly for each tests. [14]

Statistical Analysis:

GraphPad InStat (Version 3.10) was used to calculate the following data.

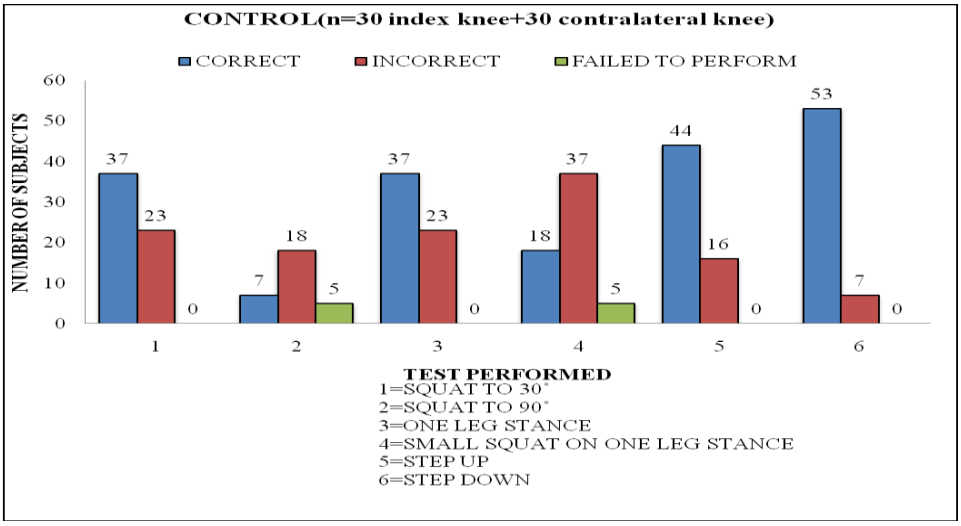
Table 1: Demographic data

Characteristic	Healthy controls(n=30) Mean(S.D.)	OA knees(n=30) Mean(S.D.)
Age(in years)	59(9.5)	59(7.91)
Height (in meters)	1.53(0.07)	1.55(0.08)
Weight (in kilograms)	61(13.5)	67(11.1)
BMI(kg/m^2)	24.5(5)	26.9(3.3)
WOMAC Score (out of 96)	NA	38(10.8)

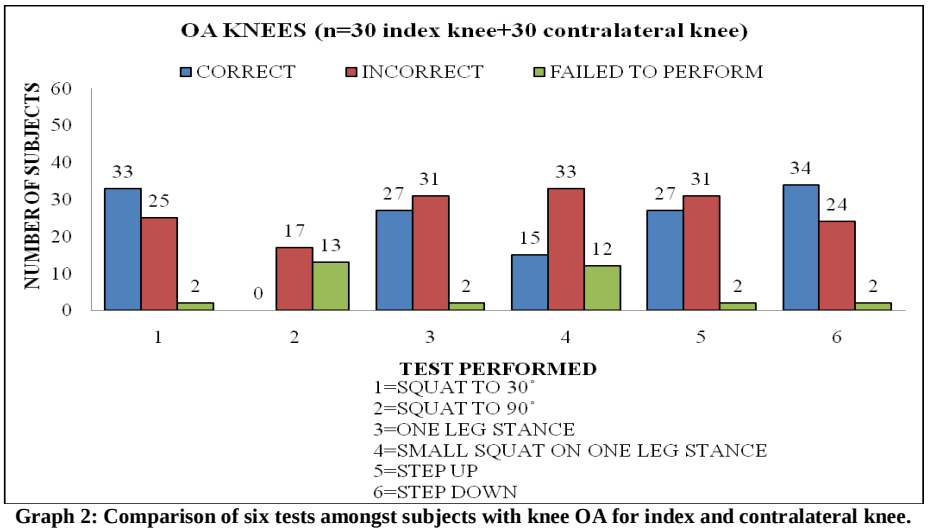
Table 2: Mean ± S.D. and p-value for all the tests performed by both the groups

	Normal Mean(SD)	OA Mean(SD)	Normal v/s OA P-value
Correct	32.67(17.04)	22.67(13)	0.2799
Incorrect	20.67(9.93)	26.83(6.01)	0.2225
Fails	1.67(2.58)	5.5(5.43)	0.1495

The collected data was tabulated in the Microsoft excel and selective Graphs were made using the same.



Graph 1: Comparison of six tests amongst healthy controls for index and contralateral knees.



Graph 2: Comparison of six tests amongst subjects with knee OA for index and contralateral knee.

RESULT

It was found that most of the OA knee subjects performed the tests incorrectly when compared to normal healthy controls.

We found that even normal healthy controls performed the tests incorrectly, although the difference for both the groups was not significant.

The p-values for comparison of healthy controls and OA knee subjects for all the tests in each category of correct (0.2799),

incorrect (0.2225) and fails to perform (0.1495) were found to be insignificant.

DISCUSSION

Our study was about the evaluation of six movement control tests performed by the subjects with OA knees and healthy controls to know the difference in their ability to perform the same tests. We got to know from table 1 that people in the OA group had a higher BMI compared to healthy controls. Obesity is one of the factors that leads to increased loading of the weight-bearing joint, which may be the most important mechanical contribution. [15] We assessed the OA knee subjects for their pain, stiffness and functional disability using the WOMAC index in which the subjects were found to be on an average (38±10.8) of mild to moderate severity on that scale. It was observed that our study population was more representative of females (23) over males (7) in each group out of 30 subjects each. The subjects from both the groups showed similar kind of representation in age and height.

Knee joint and the musculature around it is found to be comparatively weaker in OA knee subjects than healthy controls. Table 2 tells us that OA knee subjects were found to be incorrectly (26.83±6.01) performing the tests compared to healthy controls (20.67±9.93). Though, the p-value (0.2225) was found to be insignificant for the same. There was a large difference observed in the performance of both the groups mainly for the following three tests one leg stance, step up & step down. These three tests had major number of OA knee subjects performing them incorrectly when compared with healthy controls.

One leg stance requires good balance and proprioception from the joints as well coordinated activity of the postural muscles which help to keep the body in an erect and aligned position. With our changing lifestyle our postures have been degrading day-by-day and due to that the postural muscles are shortening in length and getting weaker leading to reduced dynamic balance. We observed that people with OA had increased postural sway when standing on one leg. This could be due to increased activation of the quadriceps, hamstrings & gluteus Medius while standing on one leg. [16]

The most affected functions in subjects with OA knees is ascending and descending of the stairs. WOMAC index taken for OA subjects showed us that functional ability to climb up the stairs was rated on the higher scale by the subjects. As we know while climbing up the stairs, whole weight of the body is borne by the leg which is placed first while climbing. It has been noted that there is reduced knee flexion in stance phase and reduced knee flexion during weight acceptance is thought to reduce the amount of energy normally absorbed by knee flexion, thereby increasing the forces over the joint. [17] This leads to excessive load being placed over the knee joint which due to degeneration is weak and leads to friction between the two bones due to reduced joint space in the knee and degenerated articular cartilage while climbing.

There have been numerate studies done on affection of balance and gait adaptations in people with OA knees. Although the p-value (0.2225) obtained for the comparison done between normal and OA subjects performing all the tests incorrectly is insignificant. Thus, concluding that both the groups perform the tests incorrectly and need to be taught movement control.

We observed that in the parameters which define the test incorrect most of the subjects that were classified as incorrect were due to hiking of pelvis and/or varus/valgus at the knee. This mal-alignment at the knee joint could be attributed to knee adduction moment (KAM) which is thought to signify loading of the medial compartment. This parameter has also been co-related to higher OA severity. [18]

The other 3 tests which were performed incorrectly by the subjects had a major observation of lumbar flexion as they had squatting i.e. knee flexion in the test. Subjects did knee flexion but with the compensatory movement of bending their lumbar spine to achieve the desired knee flexion. This can be due to weak postural muscles as all our joints are interconnected. For a movement to be done correctly the joints and the musculature above and below that particular joint need to be healthy and functioning well. This compensatory movement could be due to concentric shortening of global muscles like rectus abdominis and hamstrings. [19] Some subjects could perform the test correctly but were marked as incorrect as they could not hold the test position for the required time. This could be due to lack of postural control in muscles as they couldn't isometrically hold the position during the test. [19]

It was seen that many subjects in the normal category were also not able to perform the tests correctly. We saw that these subjects had their test classified as incorrect on the index knee (13±6.26) compared to their contralateral knee (7.66±5.66). Right knee was taken as the index knee for the healthy controls, it has been reported in previous studies that leg dominance is an important factor as they got significantly higher HAMs on the right side compared to left. [16] Although when both the knees were compared the p-value (0.1019) was found to be considerably insignificant. Most of the subjects were put under incorrect due to mal alignment of pelvis during the test. This means that these subjects did not have a strong core as well as good balance due to weakened or tightness in musculature or myofascial/ articular restrictions which lead to limitation in movements.

Many subjects failed to perform the tests. The failure performance was higher in OA (5.5±5.43) compared to normal subjects (1.67±2.58) with a p-value (0.1495) which was found to be insignificant.

Normal kinetic control is defined as body's ability to perform a simple movement with ease and proper alignment of all the joints and the soft tissues around it. Both the categories performed the test correctly with normal subjects (32.67± 17.04) being higher compared to OA (22.67±13) with a p-value (0.2799) being insignificant. People performing the tests correctly could be due to a good posture which helps to have a good core in result giving us smooth, coordinated and controlled movements. These subjects were found to be doing the tests flawlessly and without any extra efforts as there was smooth transition of concentric and eccentric movements of the muscles. They were even having a controlled motion while doing the test. [19]

CONCLUSION

It can be concluded that not only the OA subjects performed the movement control tests incorrectly but even normal healthy controls could not perform the tests appropriately even after they being completely free of pathologies and pains. This could be due to one of the factor's that is pathology of a joint which cause uncontrolled movements. It was found that mal alignments at the pelvis lead to incorrect results at the knee joint. Therefore, joints proximal and distal to the test joint should be taken into consideration. Thus, from our study we conclude that normal healthy individuals should be screened for such tests for the whole body and should be imparted correct education regarding the control over their movements.

REFERENCES

1. Petrella M, Neves TM, Reis JG, Gomes MM, et al.Postural control parameters in elderly female fallers and non-fallers diagnosed or not with knee osteoarthritis. *Revista Brasileira de Reumatologia* (RBR - Brazilian Journal of Rheumatology.2012 Aug;52(4):512-7.
2. Van Saase JLCM, Van Romunde LKJ, Cats A,et al. Epidemiology of osteoarthritis: Zoetermeer survey. Comparison of

radiological osteoarthritis in a Dutch population with that in 10 other populations. Annals of the Rheumatic Diseases.1989; 48:271–80.
3. Sharma L, Cahue S, Song J, et al. Physical functioning over three years in knee osteoarthritis: role of psychosocial, local mechanical, and neuromuscular factors. Journal of Arthritis & Rheumatology. 2003;48: 3359–3370.
4. Kiss RM. Effect of severity of knee osteoarthritis on the variability of gait parameters. Journal of Electromyography and Kinesiology.2011; 21: 695–703.
5. Hinman R, Bennell K, Metcalf B, et al. Balance impairments in individuals with symptomatic knee osteoarthritis: a comparison with matched controls using clinical tests. Rheumatology.2002; 41: 1388–1394.
6. Knoop J, Steultjens MPM, Van der Leeden M, et al. Proprioception in knee osteoarthritis: a narrative review. Osteoarthritis and Cartilage.2011;19: 381–388.
7. Hill KD, Williams SB, Chen J, et al.Balance and falls risk in women with lower limb osteoarthritis or rheumatoid arthritis. Journal of Clinical Gerontology and Geriatrics.2013; 4: 22–28.
8. Andriacchi T.P., Koo S., Scanlan S.F. Gait mechanics influence healthy cartilage morphology and osteoarthritis of the knee. Journal of Bone and Joint Surgery American volume. 2009;91(Suppl. 1):95–101.
9. Mills K., Hunt M.A., Ferber R. Biomechanical deviations during level walking associated with knee osteoarthritis: a systematic review and meta-analysis. Arthritis Care Research (Hoboken). 2013; 65(10):1643–1665.
10. Lewek M.D., Rudolph K.S., Snyder-Mackler L. Control of frontal plane knee laxity during gait in patients with medial compartment knee osteoarthritis. Osteoarthritis Cartilage. 2004;12:745–751.
11. Mundermann A., Dyrby C.O., Andriacchi T.P. Secondary gait changes in patients with medial compartment knee osteoarthritis: increased load at the ankle, knee, and hip during walking. Arthritis and Rheumatism. 2005;52:2835–2844.
12. Hurwitz DE, Ryals AR, Block JA, et al. Knee pain and joint loading in subjects with osteoarthritis of the knee. Journal of OrthopedicResearch.2000;18:572–9.
13. Mark Comeford and Sarah Mottaram, Kinetic control: The management of uncontrolled movement(1st),New delhi, 2013,section1:uncontrolled movements:3-4.
14. P.T. Kaukinen, J.P. Arokoski, E.O. Huber, et al.Intertester and intratester reliability of a movement control test battery for patients with knee osteoarthritis and controls. Journal of Musculoskeletal & Neuronal Interaction. 2017; 17(3):199-202.
15. Brouwer GM, van Tol AW, Bergink AP, et al. Association between valgus and varus alignment and the development and progression of radiographic osteoarthritis of the knee. Arthritis &Rheumatism. 2007; 56:1204–11
16. Lynsey D.Duffell, Dominic F.L.Southgate, Vivek Gulati, et al. Balance and gait adaptations in patients with early knee osteoarthritis. Gait Posture. 2014 Apr; 39(4): 1057–1061
17. Lewek M.D., Rudolph K.S., Snyder-Mackler L. Quadriceps femoris muscle weakness and activation failure in patients with symptomatic knee osteoarthritis. Journal of Orthopedic Research. 2004; 22:110–115.
18. Lewek M.D., Rudolph K.S., Snyder-Mackler L. Control of frontal plane knee laxity during gait in patients with medial compartment knee osteoarthritis. Osteoarthritis Cartilage. 2004;12:745–751.
19. Mark Comeford and Sarah Mottaram, Kineticcontrol: The management of uncontrolled movement (1st), New Delhi, 2013 Section 1:Muscle function and physiology: 23-25.

How to cite this article: Haral P, Doshi N. Comparative study of movement control tests between subjects of knee osteoarthritis and healthy controls. Int J Health Sci Res. 2019; 9(9):33-38.

******