

Effect of Training with Stability Trainer vs Wobble Board Training on Proprioception, Balance and Function in Patients with Knee Osteoarthritis

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Abstract— Knee osteoarthritis (OA) is a disease characterized mainly by cartilage degradation, which is reflected clinically by a gradual development of pain, stiffness, and loss of motion of the joint. There is an apparent relationship between proprioception and function of knee joint. The factors responsible for balance defects in knee OA were reported to be pain, deficits in muscle strength, and proprioception and it is plausible that proprioceptive training may lead to improvement in function. The study included 30 patients aged 40-60yrs diagnosed cases of knee OA (unilateral) were taken. Training done on with wobble board and stability trainer showed improvement in proprioception and also in balance and function.

Key words: Osteoarthritis, Stability Trainer, Wobble Board, Proprioception, Balance, Function

I. INTRODUCTION

Knee osteoarthritis 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]. Individuals with knee osteoarthritis suffer progressive loss of function, displaying increasing dependency in walking, stair climbing and other lower extremity tasks [3]. Osteoarthritis mostly affects cartilage, the tissue that covers the ends of bones at the articular processes of a joint. Healthy cartilage allows bones to glide over one another. It also absorbs energy from the shock during physical movement. In osteoarthritis, the cartilage layers breaks and wears away. This allows bones under the cartilage to rub together, causing pain, swelling, and loss of motion of the joint. Over the period of time, the joint may lose its normal shape. Also, osteophytes or bone spurs may grow on the edges of the joint causing more pain and damage. Knee osteoarthritis (OA) is a common condition in middle and older age, and its prevalence increases with age [4, 5, 6]. According to Hurley et al [7] and Sharma et al [8] knee OA causes proprioceptive deficits because of damage of intra-articular sensory receptors, including mechanoreceptors. Many studies have shown that deficits of knee proprioception are associated with insufficient information regarding appreciation of limb position [9], muscle strength and knee joint stabilization in patients with knee OA [10]. There is decrease in functional activity and walking speed because of osteoarthritis [11]. There is apparent relationship between proprioception and joint function, it is plausible that proprioceptive training may lead to improvement in function. Therefore, there is need to improve the proprioceptive function which may prevent the decline of knee function. For balance control, proprioception and quadriceps strength are required. There is significant correlation between balance and proprioception, quadriceps strength, and pain at knee joint. Proprioception is considered

as the most dependent predictor for balance. There are many studies that have investigated the effect of standard traditional exercises in the management of knee OA and reported decreased pain and increased muscle power with consequent improvement in proprioception and functional level [12, 13, 14].

Theoretically, it could be predicted that sensorimotor training affects proprioception as compared with traditional exercise programme as sensorimotor training improves sensory input to the central nervous system thus improving sensorimotor function of the knee joint [15]. Kinaesthesia and balance training were reported to improve proprioception and functional performance of knee OA patients [16, 17]. The strengthening exercises plays important role in improving strength, improving psychological well-being, improving and maintaining cartilage integrity. All of these may interact and have an additive effect on the management of OA.

The purpose of the present study is to focus on proprioception, balance and function through balance training on stability trainer and on multidirectional wobble board. This research hypothesis states that there will be statistically significant difference in the proprioception, function & balance with stability trainer as compared to wobble board training in knee OA patients.

II. METHODOLOGY

A convenient sampling involving 30 patients aged 40-60yrs diagnosed cases of unilateral knee OA ambulatory without any assistive device. Patients with neurological disorder, vestibular problems, rheumatoid arthritis, recent surgery or implants & osteoporosis were excluded from the study. The included patients were asked to fill the assessment Performa and all the procedure were explained prior to intervention. The subjects were divided into two groups. Group A received ultrasound for 6 minutes (0.8w/cm^2) and training with stability trainer, while group B received ultrasound for 6 minutes (0.8w/cm^2) and training with Multidimensional wobble board. Pre-training, all subjects were assessed single leg stance test on affected leg, knee reposition error test with bubble goniometer and function with WOMAC scale. Patients in both group received 6min of ultrasound thrice a week for four weeks along with their respective exercises. Exercises with stability trainer include bipedal heel rise for 20 seconds (5times), one leg balance on the stability trainer for 15 seconds. Repeat the exercise over the other leg (5times), hip Flexion and extension with balance on one leg and maintain for 15 seconds and repeat the exercise over the other leg (5times each), knee Bending exercises with balance on one leg and flex the knee up to 90 degree for 15 seconds and repeat the exercise over the other leg (5times each) [18].

The other group was assigned with the exercises on Multidimensional Wobble Board [19].The exercises included Single leg stance standing on firm surface on dominant leg with non-dominant leg at a 90°angle off the ground and then this activity was repeated on multidimensional wobble board. The exercises were repeated thrice for 30 seconds. The dynamic activity included anterior - posterior tilt (A/P) and medial- lateral tilt (M/L) on multidimensional wobble board with standing on both feet in the center of wobble while performing front to back tilts repeated 6 times. Clockwise and counter clockwise rotations (CWICCW) on multidimensional wobble board standing on dominant leg in each center of wobble board repeated 10 times in each direction.

Data analysis was done with the help of SPSS -16.0 versions to verify the outcome variables of the study. Independent t-test was used to compare between group difference and repeated ANOVA measures was used to analyze within group difference for all the dependent variables. The significance level set for this study was 95% (p<0.05). Demographic details of two groups are reported in Table 1. There was no significant difference between the groups on demographic information.

Variable	Group a (Stability Trainer Group)	Group b (Wobble Board Group)
Age (years)	52.2 ±6.60	50.86 ± 6.94
single leg stance (seconds)	16.26±4.87	16.73 ± 4.47
womac (%)	61.45± 12.57	57.83 ±11.22
repositioning error test (degree)	5.86± 0.91	5.75± 0.74

Table 1: Comparison of Demographic Data for Both Group

The pre data, 2nd week after exercises and 4week post treatment results for proprioception, balance and function were shown in Table 2 & table 3. Between-group analysis revealed that there were significant difference in balance and function in both the groups after 4 weeks of intervention (balance p= 0.046; function p=0.004) but no significant difference was found in proprioception (p=0.715). And with-in group analysis revealed that there were significant improvement in balance, function and proprioception in group B whereas group A shows more significant improvement in proprioception.

	Stability training group Group A			Wobble board training group Group B		
	Pre test (0 day)	2 nd week	4 th week (post test)	Pre test (0 day)	2 nd week	4 th week (post test)
Balance	16.26 ± 4.87	17.60 ± 4.85	19.66 ± 4.13	16.73 ± 4.47	21.40 ± 5.20	23.13 ± 4.91
Proprioception	5.86 ± 0.91	4.99 ± 1.28	4.13 ± 1.22	5.75 ± 0.74	5.01 ± 0.63	4.26 ± 0.74

Table 2: Between-group analysis of balance and proprioception

Session	Group A Mean ± S.D	Group B Mean ± S.D	t- value	p-value
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PRE Value WOMAC	61.45 ± 12.51	57.83 ± 11.22	0.833	0.412**
Post value WOMAC	55.76 ± 11.97	43.43 ± 9.68	3.098	0.004*

Table 3: Comparison of Womac between the Groups

*p≤ 0.05(significant) **p= Non Significant SD: Standard Deviation

III. DISCUSSION

In this study the key focus area were proprioception, balance and function in knee osteoarthritis. The primary goal of this study was to determine the effect of stability trainer training & wobble board training on balance, proprioception & function in knee osteoarthritis which result in good functional outcome. The result of the study showed significant improvement in wobble board training group in terms of balance and function but reposition error scores did not show any significant improvement as compared to stability trainer training group. Subjects included in this study had similar baseline values (SLST: Group A=16.26, Group B=16.73) (WOMAC: Group A=61.45, Group B=57.83) (RET: Group A=5.86, Group B=5.75) of all dependent variables selected, suggesting that both groups had homogenous distribution of patients. The SLST scores, RET scores AND WOMAC scores of both groups came out to be non-significant at baseline when compared using ‘t’ test. The analysis of the data collected reveal that both the group significantly improved with respect to balance, proprioception and function as depicted on SLST, RET and WOMAC scores. The comparative results of this study depicts that training with wobble board in knee osteoarthritis is a more effective treatment therapy in improving balance and function than training with stability trainer.(p-value = 0.000). The latter is being more effective in increasing proprioception in patients with knee osteoarthritis.

As suggested by Kim burton (1986) in his study trunk muscle activity induced by three sizes of wobble board that the use of wobble board coordination training to restore or improve proprioceptive response from articular mechanoreceptors following ankle injury which was well accepted, the same principles may apply in other joint disorders, so the present study was done on knee joint to study the effects of wobble board training which proved to be effective in improving balance, proprioception and function in knee osteoarthritis patients[20].29

Proprioception training is widely used in rehabilitating ankle sprains to re-strengthen the muscles and ligaments and to restore proprioception of the damaged structures Proprioceptive training involves the use of devices such as e.g. the tilt board, which is considered to be unique because of its stimulation of multiple planes of ankle movement on a weight bearing foot so training with wobble board was done to find out the effects on knee OA patients [21].

The purpose of proprioceptive training is to advance the complex activity of the neuromuscular system. Information should be transferred from the peripheral receptors – the afferent and efferent pathways of the nervous system - which enables the stability and balance of the body during static and dynamic activities which was accomplished with training with wobble board although there was not a

significant improvement. Study done by Snehal et al (2006) concluded that Training on stability trainer in various postures both static and dynamic at appropriate challenge levels helps to improve balance in ambulatory hemiplegics. Training on stability trainer can be generalized to functional activities such as staircase ascending and descending, going up and down ramp and walking on uneven surfaces. Improvement in balance results in better patient satisfaction, as they are socially more active, in the present study training with stability trainer improved proprioception but there was no significant difference[22]. In another study Bernier and Perrin (1998) found that 6 weeks of coordination and balance training had a significant effect on the modified equilibrium scores of balance in both the anterior/posterior and medial/lateral direction. There was, however, no effect observed on sway index or joint position sense of the ankle and concluded that postural sway can be improved in subjects with functional instability of the ankle following 6 weeks of coordination and balance training [23]. Balance and coordination training should continue to be an integral part of rehabilitation protocols [24]. Puett and Griffin reviewed 15 controlled trials of non medicinal, noninvasive therapies for hip and knee osteoarthritis from 1966 through 1993. The authors concluded that exercise reduces pain and improves function in patients with osteoarthritis of the knee, but the optimal exercise regimen has not been determined [25]. In accordance with the findings of the study done by Kim et al(2009) which suggested that weight or balance training on stability trainer improves the quality of an older adult's life by helping them to lessen the fear of falling, training with stability trainer improved balance, proprioception and function in knee OA patients[26]. So results clearly indicate that wobble board training and stability trainer both can be inculcated as part of rehabilitation in knee OA patients depending on which variables we want to focus on and improve.

IV. CONCLUSION

It is concluded in the present study that there was a statistically significant difference in balance, proprioception and function with wobble board training as compared to stability trainer training in patients with knee osteoarthritis. Although, both the training protocols, stability trainer training and wobble board training have found to be effective in reducing pain and improving balance, function and proprioception, however the comparative results depicted that the subjects with wobble board training showed an additional benefit in terms of increasing balance and an improvement in functional activities (on WOMAC). Hence the wobble board training might be a better therapeutic intervention as compared to stability trainer training for treating knee OA patients.

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