Effects of Wobble Board Balance Exercises Versus Aerobic Balance Exercises Using Pain Shield Software on Unilateral Knee Osteoarthritis

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Abstract. Osteoarthritis is the inability of the joint to heal from pressures brought on by abnormalities in the periarticular tissue or joints. Osteoarthritis is a disease of the entire joint, despite the fact that cartilage loss is fundamental. Research indicates that the prevalence of osteoarthritis in men aged 60 to 64 is higher in the right knee (23%) compared to the left knee (16.3%). For many years, individuals with OA have been treated with aerobic exercise as part of a rehabilitation program to reduce pain and enhance functional status. A total of 50 participants age group ranges from 45-60 year old, subjects capable of waking without any aid, both genders with grade 2 and 3 using Kallegren Lawrence classification system were included. Subjects with recent trauma, neurological condition, intra-articular injection, surgical history to the affected lower limb were excluded from the study. The study has conducted with 50 participants and all the participants have completed the study. There was significant difference between experimental and control group outcome taken were pain shield, berg balance and sit to stand Post test values were 3.27, 11.04 and 4.92 of experimental group and post test values were 4.47, 9.76 and 4.80 of control group. The result has shown improvement in experimental group with significant difference in mean values and p value is less than 0.0001. The study has concluded that the intervention of wobble board balance exercise versus aerobic balance exercise with progressive resistance training has bettered on pain, strength, balance and functional capability on unilateral knee osteoarthritis subjects with p value 0.0001 has shown significant difference in statistics.

Keywords: Osteoarthritis knee, Wobble Board Exercise, Aerobic balance exercise

1 Introduction

Osteoarthritis is the inability of the joint to heal from pressures brought on by abnormalities in the periarticular tissue or joints. Osteoarthritis is a disease of the entire joint, despite the fact that cartilage loss is fundamental. Individual differences exist in the pace of advancement within a knee over time [1]. All of the structures in a joint are impacted by osteoarthritis. Along with the loss of hyaline articular cartilage, there is also bone remodeling, which results in periarticular muscle weakening and capsular stretching. Certain patients develop lesions in the bone marrow that may be indicative of bone damage, laxity of the ligaments, and synovitis [2]. Articular degeneration in

© The Author(s) 2025
S. Kannadhasan et al. (eds.), Proceedings of the International Conference on Sustainability Innovation in Computing and Engineering (ICSICE 24), Advances in Computer Science Research 120,
https://doi.org/10.2991/978-94-6463-718-2_44

primary osteoarthritis has no discernible underlying cause. Either aberrant articular cartilage, as in rheumatoid arthritis (RA), or an aberrant concentration of force across the joint, as in post-traumatic reasons, can result in secondary osteoarthritis [3].

Osteoarthritis of the knee was the most prevalent kind, affecting 6% of individuals. As one ages, the risk of acquiring osteoarthritis rises. Research indicates that the prevalence of osteoarthritis in men aged 60 to 64 is higher in the right knee (23%) compared to the left knee (16.3%). Conversely, women appear to have a more uniformly distributed case of osteoarthritis (right knee, 24.2%; left knee, 24.7%). Osteoarthritis of the knee is more common among people 70 to 74 years old, with a 40% increase in cases[4].Due to bone remodeling and cartilage loss, OA4-induced changes in joint cartilage have certain effects. One of those effects is joint instability, which when paired with other characteristics of osteoarthritis (OA) results in a decrease in joint proprioception and range of motion, as well as a feeling of insecurity or inability to execute joint movements. These factors collectively impede the semi-static and dynamic balance [5].

Chondrocytes are the cells found in articular cartilage that produce and break down the extracellular matrix (ECM), an avascular tissue made up of type II collagen, big, aggregating proteoglycans, smaller hydrophilic macromolecules, and non-collagenous proteins. The loss and aberrant remodeling of the extracellular matrix in the cartilage are the main pathogenic events in osteoarthritis. The articular cartilage is exclusively composed of chondrocytes, which are responsible for cartilage remodeling, tissue homeostasis, and damage response[6].

When balance is disrupted, the central processing of this information leads to synchronized neuromuscular responses that guarantee the center of mass stays within the base of support. For balance regulation to be effective, powerful muscles must contract quickly in addition to receiving precise sensory information Changes that hasten the degeneration of these systems or exacerbate the consequences of aging could arise from the existence of knee OA. Patients with osteoarthritis (OA) have decreased quadriceps activation and strength in addition to abnormalities in knee joint proprioception. When these deficiencies are combined with the aging process, this patient population may experience more severe balance impairments than their age-matched, healthy peers [7]. Many OA patients experience what they consider to be joint instability that impairs their physical activity. Understanding how individuals try to minimize instability by controlling laxity is essential for designing treatment plans that will enhance the quality of life for patients with medial knee OA [8]. One or more of the following factors may be responsible for improvements in wobble board performance: improved feed-forward and feed-backward postural control mechanisms, increased brain activity in the supplementary motor region, improved inter-segmental coordination and/or strengthened muscles systematic reviews explore the efficacy of wobble board training for enhancing balance performance in older adults[9]. The Pain shield Treatment Automator. The treatment actuator is cable-connected to the driver and has an integrated ultrasonic transducer. The active component that transforms electric signals into ultrasonic waves is called a transducer. To provide a successful therapy, the transducer needs to make complete contact with the skin. Adhesive pain shield patches the actuator is fastened to the impacted area by the adhesive patches [10].This study discusses the application of low-frequency ultrasound therapy, similar to Pain Shield, in managing chronic lower limb pain and provides case examples [11].

This review discusses the biophysical effects of therapeutic ultrasound, including its application in treating lower limb conditions such as tendinitis, muscle strains, and joint pain [12]. For many years, individuals with OA have been treated with aerobic exercise as part of a rehabilitation program to reduce pain and enhance functional status [13]. Technology related to electronic health (eHealth) is viewed as a promising means of overcoming these constraints. Many chronic illnesses can be prevented, rehabilitated, or treated with the help of eHealth-supported home-based interventions that offer patient education, self-management instructions, incentive, monitoring, feedback, and communication facilitation [14].

Outcome measures used is NPRS to assess pain, berg balance scale to assess balance in individuals and sit to stand to assess lower limb strength. The aim of the study is to find out the wobble board balance exercises and aerobic balance exercises on Unilateral Osteoarthritis knee subjects to improve balance, strength and physical function.

2 Methods and Procedure

A total of 50 participants age group ranges from 45-60 year old, subjects capable of waking without any aid, both genders with grade 2 and 3 using Kallegren Lawrence classification system were included. Subjects with recent trauma, neurological condition, intra-articular injection, surgical history to the affected lower limb were excluded from the study. The sample size was collected from OPD of saveetha college of physiotherapy. The study was started after receiving approval from ISRB. Then the therapy clearly explained about the need and necessary of this study after that the information consist form was collected from all individuals include in this study. The subjects was separated into 2 group by using the SPSS software. Each group has 25 subjects and each group has 7 males and 6 females age ranges from 45-55 years old, 6 males and females age ranges from 56 -60 years old. Both group received a progressive resisted exercises was performed for 15 min and group A received wobble board balance exercises and group B received was peformed for 30 min. The study duration was 4 weeks, 4 session per week, 45 min per session was conducted.

Common intervention Progressive resistance training was given to both groups. It included calf raise, hamstring curl, hip abduction, adduction and flexion are performed with the help of dumbbell or sand bag or thera-band for adding a resistance to those exercises. This exercises was performed for 10 repetition for 15 minutes.

The group A received wobble board balance exercises. The therapist ask the subjects to place their feet parallel on the board and rock it back and front, this was performed for 10 repetition for 2 set for 10 min. the therapist ask the subjects to place your feet parallel on the board and sway it back and front this was performed for 10 repetition for 2 set for 10 minutes. the therapist ask the subjects to place your feet shoulder-width apart on the board and move the front of it in a circular motion this was performed for10 repetition for 2 sets for 10 minutes

The group B received aerobic exercise, it included a brisk walking, jogging and static cycling. The brisk walking, jogging was performed for 20 min possible distanced is to be covered by the subjects. The static cycling was performed without adding any resistance for 10 minutes.

2.1 Outcome measures: Pain was assessed using pain shield software which uses numeric values of 0-10. Berg balance scale which is widely used for assessing in elderly

population to check their balance which consists of 14 components. 30 second Sit to stand test is widely used for assessing strength of lower limb which is reliable in elderly population

3 Results and Statistical Analysis

The study has conducted with 50 participants and all the participants have completed the study. There was significant difference between experimental and control group. Compared with the values before and after exercise of pain shield, berg balance scale and 30 second sit to stand test. The pre values of experimental group of pain shield outcome, berg balance scale and 30 sec sit to stand test 5.87, 6.80 and 7.00. post test values were 3.27, 11.04 and 4.92. control group pre test values of pain shield, berg balance scale and sit to stand test were 5.80, 5.56 and 6.92 and post test values were 4.47, 9.76 and 4.80.

Table 1. Comparing clinical outcomes post-test values between groups.

Outcomes	Experimental		Control		P value
	Mean	SD	Mean	SD	
PAIN SHIELD	3.13	0.92	4.53	0.99	0.0001
Berg balance scale	11.04	1.72	9.76	1.51	0.0001
STST	7	1.60	4.92	1.81	0.0001

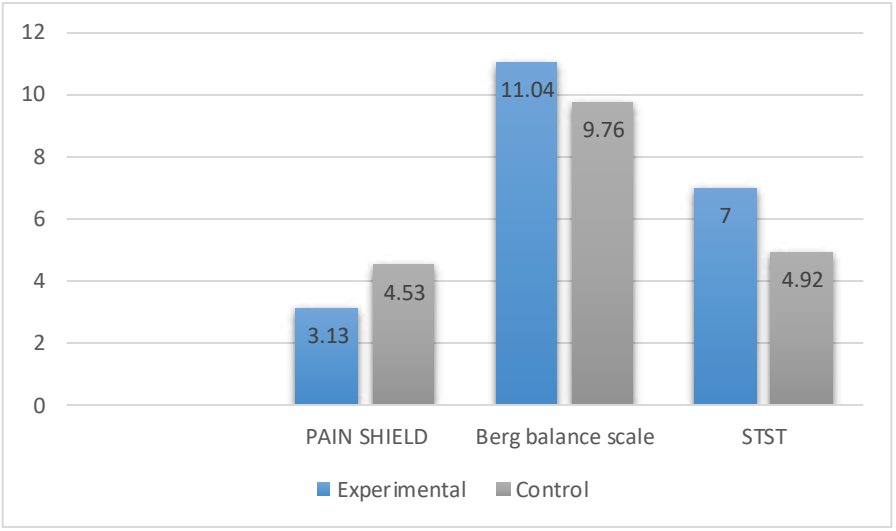

Fig. 1. Post test comparison between the groups for Pain Shield, Berg balance Scale, STST.

4 Discussion

The clinical trial was delivered the Effectiveness of wobble board balance exercise versus aerobic balance exercise with progressive resistance training for pain, strength,

balance on unilateral osteoarthritis knee subjects and accepting the alternative thesis and rejecting null thesis. Overall 50 participants were involved in the study and pain and strength were assessed pre and post intervention the participants were entering wobble board balance exercise and progressive resistance training for 4 weeks 3 times per week for 20- 30 minutes and study were supported by An example of a wobble board Researchers have discovered that the amplitude of the soleus H-reflex is smaller when standing upright on a soft surface as opposed to a solid one because of increased body motion[15].

With or without muscle strengthening exercises, this guideline suggests aerobic exercises (such as brisk walking, running, spinning, etc.) as a part of an overall exercise program as a promising non-pharmacological intervention for pain relief, improved physical function, and quality of life among people with knee osteoarthritis [16] . Since some individuals with knee OA may not be able to do aerobic training in loading positions because of discomfort or being overweight, sitting aerobic exercise without weight may be a safe substitute [17]. While some strength training has no discernible impact on endurance ability, it is thought that long-term endurance training influences the development of strength ability. Additionally, the impact of concurrent aerobic and strength training on endurance ability is comparatively smaller than that of strength ability [18]. Given the observed improvements in strength, it is likely that the RT groups benefited from PA RT in addition to the SM group. Additionally, RT has been shown to improve a number of functional limitations that lead to disability in patients with OA of the knee, including decreased knee ROM, neurological deficits, and weakness in the quadriceps muscles. Additionally, it has been demonstrated that RT programs enhance psychological aspects like anxiety, despair, mood, and self-efficacy [19]. After resistance training, the knee stabilization mechanism may teach the motor control system to reduce load on the symptomatic side of the joint; however, this mechanism might only work on more neutral knees, not more mal aligned knees [20].

The Sit-to-Stand Test (STS) gauges an individual's ability to quickly stand and sit in a chair with a backrest. Assuming that standing and sitting are routinely done throughout everyday activities, the findings can offer important insights into how the lower limbs work[21-22].When compared to the control group, we observed that those with knee OA had more postural sway, a longer stand-to-sit task duration, and decreased ankle dorsiflexion RoM, quadriceps femoris, and TA activation level. In addition, during the task, people with knee OA may have more BF muscle activity and pelvic anterior tilt RoM as a kind of functional compensation compared to the control group [23]. The relationship between HRQoL and STS-30, particularly in the physical domains the robust relationship between exercise ability and STS-30 the STS-30's differentiation of limited exercise capacity determining the STS-30 cut-off points (12 repetitions) in order to discover poor exercise capacity, high test-retest reliability, and STS-30 MDC [24]. This may be explained by the maximum effect observed in BBS (when a test score hits its top limit), showing that it might not be a useful therapeutic tool in determining the risk of falling in older persons living in the community or in those who are physically active [25]. Enforcing strict adherence to guidelines, such as keeping the chair height constant during the STS test, presents a significant problem in the self-teleassessment of participants for digital health applications. This difficulty may prevent home-based telehealth examinations from progressing as planned [26].The BBS consists of 14 tasks that include static movements such as sitting and standing and movements such as turning and bending. Tasks are scored on a scale of 0 (“unable to perform or needs assistance”) to 4 (“able to perform independently”). Lower scores are given if participants are unable to meet time or distance requirements [27].The efficacy of

therapeutic ultrasound, such as Pain Shield, in the postoperative rehabilitation of lower limb function is assessed in this randomized controlled trial [28]. In order to treat lower limb injuries, this meta-analysis looks into the use of therapeutic ultrasound—which includes tools like Pain Shield as a supplement to physical therapy [29]. This follow-up study investigates the efficacy of targeted ultrasound therapy, such as Pain Shield, for the long-term management of osteoarthritis pain in the knee over a five-year period [30]. This study highlights the advantages of non-invasive pain therapy in this demographic by examining the use of portable ultrasound devices, such as Pain Shield, in the management of lower limb pain in older individuals [31].

5 Conclusion

The study has concluded that the intervention of wobble board balance exercise versus aerobic balance exercise with progressive resistance training has bettered on pain, strength, balance and functional capability on unilateral knee osteoarthritis subjects with p value 0.0001 has shown significant difference in statistics in wobble board balance exercise group.

Acknowledgements: I want to sincerely thank my guide for all of their helpful inputs. Their knowledge, experience, and research have substantially improved my comprehension of subject. Additionally, I value their cooperation and other particular contributions. This job would not have been feasible without their diligence and commitment.

Disclosure of Interest: Regarding the content of this article, the author has no conflicting interests to disclose.

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