



## “Comparative Efficacy of Kinesthesia & Balance Exercises With Open Chain Exercises In Functional Performance in Knee Osteoarthritis”

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### Abstract

**Background:** Osteoarthritis is most commonly encountered disease of the musculoskeletal system. Symptoms and disability in individuals with osteoarthritis increasing with age. The physical disabilities arising from osteoarthritic knee prevent the performance of daily life activities. Several factors play in the occurrence of physical disability in osteoarthritis patient. This include pain, restriction in the joint range of movement, muscle weakness, kinaesthesia and balance impairment. Many Treatments are available for treating Osteoarthritic knee such as open chain Exercise, close chain exercise, isometric exercise etc., but few studies comparing Kinaesthetic and balance and open chain exercises are done. The Objective of the study is to find out the comparative effect of kinaesthesia & balance exercises And Open chain exercises in reducing pain and improve the functional performance in Osteoarthritis in Knee.

**Methodology:** This is a Comparative Study done on osteoarthritic patients of both genders with age limit of >65 and <85 subjects (N=30) were randomly design in two groups Group A (N=15) And Group B (N=15).

Group A will be treated with kinaesthesia & Balance exercises And Group B will be treated with only open chain exercises for eight weeks.

Pre and Post intervention outcome were major use VAS & WOMAC Scale.

**Key Words:** Pain, Functional Improvement, VAS, WOMAC, Osteoarthritis

### Introduction

Osteoarthritis (OA) is primarily a cartilage disease as it is characterized by the progressive loss of hyaline articular cartilage. Ultimately, the articular cartilage degenerates with fibrillation, fissures, ulceration, and full thickness loss of the joint surface.<sup>1</sup> Common sites developing OA include the knee, hand, hip, spine and foot. Among these, the knee is the most commonly affected joint, and knee OA patient present with a combination of inflammation, pain, stiffness, muscle atrophy and deformity.<sup>2</sup>

The great increase in the elderly population worldwide is the most important change in the field of public health in the 21st century

There are two types of osteoarthritis: primary and secondary.

**Primary osteoarthritis:** - This is a chronic degenerative disease that is related to, but not caused by, aging. As a person ages, the water content of their cartilage decreases, thus weakening it and making it less resilient and more susceptible to degradation. There are strong indications that genetic inheritance is a factor, as up to 60% of all OA cases are thought to result from genetic factors.<sup>6</sup>

**Secondary arthritis:** - This tends to show up earlier in life, often due to a specific cause such as an injury, a job that requires kneeling or squatting for extended amounts of time, diabetes, or obesity. But though the aetiology is different than that of primary OA, the resulting symptoms and pathology are the same.<sup>6</sup>

Osteoarthritis (OA) is divided into five stages:

#### Stage 0

This stage is classified as “normal” knee health. The knee joint shows no signs of OA, and the joint functions without any impairment or pain.

### Stage 1

A person with stage 1 OA is showing very minor bone spur growth. (Bone spurs are bony growths that often develop where bones meet each other in the joint.) Likely, a person with stage 1 OA is not experiencing any pain or discomfort as a result of the very minor wear on the components of the joint.

### Stage 2

OA of the knee is considered a “mild” stage of the condition. X-rays of knee joints in this stage will reveal greater bone spur growth, but the cartilage likely remains at a healthy size — the space between the bones is normal, and the bones are not rubbing or scraping one another. Synovial fluid is also typically still present at sufficient levels for normal joint motion. However, this is the stage where people may first begin experiencing symptoms pain after a long day of walking or running, greater stiffness in the joint when it’s not used for several hours, tenderness when kneeling or bending.

### Stage 3

OA is classified as “moderate” OA. The cartilage between bones is showing obvious damage, and the space between the bones is narrowing. People with stage 3 OA of the knee are likely experiencing frequent pain when walking, running, bending, or kneeling. They also may experience joint stiffness after sitting for long periods of time or when waking up in the morning. Joint swelling may be present after extended periods of motion, too

### Stage 4

OA is considered “severe.” People in stage 4 OA of the knee experience great pain and discomfort when walking or moving the joint. That’s because the joint space between bones is dramatically reduced the cartilage is almost completely gone, leaving the joint stiff and possibly immobile. The synovial fluid is decreased dramatically, and it no longer helps reduce the friction among the moving parts of a joint.<sup>7</sup>

Applied physical therapy for OA mainly consists of cold, heat, ultrasound and shortwave therapy, instruction in joint use and maintenance of range of motion, supplying patients with canes or orthotic devices, open chain exercises and Kinaesthesia Balance prevent muscle atrophy.<sup>9</sup> three basic types of therapeutic exercises exist: isotonic, isometric, and isokinetic.<sup>10</sup>

Various measures are available for the treatment of OA knee such as conservative management including Pharmacotherapy and Physiotherapy, or surgical management in the form of resurfacing of joint or replacement surgeries.

Open kinetic chain exercise (OKC) occurs when the movement allows the distal part of the limb to move freely while the proximal part is fixed. OKC exercise plays an important role in isolating individual muscle groups. It tends to generate more distraction and rotational forces and is often used with concentric muscle contraction.<sup>11</sup> isometric exercise is a mode of speed constant exercise. The patient contracts the muscle at various isometric hold angles in the range of motion, as present. The isometric muscle strengthening exercise program consisted of 10 repetitions at the maximum velocity.<sup>12</sup>

Kinaesthesia, Balance & Agility Exercise(KBA) techniques are designed to improve dynamic joint stability using a series of physical activities which challenge a participant’s neuromuscular system to maintain balance and coordination. Most frequently, KBA is used to rehabilitate and prevent anterior cruciate ligament ruptures<sup>14, 15, 16, 17</sup> and ankle sprains<sup>18, 19, 20</sup> among athletes. These proprioceptive deficits may contribute towards reduced dynamic knee stability. KBA is designed to decrease proprioceptive impairment by using agility and balance exercises to activate, challenge, and adapt the nervous system’s proprioceptors.

Decreasing proprioceptive deficit would thereby increase dynamic knee stability and improve activities of daily living function. In addition, joint instability and frontal plane joint laxity has been cited as a probable causative factor in both the development of knee OA and the further erosion of articular cartilage among persons with knee OA.<sup>21, 22, and 23</sup>

### Objective:

To compare the efficacy of kinaesthesia & balance exercise with open chain exercise in functional performance in knee osteoarthritis.

### Methodology:

A Comparative study was done on 30 samples, with the age group of 60-70 years with osteoarthritis of knee from Parul sevashram hospital, Vadodara. A convenience sampling method was done with n=15 in each groups.

Group A: subjects received kinaesthesia & Balance exercises.

Group B: subjects received open chain exercises.

### Criteria for Study:

### Inclusion Criteria:

- Age 60 to 70 years
- Having no morning stiffness or morning stiffness less than 30minutes
- Having primary osteoarthritis of the knee joints
- Stage of OA between 2-3

**Exclusion Criteria:**

- Age <60 years and >70 years.
- Patient with knee deformity or trauma.
- Intra articular steroid injection.
- Any neurological condition affecting lower limb.
- Patient with THR or TKR or any knee surgery
- Having no evidence of malignancy and having no evidence of infection on the skin over knee joints.

**Outcome Measures:**

Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC)  
Visual Analogue Scale (VAS)

**Procedure:**

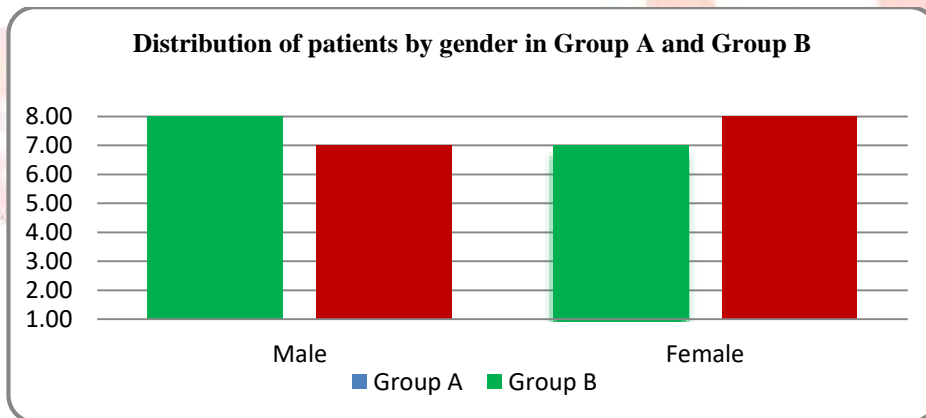
Participants were allocated to treatment group using sealed, opaque envelopes. The envelopes contained stickers denoting A or B. subjects who picked A were included in the group A (kinesthesia & Balance exercises) and the subjects who picked B were included in group B (open chain exercises). The exercises were given for 3 weeks, with addition of complex exercises introduced every week. Each exercises were repeated for 5 times, with enough rest period.

Following this, demographic information including name, age, gender, occupation was collected. Duration of symptoms and side affected noted and initial evaluation of pain profile was done using Visual Analogue Scale (VAS). Functional performance was assessed using the western Ontario & Mc Master Universities Osteoarthritis Index (WOMAC).

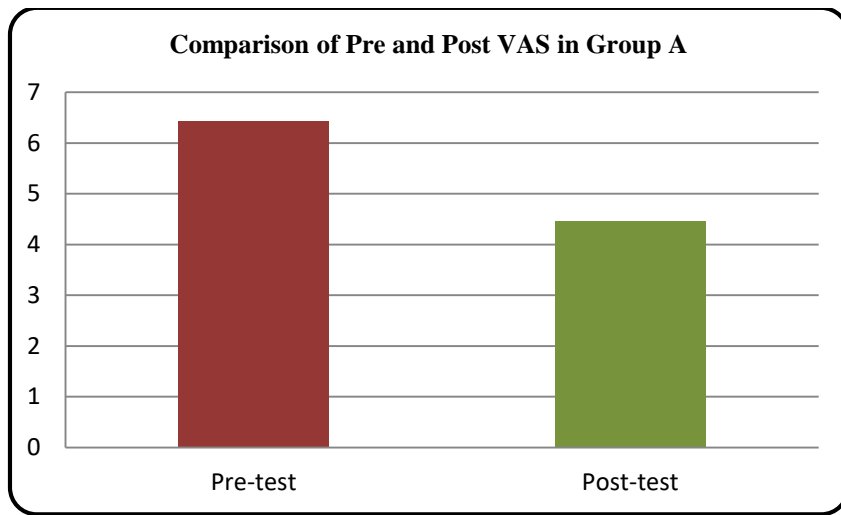
All the subject with the osteoarthritis of knee as diagnosed by an orthopaedic surgeon who reported to physiotherapy outpatient, were selected as per the inclusion and exclusion criteria. Subjects who were willing to participate in the study were briefed about then study and the intervention. After briefing, their written consent was taken

**DATA ANALYSIS:****TABLE 1: Distribution of patients by gender in Group A and Group B**

	Male	Female	Total
Group A	8	7	15
Group B	7	8	15

**TABLE 2: Comparison of Pre-and Post VAS in Group A**

Time	Mean	SD	Mean Difference	SD Difference	T-Value	P-Value
Pre-test	6.433	1.425	1.967	0.8121	9.379	<0.0001
Post-test	4.467	1.246				

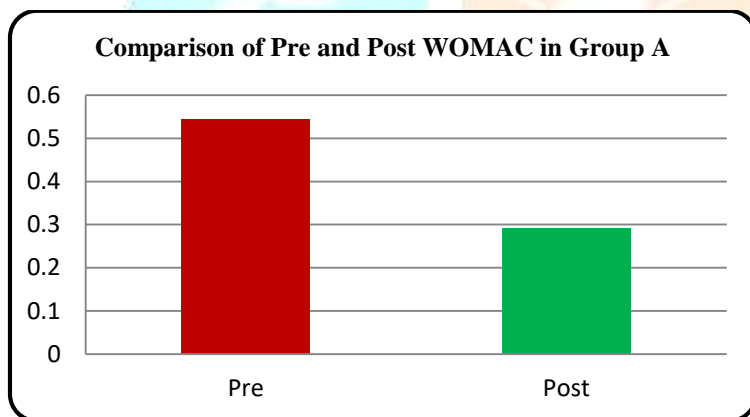


The above table showed that difference in VAS in Group A before and after was significant.

The two-tailed P value is < 0.0001, considered extremely significant. t = 9.379 with 14 degrees of freedom.

**TABLE 3: Comparison of Pre and Post WOMAC in Group A**

Time	Mean	SD	Mean Difference	SD Difference	T-Value	P-Value
Pre	0.5427	0.1148	0.2507	0.1122	8.651	<0.0001
Post	0.2920	0.0537				

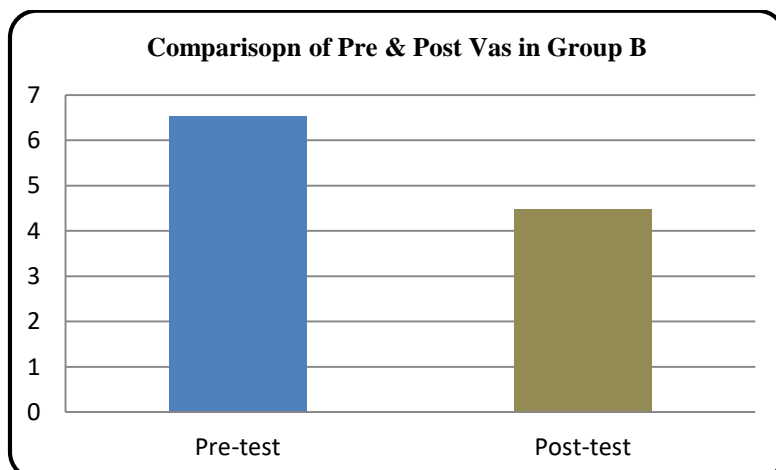


The above table showed that the difference in WOMAC In Group A before and after was significant.

The two-tailed P value is < 0.0001, considered extremely significant. t = 8.651 with 14 degrees of freedom.

**TABLE 4: Comparison of Pre-and Post VAS in Group B**

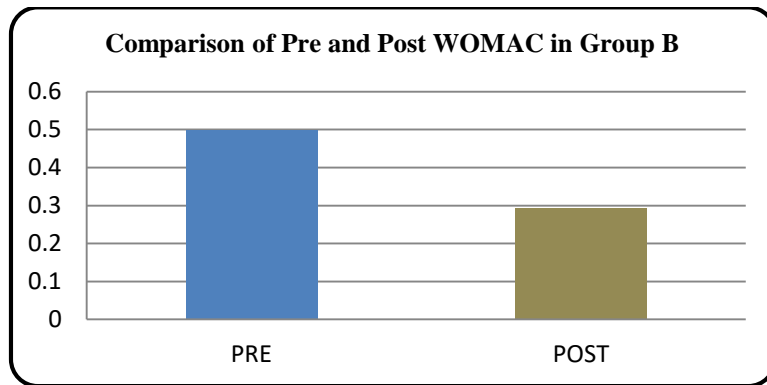
Time	Mean	SD	Mean Difference	SD Difference	T-Value	P-Value
Pre-test	6.533	0.9722	2.067	0.7287	10.985	<0.0001
Post-test	4.467	1.026				



The above table showed that difference in VAS in Group B before and after was significant. The two-tailed P value is  $< 0.0001$ , considered extremely significant.  $t = 10.985$  with 14 degrees of freedom

**TABLE 5: Comparison of Pre and Post WOMAC in Group B**

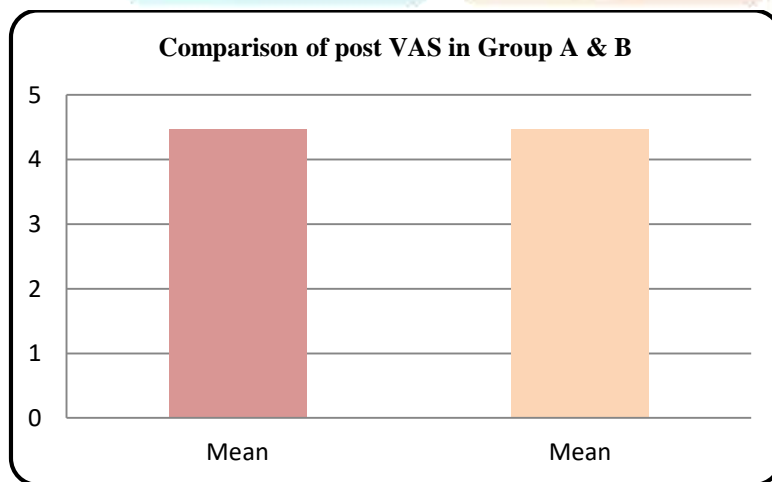
Time	Mean	SD	Mean Difference	SD Difference	T -Value	P -Value
Pre	0.498	0.0902	0.2040	0.07953	9.934	$< 0.0001$
Post	0.294	0.0526				



The above table showed that difference in WOMAC in Group B before and after was significant. The two-tailed P value is  $< 0.0001$ , considered extremely significant.  $t = 9.934$  with 14 degrees of freedom.

**TABLE 6: Comparison of post and post VAS in Group A & Group B**

Time	VAS (Group A)	VAS (Group B)
	Mean	Mean
Post	4.4666	4.4666

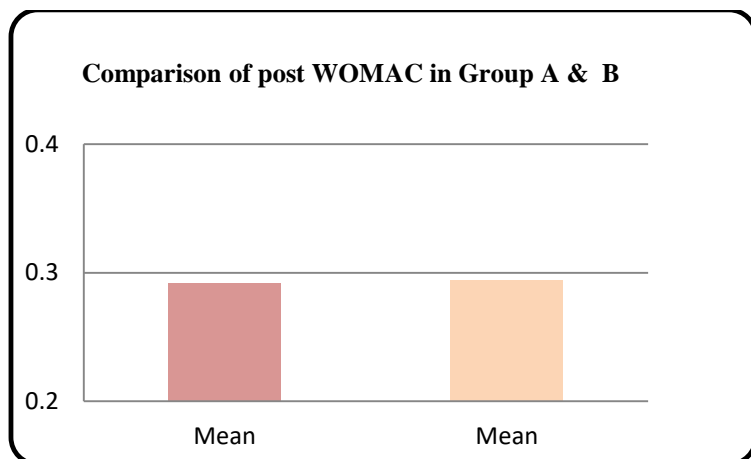


The two-tailed P value is  $> 0.9999$ , considered not significant.  $t = 0.000$  with 28 degrees of freedom.

**TABLE 7: Comparison of post WOMAC in Group A & Group B**

Time	WOMAC (Group A)	WOMAC (Group B)
	Mean	Mean
Post	0.292	0.294





The two-tailed P value is 0.9187, considered not significant.  $t = 0.1030$  with 28 degrees of freedom.

## DISCUSSION:

This comparative study was done to find out the efficacy of kinaesthesia & balance exercise with open chain exercise in improving functional performance in knee osteoarthritis. The study was conducted on 30 subjects in a community. Women and Men with the age of 60-70 years were included in the study. The subjects were divided into two groups, Group A was given Kinaesthesia & Balance exercises and group B was given open chain exercises. A pretest outcome measures i.e VAS and WOMAC were given. Interventions were carried out for 3 weeks. The results were derived by using statistical methods with the help of statistics software GRAPHPEP INSTAT.

After statistical analysis there was significant differences in pretest and post values within two Outcome variables of each group but there was no significant differences seen when two outcome measures of each group were compared. The study showed that both groups are effective in reducing pain and improving functional performance in knee osteoarthritis.

The effectiveness of both group can be explain by the following physiology of both intervention

Open kinetic chain exercise play an important role in isolating individual muscle group. it tends to generate more distraction and rotational forces and is often used with concentric muscle contraction.

In kinesthesia and balance exercise parameter of functional status and motor control improved better. This might be the result of improvement of dynamic stabilization by the synergistic and synchronous working of the muscle group. Similarly repetitive movements that are used in daily life exercises might have contributed to this improvement.

## LIMITATIONS AND RECOMENDATIONS:

The studies can be done on a large population, it can be done on patients more than 70 years of age. The studies can be done on with the protocol of more than 3 weeks. The studies can be done on population affected with secondary OA.

The study could have included patients with less than 60 years of age and it could have been done on a large population.

## CONCLUSION:

This study concludes that kinesthesia and balance exercise & open chain exercise both are effective in improving functional performance in knee osteoarthritis.

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