Original Study

Indian Journal of Physiotherapy and Occupational Therapy
Volume 16 No. 3, July-September 2022

Comparsion of the Effect on Balance Training with Foam Balance Activity and Tilt Board Exercise to Improve Fall Risk among Physically Active Chronic Knee Osteoarthritis Patients in Selected Places of Bengaluru

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How to cite this article: Pavana, Dilpreet Kaur, Pruthviraj. R. Comparsion of the Effect on Balance Training with Foam Balance Activity and Tilt Board Exercise to Improve Fall Risk Among Physically Active Chronic Knee Osteoarthritis Patients in Selected Places of Bengaluru. Indian Journal of Physiotherapy and Occupational Therapy 2022;16(3):67-72.

Abstract

Background and purpose: Knee osteoarthritis is one of the most prevalent musculoskeletal complaints worldwide. Individuals with knee OA display impairments in knee joint proprioception. Reduced balance function is associated with an increased risk of falling. The aim of this study was to measure the balance between foam and tilt board training among physically active chronic osteoarthritis patients and to compare the effectiveness of balance training using proprioceptive tools like foam and tilt table among physically active chronic osteoarthritis patients.

Methods: This study included subjects between the ages of 40-70 years with chronic knee osteoarthritis and a body mass index of 30 and above. Subjects were recruited based on inclusion and exclusion criteria. It was a comparative study with 40 subjects divided into two groups of 20 each. Demographic data and other variables were collected and recorded and measures like VAS, WOMAC, Functional reach test and Berg balance scale were used.

Results: The foam balance activity group as well as the wobble board exercise group showed effective improvements clinically after the intervention. Comparison between groups did not show statistically significant improvement is any one over the other but clinically significant improvements were seen more in the wobble board exercise group.

Conclusion: The study concludes that the wobble board exercise group subjects showed clinically better improvements in balance and functional abilities when compared to the foam balance activity group subjects. Comparison between both groups did not show statistically significant improvement.

Keywords: Knee osteoarthritis; Balance; Foam balance; Wobble board.

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Introduction

Knee osteoarthritis (OA) is one of the most prevalent musculoskeletal complaints worldwide, affecting 30–40% of the population by the age of 65 years.[1] It is a major cause of impairment and disability among the elderly [2,3] and poses a significant economic burden on the community.[4] Individuals with knee OA suffer progressive loss of function, displaying increasing dependency in walking, stair climbing and other lower extremity tasks.[3] Balance is an integral component of these and many other activities of daily living.Balance is a complex function involving numerous neuromuscular processes.[5,6,7] Control of balance is dependent upon sensory input from the vestibular, visual and somatosensory systems. Central processing of this information results in coordinated neuromuscular responses that ensure the centre of mass remains within the base of support in situations when balance is disturbed. Effective control of balance thus relies not only on accurate sensory input but also on a timely response of strong muscles. Balance impairments are associated with an increased risk of falls and poorer mobility measures in the elderly population.[8,9,10]

Age-related impairments in balance and postural stability are well documented.[11.12.13] Ageing is associated with a decline in the integrity of the physiological systems that contribute to the control of balance.[6,14,15]

Control of balance is essential in all postures and situations, both static and dynamic. Postural sway is often used as an indicator of static standing balance [16-18] where bodily movement in both the antero-posterior (AP) and lateral direction is analysed, usually using force platforms. These expensive apparatuses are not readily available to the majority of clinicians, and are thus not appropriate for use in the clinical setting. Furthermore, falls and loss of balance most commonly occur during movement-related tasks such as walking [19, 20] and less frequently during static activities. It is therefore important that the evaluation of balance incorporates testing procedures that reflect the dynamic nature of such locomotor tasks, as static tests of balance are less able to identify individuals at risk of falls than dynamic tests [10, 21.]

Perturbation-based balance training is an intervention involving repeated postural perturbations aiming to improve control of rapid balance reactions. Perturbation/balance exercises have been shown to be well tolerated by Osteoarthritis (OA) knee clients and were also associated with improved pain, function, and balance. Also has been shown in studies on knee OA populations that the additive positive effects of kinesthesia and balance exercises increase their functional capacities. The exercise program for the training group comprised balance training standing on a wobble board for 9 weeks, twice a week. In all, 11 training group subjects and 11 control group subjects completed this study. After 9 weeks, standing time on a wobble board, standing time on a balance mat, and maximum displacement distance of anterior-posterior centre of pressure in the training group were significantly greater than those of the control group. These results suggest that wobble board training is effective for elderly people to improve their standing balance, by which they frequently control their centre of gravity and maintain a standing posture on unstable surface conditions.[22]

This study focuses on training for balance using proprioceptive tools such as foam balance and tilt board to improve the strategy for balance and minimizing fall risk in elderly population with chronic osteoarthritis. The present study aims to compare balance between foam and tilt board in chronic osteoarthritis patients to minimize the fall risk.

Methodology

Source of Data: The study will be conducted by recruiting physically active subjects of knee osteoarthritis.

Method of Collection of Data:

The data for the study will be collected based on the following categories:

- **Study setting:** RV College of Physiotherapy OPD and Community set up in Bengaluru.
- **Study subjects:** Chronic Knee osteoarthritis patients.

- **Study design:** Comparative study
- **Sampling technique:** Simple Random sampling
- **Study recruitment:** Community setup and OPD set up of RV College of Physiotherapy
- **Sample size calculation:** n=40, 20 subjects each arm.

Inclusion Criteria

- Subjects willing to participate and sign the written informed consent
- AGE: 40-70years
- Unilateral/Bilateral physically active OA patients of Chronic duration.
- Both Genders –Male and Female
- BMI of 30 or more than 30

Exclusion Criteria:

- Subjects with other diseases affecting quality of life (example: cancer, moderate to severe chronic renal insufficiency, chronic respiratory diseases, cardiovascular diseases including uncontrolled hypertension, diabetes) and the presence of severe cognitive, visual or hearing impairments
- Subjects who are terminally ill for which exercises would be contraindicated.
- Subjects use ambulatory device for walking
- Subjects with history of knee surgeries
- Subjects with history of intra-articular steroid injection (previous 6 months)
- Deformities of spine, hip and knee
- Recent soft tissue injury around knee joint
- Any neurological disorder

Materials Required

- Stationeries
- Consent form printouts
- Questionnaires print outs
    1. Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC)
    2. Berg balance scale (BBS)
    3. Functional reach test
- Weighing scale
- Stature meter
- Wobble Board
- Memory Foam Surface (48cm*40cm) – Rectangular in shape

Outcome Measuring Tools

1. Berg balance scale (BBS)
2. Functional Reach Test (FRT)

Procedure

For this study an informed written consent from the selected subjects was obtained after explaining the purpose of the study. The researcher recruited the subjects based on inclusion and exclusion criteria. Demographic data of the subjects was collected and recorded which included the name of the subject, age of subject and anthropometric measurement of height and weight to calculate body mass index. Initial evaluation for their pain profile using visual analogue scale (VAS) was recorded followed by Pre - test Western Ontario and McMaster Universities Arthritis Index (WOMAC) scores. This was taken by asking questions to the subjects about their pain, stiffness and functional independence. Pre and post-test balance scores were recorded using Berg balance scale (BBS) and Functional reach test.

Group A: Foam Balance Activity

Total subjects: 20

Exercises

1. Double-Leg Foam Balance Activity: Subject stands on a soft foam surface with both feet on the ground. Therapist attempts to perturb patient balance in random fashion.[23]
2. Single leg stance standing on dominant leg with non-dominant leg off the ground. [24]
3. The exercise to be repeated thrice for 30 seconds.
4. Medial lateral tilt with standing on both feet in the centre of the foam surface repeated 6 times.[26]
5. Balance with two legs, eyes open then eyes closed. [25]
6. Balance with both legs – Foam surface is placed near a wall. Then ask the patient to stand on it and just try to maintain the balance. [26]

7. Anterior posterior tilting – slowly tilt back and forth by hinging at the ankles and try to avoid bending at the waist. [26]
8. Tilt forward and backward with feet facing either corner of the foam surface. [26]

Frequency and Duration: 4 times a week for 4 weeks.[26]

Group B: Wobble Board Exercise

Total subjects: 20

Exercises : All the exercises were given as same as group A

Frequency and Duration: 4 times a week for 4 weeks. [26]

Result Analysis

The data collected for this study was entered in MS Excel, MS Word (2019).

The data collected for this study was analysed statistically in the following two ways: The data collected for this study was analysed statistically in 2 ways- descriptive and inferential statistics.Parametric student t test and non-parametric Mann-Whitney test was used within the groups based on verification normality assumption.

Table 1: Gender Distribution

Gender	Foam balance activity (Group A)	Wobble board exercise (Group B)
Male	2	4
Female	18	16
Total	20	20

Table 2: Mean and Standard deviation of Age, Body mass index and duration of work for both groups

	Foam balance activity		Wobble Board Exercise	
	Mean	SD	Mean	SD
Age (years)	59.15	10.74	50.45	8.60
BMI	31.63	1.75	32.05	1.44
Duration of Work (hours per day)	6.55	1.50	7.25	1.45

Table 3 and 4: Functional reach test and Berg balance scale scoring for both the groups

Foam Balance Activity	Pre-test		Post-test		t - value	P-value
	Mean	SD	Mean	SD		
Functional Reach Test (FRT in cm)	20.9	4.7	27.8	6.2	10.955	P < 0.001
Berg Balance Scale - BBS (Out of 56)	42.1	3.5	48.3	4.4	7.289	P < 0.001

Wobble Board Exercise	Pre-test		Post-test		t-value	P-value
	Mean	SD	Mean	SD		
Functional Reach Test (FRT in cm)	22.2	2.6	34.4	3.2	17.290	P < 0.001
Berg Balance Scale - BBS (Out of 56)	44.3	3.4	54.0	2.3	26.171	P < 0.001

Table 3 and 4: In the foam balance activity group, the functional reach test and berg balance scale score improvements did not show any statistical significance but functional reach test improved post-test. Both groups showed equally effective improvements pre-test to post-test and clinically, subjects showed great improvement with respect to ADL activities. Comparison between both groups did not show statistically significant improvement but the exercise regime intervention showed clinically significant improvement in both groups

Discussion

The present study was conducted to measure the balance between foam and tilt board training among physically active chronic knee osteoarthritis patients and to compare the effectiveness of balance training using proprioceptive tools like foam and tilt table among chronic knee osteoarthritis patients. The study groups included subjects between the ages of 40 and 70 years and with a body mass index of 30 and above. The variables of pain, function and

balance were assessed using the Visual analogue scale, WOMAC scores, Functional reach test and Berg balance scale. A total of 40 subjects had participated in this study after signing the informed consent form. They were assessed for the variables along with the demographic data collection and the findings were recorded.

A study was conducted which assessed the effects of wobble board balance training on physical function in institutionalized elderly people. The results suggested that wobble board training is effective for elderly people to improve their standing balance, by which they frequently control their centre of gravity and maintain a standing posture on unstable surface conditions.[26]

In this study the mean age for the foam balance activity group is 59.15, whereas for the wobble board activity group is 50.45, that is almost a nine years difference. This difference implies that the subjects of the foam board activity group being older might have more wear and tear of joints and greater balance impairments when compared to the subjects of the wobble board exercise group. This could have been a factor for better balance improvements in wobble board group clinically.

The mean body mass index of the foam balance activity group is 31.63 whereas of the wobble board exercise group is 32.05. Despite the fact that wobble board group subjects are more obese compared to foam balance group subjects, wobble board group subjects showed better clinical results and improvement in balance.

In this study, the mean hours of work per day for the foam balance group is 6.55 and of the wobble board group is 7.25. This shows greater hours of work among the wobble board group subjects. Even though this group was more physically stressed, they showed greater improvements in balance

The mean VAS score of the foam balance group subjects is 3.90 and that of wobble board group subjects is 3.50. The mean WOMAC score of the foam balance group is 34.75 and of the wobble board group is 32.85. This implies that the level of pain and functional impairments is higher in the foam balance activity group compared to wobble board exercise group and this could be a reason for better balance improvements seen clinically in the wobble board exercise group.

Limitations

- Secondary OA populations have been included, whereas, primary arthritic populations could have been included in the study
- Duration of study was limited to 4 weeks. Long term rehab could have been included to improve results.
- The study has considered a body mass index of 30 and above. It could have included 40 and above to include highly obese category to see better functional recovery among this population.
- The age distribution of subjects between both the groups could have been equally considered.

Conclusion

The objectives of the study were to measure the balance between foam and tilt board training among physically active chronic knee osteoarthritis patients and to compare the effectiveness of balance training using proprioceptive tools like foam and tilt table among chronic knee osteoarthritis patients.

The study concludes that the wobble board exercise group subjects showed clinically better improvements in balance and functional abilities when compared to the foam balance activity group subjects. Comparison between both groups did not show statistically significant improvement.

Conflict of Interest: There was no personal or institutional conflict of interest for this study

Source of Funding: Self.

Ethical Clearance: Ethical clearance taken from R.V. College of Physiotherapy, Bengaluru

References

1. Van Saase JLCM, Van Romunde LKJ, Cats A, Vandenbroucke JP, Valkenburg HA. Epidemiology of osteoarthritis: Zoetermeer survey. Comparison of radiological osteoarthritis in a Dutch population with that in 10 other populations. Ann Rheum Dis1989;48:271–80.
2. Davis MA, Ettinger WH, Neuhaus JM, Mallon KP. Knee osteoarthritis and physical functioning: Evidence from the NHANES I epidemiologic follow-up study. J Rheumatol 1991;18:591–8.
3. Guccione AA, Felson DT, Anderson JJ et al. The effects of specific medical conditions on the functional limitations of elders in the Framingham Study. Am J Public Health1994;84:351–8.
4. Rothfuss J, Mau W, Zeidler H, Brenner MH. Socioeconomic evaluation of rheumatoid arthritis and osteoarthritis: A literature review. Semin Arthritis Rheum1997;26:771–9.
5. Horak FB, Shupert CL, Mirka A. Components of postural dyscontrol in the elderly: A review. Neurobiol Aging 1989;10:72 7–38.
6. Stelmach GE, Teasdale N, Di Fabio RP, Phillips J. Age related decline in postural control mechanisms. Int J Aging Human Dev 1989;29:205–23.
7. Jones G. Posture. In: Kandel E, Schwartz J, Jessell T, eds. Principles of neural science. New York: McGraw-Hill, 2000:816–31.
8. Imms FJ, Edholm OG. Studies of gait and mobility in the elderly. Age Ageing 1981;10:147–56.
9. Lichenstein MJ, Shields SL, Shiairi RG, Burger MC. Clinical determinants of biomechanics platform measures of balance in aged women. J Am Geriatr Soc 1988;36:996–1002.
10. Shumway-Cook A, Brauer S, Woollacott M. Predicting the probability for falls in community-dwelling older adults using the timed up & go test. Phys Ther 2000;80:896–903.
11. Whipple R, Wolfson L, Derby C, Singh D, Tobin J. Altered sensory function and balance in older persons. J Gerontol 1993;48:71–6.
12. Hurley MV, Rees J, Newham DJ. Quadriceps function, proprioceptive acuity and functional performance in healthy young, middle-aged and elderly subjects. Age Ageing 1998;27:55–62.
13. Koceja DM, Allway D, Earles DR. Age differences in postural sway during volitional head movement. Arch Phys Med Rehabil 1999;80:1537–41.
14. Woolacott M, Shumway-Cook A, Nashner LM. Aging and posture control: Changes in sensory organization and muscular coordination. Int J Aging Human Dev 1986;23:97–114.
15. Teasdale N, Stelmach GE, Breunig A. Postural sway characteristics of the elderly under normal and altered visual and support surface conditions. J Gerontol 1991;46:B238–44.
16. Era P, Heikkinen E. Postural sway during standing and unexpected disturbance of balance in random samples of men of different ages. J Gerontol 1985;40:287–95.
17. Ekdahl C, Andersson SI. Standing balance in rheumatoid arthritis. A comparative study with healthy subjects.ScandJRheumatol1989;18:33–42.
18. Kollegger H, Baumgartner C, Wober C, Oder W, Deecke L. Spontaneous body sway as a function of sex, age, and vision: Posturographic study in 30 healthy adults. Eur Neurol1992;32:253–9.
19. Campbell AJ, Borrie MJ, Spears GF, Jackson SL, Brown JS, Fitzgerald JL. Circumstances and consequences of falls experienced by a community population 70 years and over during a prospective study. Age Ageing1990;19:136–41.
20. Niino N, Tsuzuku S, Ando F, Shimokata H. Frequencies and circumstances of falls in the national institute for longevity sciences, longitudinal study of aging (NILS-LSA). J Epidemiol 2000;10:S90–4.
21. Briggs RC, Gossman MR, Birch R, Drews JE, Shaddeau SA. Balance performance among noninstitutionalized elderly women. Phys Ther 1989;69:748–56.
22. https://www.ncbi.nlm.nih.gov/m/pubmed/21869636/
23. Hirase T, Inokuchi S, Matsusaka N, Okita M. Effects of a balance training program using a foam rubber pad in community-based older adults: a randomized controlled trial. J Geriatr Phys Ther. 2015 Apr-Jun;38(2):62-70.
24. Shhalini Grover1 Karishma Khanduja2. Effect of Training with Stability Trainer vs Wobble Board Training on Proprioception, Balance and Function in Patients with Knee Osteoarthritis. IJSRD | Vol. 5, Issue 07, 2017.
25. Amal F.Ahmed. Effect of sensorimotor training on balance in elderly patients with knee osteoarthritis. Journal of Advanced Research Volume 2, Issue 4, October 2011, Pages 305-311
26. Ghosh PK, Ray D, Chatterjee B, Acharya S, Adhikary S, De A. Comparative study of the effectiveness between balancing exercises and strengthening exercises with common use of TENS to improve functional ability in Osteoarthritis involving knee joint. IAIM, 2015; 2(10): 117.