International Journal on Science and Technology (IJSAT)
E-ISSN: 2229-7677 ● Website: www.ijsat.org ● Email: editor@ijsat.org

A Study to Compare the Effect of Structured Neuromuscular Postural Training Versus Isometric Exercise for Balance Impairment in Patient with Osteoarthritis Knee

G.subalakshmi[1], premkumari ganesan[2]

[1]Assistant professor MPT, Neuro, Physiotherapy, Sri venkateshwaraa College of physiotherapy.
[2]PhD scholar, physiotherapy, Saveetha College of physiotherapy.

Abstract

Background: Osteoarthritis is a chronic disease which is evolved by deterioration of articular cartilage and hypertrophy of the bone margins is called osteophytes. It commonly affect the women than men with a ratio varying between 1:5 and 1:4 affected with osteoarthritis knee. The worldwide estimate indicates 13% of men and 19% of women, over 40 years affected with OA knee. The patient with OA knee have disability in their proprioception and it is a risk factor for fall injury. Here, structured neuromuscular postural training uses sensory motor training intervention to improve static and dynamic mechanism of balance. **Methodology:** in this comparative study OA was assessed using WOMAC and balance was assessed by using tinetti scale. After inclusion of the patient separated into two groups. Group A have received SNPT and the group B received isometric exercise alone. Total study duration was 3 month. **Result:** a total of 30 participants were included. Patient with knee osteoarthritis age between 41-80 years. In that group A showed significant improvement in reducing balance impairment (tinetti: pre- test mean = 16.93, post-test mean 26.87) and functional ability (WOMAC: pre-test 23.73, post- test mean = 13.47) than group B. group A showed significant "P" value <0.0001 for tinetti and WOMAC scale. High statistically significant difference was observed for SNPT treatment. **Conclusion:** SNPT training improve the balance impairments in OA knee subjects than compared with isometric exercise alone for OA knee.

Keywords: OA –osteoarthritis, SNPT- structured neuromuscular postural training, WOMAC – western Ontario and McMaster Universities Osteoarthritis Index.

1. Introduction

Osteoarthritis is a common chronic articular disease with an increasing prevalence due to population with aging and obesity.(1) Which is evolved by deterioration of cartilage and hypertrophy of the bone margins is called osteophytes.(2) The disease characterized by musculoskeletal pain, joint line tenderness, balance and proprioception impairments. According to prevalence rate affects more women than men. The worldwide estimate indicates 13% of men and 18% of women, over 40 years of age are affected with osteoarthritis of knee.(3) Many somatosensory system related to balance control such as vestibular system, proprioception, cognition and muscular strength. Patient with OA knee have a disability in their

proprioception and prone to get fall injuries. [4] Balance impairment of OA knee evaluated by following test: timed up and go test, functional reach test, berg balance scale, Tinetti and WOMAC scale. [4] Traditional method of treatment for OA knee with balance impairment are aerobic exercise, strengthening exercises, retro walking, toe walking, balance board exercises, mini trampoline and plyometric exercises.[6] Structured neuromuscular postural training used for the management of OA, this technique has different component. Followed by procedure joint distraction along with mobilization will increase the synovial fluid within a joint. These mechanical forces further stretch and deform the collagen to improve the function. The co contraction of agonist and antagonist is to achieve the joint stability, which can improve kinesthetic sensation. Balance exercise are designed to improve the muscle strength around the joint. SNPT uses sensorimotor training intervention to improve both static and dynamic balance. [7] The purpose of the study is to compare the SNPT and isometric exercise for OA knee patients with balance impairment. [8]

2. Methodology

The comparative study design was used in this study, total number of participants 30 subjects includes both male and females age group between 45 to 80 years. Subjects were grouped through randomized group allocation into group A (SNPT) 15 subjects, group B (isometric) 15 subjects, total study duration was 3 months. The study conducted in sri venkateshwaraa medical college hospital and research center, Puducherry. Inclusion criteria: radio graphical confined knee osteoarthritis (stage I-III), age between 41 to 80 years having fear of falling, patient tinetti score from 19-24. Exclusion criteria: sports injury and traumatic injury, inflammatory arthritis and metabolic disorders along with specific vestibular proprioceptive or visual impairment, history of recent knee replacement surgery on involved limb and balance deficit from other non- musculoskeletal conditions: diabetic neuropathy, neurological impairments and cerebral disorders. Outcome tool: WOMAC index is a self-administrated questionnaire used for this study. Tinetti assessment tool is task oriented examination used to analyze the gait and balance component.

3. Procedure

Group A received structured neuromuscular postural training it has two phases, 1) adaptive phase: initially passive tibio- femoral mobilization was done with the involved knee overhanging the edge of the cough at the end of the mobilization manual thrust given directly to the caudal direction to mobilize the joint to reach full knee extension. Followed by co contraction of agonist and antagonist muscles around knee were targeted. For this maneuver patient positioned in crook lying, therapist should give instruction to tighten both quadriceps and hamstring muscles by pressing the heels into the floor hold it for 6 sec and repeat for 3-5 times. 2) Dynamic phase: balance training is given to restore the neuromuscular control and coordination. Rocker board exercise first placed on the mat near a wall. Instruct the patient to slowly rock it back and forth by hinging at the ankles. The rocking movement was done in various direction feet facing either corner or towards narrowed base it should be continued for 5- 30 minutes intermittently. Group B have received isometric exercise it can be Given in the two position variation from supine and long sitting with towel place beneath the popliteal fossa instruct the patient to press the knee towards the towel hold it for 6 seconds and repeat for 10 times. Each group have received conventional therapy as SWD for 15 minutes each session.

4. Statistical analysis

In this study, to compare the effect of structured neuromuscular postural training versus isometric exercise for balance impairment in patient with osteoarthritis knee was found by comparing the significant different between experimental and control group. Pre and post differences within the two groups were analyzed by using paired t test for each outcome measures. Statistical significance was set at P<0.05 was considered as a significant difference.

Within Group Analysis of Pre and Post Intervention Values of Tinetti Between Group A And Group B

Outcome	Pre- test	post -test	'T' values	'P' values
TINETTI-A	16.93±1.94	26.87±1.68	54.66	<0.0001
INETTI-B	19.40±1.76	24.20±1.42	14.69	<0.0001

Table: 1 The Pre And Post –Test Values Of Tinetti Between Group –A And Group-B

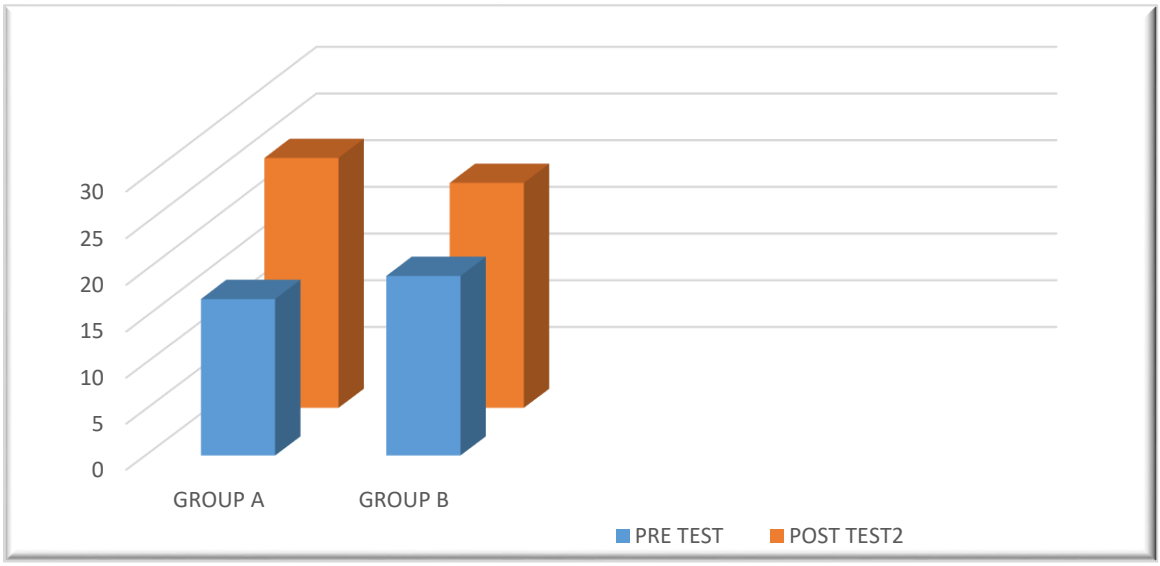
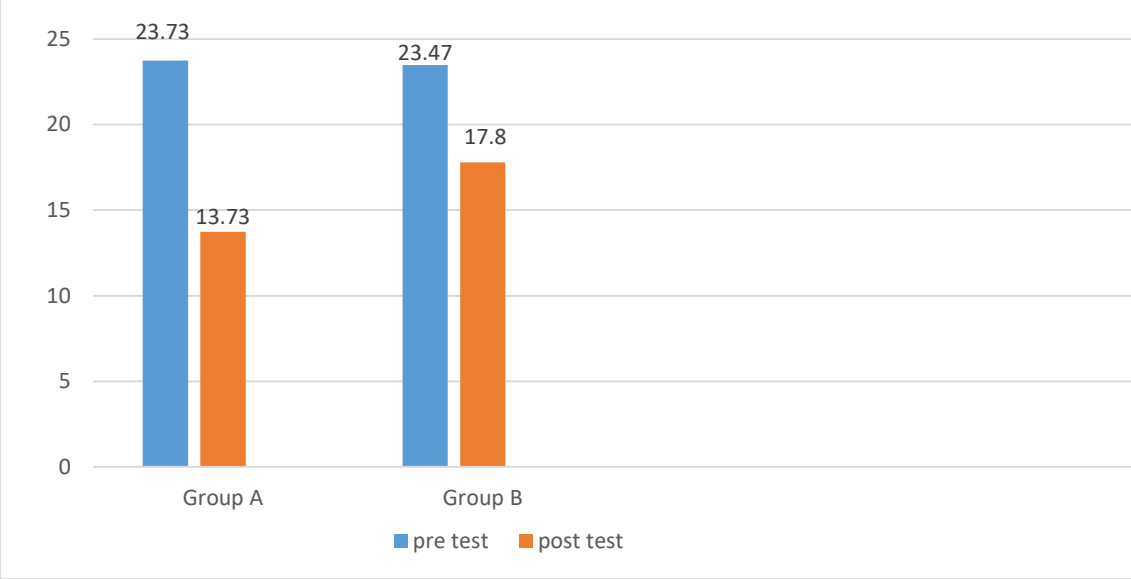


Table: 2 Within Group Analysis Of Pre And Post Intervention Values Of Womac Between Group A And Group B

Outcome	Pre- test	post -test	'T' values	'P' values
WOMAC A	23.73±2.21	13.47±2.23	86.86	<0.0001
WOMAC B	23.47±4.12	17.80±4.42	14.22	<0.0001



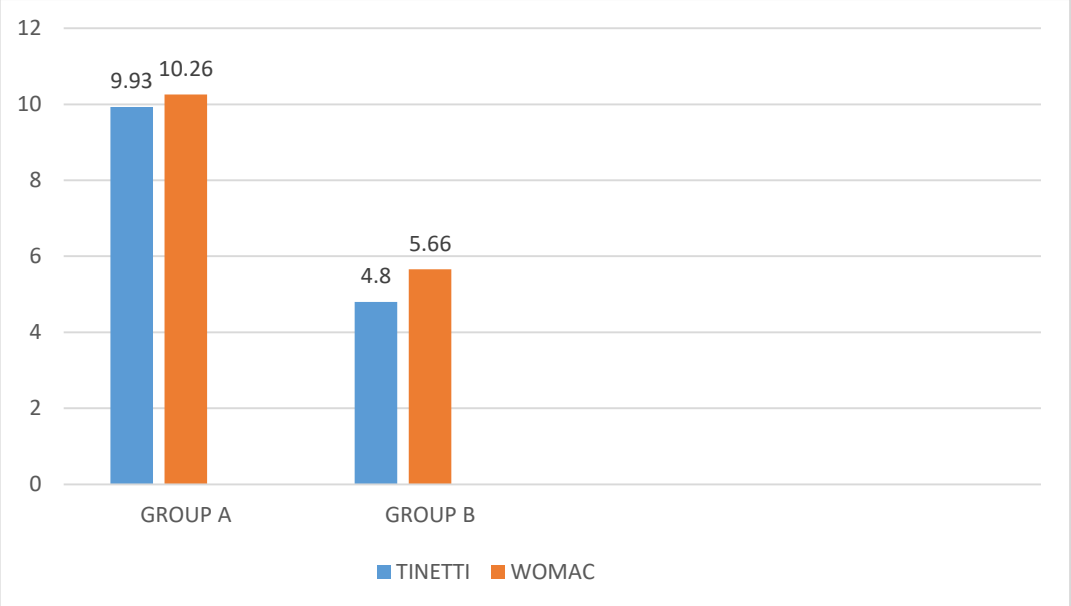
In within group analysis the pre and post –test value of WOAMC test for Group A and Group B was significantly reduced.

Table: 3 Between Group Analyses for Tinetti (A&B)

GROUP	Mean	S.D	'T' values	'P' values
GROUP A	9.93	0.70	13.73	0.0001
GROUP B	4.80	1.26		

Table: 4 Between Group Analysis of Womac Score (A&B)

GROUP	Mean	S.D	'T' values	'P' values
GROUP A	10.26	0.45	11.06	0.0001
GROUP B	5.66	1.54		



5. Discussion

Individuals with OA exhibit reduced walking speed likely due to alternations in the neuromuscular stratergy of the lower extremity kinetic chain in response to joint pain and muscle weakness. In chronic OA patients the patient is usually entrapped in a close loop cycle called the physical reconditioning cycle were the patient is tires to compensate for his pain by adapting unnatural and restricted posture. This may leads to muscle spasm and loss of joint movement. Pain leads to a decreased activation of the muscle it aggravates the disability and muscle weakness it associated with decreased functional activity. As increased joint inflammation and effusion may decreased proprioception, it is important aspects of a knee OA. Dysfunction within this neural structures may immediate weakness and instability in the joints affected by OA and negatively affected the proprioception.

The postural stability and balance has impact of feed forward anticipatory control in the form of SNPT control approach based on the motor learning. The strength training by the way of high resistance improves the mechanical efficacy of the efferent drive on the motor neurons, while a sensorimotor training alters the afferent input on the CNS. The main findings of this study were that sensorimotor training produced significant improvement of all balance measurements, while an isometric exercise produce a less significant improvement in all the balance measurement. The observations from the presents study suggest that balance exercise in weight bearing can be safely added to isometric exercise approach, using clinical reasoning to adjust individually for dose and progressions, in the patient with OA. In this study the chronic OA patient generally have balance It lead to alterations in the neuromuscular strategy, postural instability, studies suggest that SNPT generally improved the motor learning and high mechanical efficiency in subjects with OA knee. This study show SNPT reduced balance impairments improve muscle function and proprioception than compare with isometric contractions. Isometric contraction generally improves the recruitment of motor muscle fibers but that is not acting on the joint anymore. So in order to improve the joint mobility and gliding SNPT has to be done. Generally, muscle contraction would have a deleterious effect on the joint so to restore the normal joint physiological and accessory movements the manual therapy should be advised. Isometric contractions generally improved the muscle strength but SNPT will improve the joint accessory and physiological movements so there is a need for OA patients to

do manual glides along with muscle contractions that will reduce the balance impairments and improves the proprioception for the subjects added as an adjacent. Generally, when used to do the manual glides along with accessory movement for the joint it stimulates the joint proprioceptors so it might be result in decrease in the balance impairment than compare to isometric exercise alone in subject with OA knee. Quadriceps strength is strongly associated with the knee pain and disability. Muscle weakness may in turn interfere with thee normal, mechanics around the knee joint. These increasing knee pain can also be decreased temporarily decreasing the compressive force on the joint, this is accompanied when technique designed to distract the two joint surface are used. Strengthening exercise can improve the stability to the knee joint. Several studies proved that mobilization techniques play important role in improving pain, strength and functional performance in OA knee. In addition, manual traction may temporarily reduce compression on the meniscus and move fluid within a joint. This may reduce the potential motion limiting effects of both pain and swelling. The exact mechanism for the perceived pain reduction with manual or mechanical traction is not well understood, but theoretically it has been associated with increased. Synovial fluid circulation, articular receptor stimulation, improved tissue extensibility and transient reduction of compressive force on the articular surface. This study concluded that physical interventions including manual therapy and exercise improves muscle strength, functional ability and reduced pain in the patients with OA knee.

6. Result

In this present study, the sample size consists of 30 patients with knee arthritis age between 41-80 years from the result it shows the intergroup comparison of different balance measurements. The difference was found statistically using measuring of paired T-test to find the significance of the intervention used among the groups. In that group a showed significant improvement in reducing balance impairment (Tinetti; Pre-test mean = 16.93, post-test mean 26.87) And functional ability (WOMAC; pre-test mean=24.20 and WOMAC; pre-test mean= 17.80). Group A showed significant “p” value <0.0001 for T inetti and WOMAC scale. High statistically difference was observed for SNPT treatment.

7. Conclusion

The present study concluded that structured neuromuscular postural training shows improvement in balance and functional outcome in patients with OA knee than subjects who have received isometric exercise alone.

8. Limitations and recommendations

The study duration was only 3 weeks were taken. Sample size was small. In this study we could not dissect out the separate effects for each treatment component. Future recommendations should evaluate the proprioceptive exercise improve the balance in OA knee. SNPT can be the first line treatment for OA knee subjects than isometric contraction exercise. Sample size should be increased. Future study conducted in a longer duration for various neurological conditions.

9. Conflict of interest & funding

There is no conflicts of interest in this study and there was no funding agencies used in this study.

References

1. A Mahajan T,S Varma journal of osteoarthritis Japi.vol.53: 2005
2. S.R Goldering and M.B Gold ring clinical aspects, pathology and pathophysiology of osteoarthritis J musculoskeletal neuronal interact; 6(4):376-378.2006.
3. Anna Litwic MD, Epidemiology and burden of osteoarthritis Br Med Bull 2014: 105-199.doi: 10.1093/bmb/ids038.year2013.
4. Hee Sang Kim, M.D., journal of balance control and knee osteoarthritis severity Mec Ann Rehabil Med Volume. 35; 701-709: year 2011.
5. Neol Macwan, Lata D Parmar proprioceptive impairments in OA knee patients International Journal of multidisciplinary Research and Development Vol: 2, Issue 5, 351-357 May 2015.
6. Carolyn Kisner, Lynn Allen Colby: Isometric exercise and mobility exercise for OA knee therapeutic exercise 5 edition: Page 176: year 2007.
7. Sing, O.P Gambier, I.S; The effect of structured neuromuscular posrural training in balance modulation and fall prevention strategy in osteoarthritis Journal of exercise Science & Physiotherapy JESP Volume 11; 42-51; year 2015.
8. Eva Ageberg and Ewa M. Roos Neuromuscular exercise as a treatment of degenerative knee disease Exerc. Sport Sci. Rev., Vol.43, No. 1,pp. 14-22, 2015.
9. Hussein Abaza Effect of balance training, plus back seeds capsules on knee joint injuries, balance and performance J Am Sci;11(1): 136-139.[ISSN: 1545-1003] 2015.
10. Michael V Hurley, David L Scott,Joanne Rees,Di Newham Sensory motor changes and functional performance in patient with knee osteoarthritis Annals of rheumatic Disease 56:641-648;; 1997. Doi: 10.1136 ard.56.11.341
11. Nafish khalaj balance and risk of fall in individual with bilateral mild to moderate OA knee 2015. . doi:10.1371/journal.pone.0092270
12. Amany S.sorour Effectiveness of acupressure versus isomteric exercise on pain, stiffness and physical function in knee arthritis in female patients (2014) april 8;5(2):193-200. doi: 10:1016.
13. Ahmad Alhadir Shahnnawaz Anwar Effect of isometric quadriceps exercise on muscle strength, pain, and function in patient with knee osteoarthritis J, Phys, Sci 26: 745-748, (2014).PMICD: 4047243 DOI: 10.1589.
14. Danial Rhon, Gail Deyle, Manual physical theapy and perturbation exercise in knee osteoarthritis Journal of manual and manipulative therapy Vol 21NO.4 2013. doi 10.1179/2042618613Y.0000000039.
15. Deepali Sign, Effect of sensorimotor on balance in elderly patient with OA knee (2011) 2(4):305-311 doi: 10:1016.

FIG 1: Distraction and manual gliding

FIG 2: co contraction of agonist & antagonist

FIG 3: Balance training

FIG 4: quadriceps isometric exercise