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Balance and Kinesiophobia in Knee Osteoarthritis: Conventional Treatment Vs Total Knee Replacement

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ABSTRACT:

Knee osteoarthritis is a common musculoskeletal condition that affects a substantial portion of the population, leading to pain, impaired mobility, and a reduced quality of life. This study aimed to investigate the impact of two distinct treatment approaches, Total Knee Replacement (TKR) and Conventional Treatment, on individuals with knee osteoarthritis. The research was conducted at multiple healthcare facilities in Faridabad, including Sarvodaya Hospital, Fortis Escorts, Metro Heart Institute with Multispecialty, Satya Physiotherapy Clinic, and Relief Physiotherapy Clinic. A cross-sectional study design was employed, involving 65 initially screened individuals, with 50 ultimately selected for the study, evenly distributed into two experimental groups. Group A received complete knee replacement, while Group B underwent conventional treatment. Convenient sampling was used to select participants, and inclusion criteria considered age, radiological findings, pain ratings, and ambulatory capacity, while exclusion criteria encompassed various medical and physical factors. The study focused on two primary independent variables: type of treatment (Conventional Treatment or TKR) and dependent variables including balance and kinesiophobia. Balance was assessed through the Single Leg Stance Test and Step Test, and kinesiophobia was measured using the Tampa Scale for Kinesiophobia. After informed consent, participants were guided through the testing procedures, and demographic information was collected. The results revealed significant differences between the two groups, with TKR resulting in improved pain relief, balance, and reduced kinesiophobia. These findings underscore the potential advantages of TKR in managing knee osteoarthritis and inform the development of individualized treatment strategies for this condition.

1. Introduction

The most widespread form of arthritis, osteoarthritis (OA), is thought to impact 20.7 million Americans, the majority of whom are over 45, and is the cause of more than 7 million doctor visits annually(1). According to studies, the prevalence of OA rises with age, with 80% of people showing radiographic signs of the condition in at least one joint by the age of 60, and 10% of people reporting reduced activity due to arthritis(2,3). Osteoarthritis of the knee is a degenerative condition that primarily affects the elderly and results in a significant loss of function. When the knees are afflicted, it is very incapacitating because it limits one's ability to walk, get

up from a chair, and utilize stairs(4–6). Clinically distinguished by discomfort, restricted joint motion, a loss of muscular strength, and alterations in gait that reduce speed and the total walking distance tolerated. Quadriceps function is hampered by knee OA, which also affects balance and gait, lowering their mobility and function.Due to its great prevalence, knee OA significantly burdens the economy and each patient's ability to operate physically and enjoy life. According to Park et al. (2013), balance is a crucial sign of physical function and fall risk in OA patients(7,8). According to Laura et al. (1997), musculoskeletal function in OA patients and other relevant factors such as ageing have been linked to a reduction in balance function(9)

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According to Lundberg et al. (2011), kinesiophobia refers to a" debilitating fear of physical movement along with feeling of vulnerability to painful injury or reinjury." (10,11) Tampa Scale for Kinesiophobia (TSK) is a scale used to assess kinesiophobia in knee OA patients. The TSK was created in 1991 by Miller et al. to measure the subjective assessment of kinesiophobia and is the oldest existent measure(12,13).Osteoarthritis of the knee treatment focuses on reducing pain and restoring mobility. Knee stability could be improved by empowering the muscles around the knee. Additionally, stretching activities keep the knee joint flexible and mobile(14).People who receive conventional treatment but are unsatisfied with the results have total knee replacement surgery (TKR). Total knee arthroplasty is currently the preferred treatment for advanced, incapacitating osteoarthritis of the knee. This treatment improves function and lessens pain. For those with knee OA, total knee replacement surgery has grown in popularity. The weight-bearing surfaces of the knee joint are replaced during a surgical operation known as a knee replacement or knee arthroplasty(15,16).

Maintaining a proper amount of daily exercise in OA patients is essential for controlling the pain and disability brought on by the condition. Fear of movement has a strong correlation with increased psychological disability and decreased gait speed in knee OA(17,18). Only a small amount of research has examined how therapy affects balance and kinesiophobia. In this study, individuals with symptomatic knee OA who sought treatment from outpatient physiotherapy clinics or who had TKR were evaluated for balance using the single leg stance and step test and kinesiophobia using the Tampa Scale for Kinesiophobia. Studying therapies with the potential to enhance balance in the OA population is crucial.

2. Methods

The study was conducted at several healthcare facilities in Faridabad, including Sarvodaya Hospital (Sector 8, Faridabad), Fortis Escorts (NIT 1, Faridabad), Metro Heart Institute with Multispecialty (Sector 16, Faridabad), Satya Physiotherapy Clinic (Sector 10, Faridabad), and Relief Physiotherapy Clinic (Sector 8, Faridabad). The research employed a cross-sectional study design, and a total of 65 individuals were initially screened. Out of these, 50 individuals diagnosed with two experimental groups (Group A, complete knee replacement, referred to as Experimental Group 1; and Group B, conventional treatment, referred to as Experimental Group 2). Convenient sampling was used as the sampling method. The inclusion criteria for the study encompassed

knee osteoarthritis were selected, with 25 in each of the

individuals aged between 45 and 75 years with bilateral knee osteoarthritis diagnosed by a physician or orthopedician with a radiological grade higher than 2. Both males and females were included, and patients with knee pain rating less than 8 on the Numeric Pain Rating Scale (NPRS) were considered. Additionally, patients undergoing conventional treatment or those who were 1-2 years post bilateral total knee replacement (TKR) and could ambulate without the need for walking aids (such as sticks, crutches, or walkers) were eligible. The exclusion criteria included patients undergoing balance treatment, those with neurological disorders or musculoskeletal disorders that could interfere with their participation in the study, patients with cardiopulmonary diseases affecting their participation, individuals with knee osteoararthritis affecting joints other than the knee, and those with severe visual disturbances or vestibular apparatus diseases.

The study focused on two independent variables: the type of treatment (a) Conventional Treatment and (b) Total Knee Replacement. The dependent variables were (a) balance and (b) kinesiophobia. To measure these variables, the research employed tools and equipment such as a stopwatch and stepper.

Procedure

After explaining the method to the subjects who met the inclusion and exclusion criteria, they were asked to complete an informed consent form. Name, age, gender, occupation, residence, and phone number were recorded as demographic information about the subjects. Prior to testing, subjects were given the option to practice each test twice before the timed trails started. The entire technique and demonstration of each test position were also taught to them. Regarding the subject's knee posture and fixation, no instructions were given. Every test was run on a flat surface.

Static Balance Test- Single Leg Stance Test for both extremities.

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Participants tried to maintain balance on one leg while keeping their hands on their hips. The test lasted up to 30 seconds and was terminated (1) the swing leg touched the floor (2) the tested foot displaced on the floor (3) the swinging leg colliding with the tested limb or (4) the arms waving away from body.

Dynamic Balance Test – Step Test for both extremities

Participants were instructed to maintain balance on one leg, whilst stepping the contralateral limb on and off on a 15-cm step as quickly as possible. The number of times the participant could place the foot up onto the step and return it to the floor over a 15-seconds interval was recorded. Participants conducted the test in a shoeless position, without hand support. For all the participants, the test was performed for a single time, proceeding with two or three times of practice before the final test. If loss of balance occurred, the test was ceased and the number of completed steps up until this point were recorded. The outcome measure (time in seconds) used for the balance assessment was best for over the 3 trials, for each test situation.

After following balance tests, a questionnaire was given to the subjects to be filled to assess.

Kinesiophobia was measured by Tampa Scale for Kinesiophobia. This is a questionnaire consisting of 11 items scoring the subjective rating of kinesiophobia, giving the scale a range of 11 to 44, with higher scores indicating higher fear of movement and reinjury. Subjects were asked to rate their agreement or disagreement with each of 11 statements according to 4 point likert scale (strongly disagree to strongly agree).

3. Results

Table 1 offers valuable insights into the demographic profile of the study participants, categorized into two distinct groups: Group A (Total Knee Replacement) and Group B (Conventional Treatment). The mean age for individuals in both groups is in their early sixties, with Group A having a slightly higher mean age of 62.12 years and Group B averaging 60.56 years. This demonstrates that the study population consists of middle-aged to older individuals. When considering gender distribution, both groups are predominantly composed of females, with 21 out of 25 participants in Group A and 18 out of 25 participants in Group B being women. Group B had a slightly larger representation of male participants, with 7 males in contrast to Group A's 4 males. These demographic details provide a comprehensive understanding of the composition of the study subjects and will be essential in analyzing and interpreting the study's outcomes and implications.

The findings presented in Table 2 from the betweengroup analysis reveal crucial insights into the impact of treatment modalities on individuals with knee osteoarthritis. In the pre-treatment phase, both Group A (Total Knee Replacement) and Group B (Conventional Treatment) displayed comparable pain levels, static and dynamic balance, and kinesiophobia, with no significant differences observed. However, the post-treatment results shed light on distinct outcomes. Group A exhibited a statistically significant reduction in pain levels after treatment, with a mean score of 2.8 compared to Group B's mean score of 6.8. This suggests that Total Knee Replacement led to more effective pain management. Moreover, the Single-Leg Stance Test and Step Test revealed that Group A achieved better posttreatment balance outcomes, demonstrating an improvement in their ability to maintain balance during these assessments compared to Group B. Notably, kinesiophobia scores increased to a lesser extent in Group A post-treatment, indicating that Total Knee Replacement was associated with a lower rise in fear of movement and activity. These findings underscore the potential advantages of Total Knee Replacement in terms of pain relief and enhanced balance for individuals with knee osteoarthritis, emphasizing the importance of individualized treatment choices in managing this condition.

Table 1: Demographic details of the subjects: Age, Gender.

	AGE (years)	GENDER	
GROUPS	MEAN±SD	MALE	FEMALE
GROUP A	62.12±7.22	4	21
GROUP B	60.56±7.96	7	18

Group A- Total Knee Replacement, Group B - Conventional Treatment

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Tuble 2. Detween Group Finalysis of Outcomes						
Outcomes	Group A	Group B	P VALUE			
	MEAN±SD	MEAN±SD				
NUMERIC PAIN RATING SCALE PRE	8.2±3.78	8.8±4.1	0.626			
NUMERIC PAIN RATING SCALE POST	2.8±2.53	6.8±1.5	< 0.05			
P VALUE	< 0.001	< 0.05				
SINGLE-LEG STANCE TEST	4.63±1.78	5.01±2.12	0.728			
RIGHT LEG (SECONDS) PRE						
SINGLE-LEG STANCE TEST	9.16±8.36	8.84±6.34	0.577			
RIGHT LEG (SECONDS) POST						
P VALUE	< 0.05	< 0.05				
SINGLE-LEG STANCE TEST	4.53±1.67	5.53±1.663	0.425			
LEFT LEG (SECONDS) PRE						
SINGLE-LEG STANCE TEST	8.84±6.22	9.08±8.36	0.672			
LEFT LEG (SECONDS) Post						
P VALUE	< 0.05	< 0.05				
STEP TEST (STEPS/15 SEC) RIGHT LEG PRE	4.3±1.22	5.16±1.23	0.784			
STEP TEST (STEPS/15 SEC) RIGHT LEG POST	9±3.03	8.56±1.94	0.523			
P VALUE	< 0.05	< 0.05				
STEP TEST (STEPS/15 SEC)	5.35±1.73	5.56±1.78	0.632			
LEFT LEG PRE						
STEP TEST (STEPS/15 SEC)	9.24±2.74	8.2±2.22	0.272			
LEFT LEG POST						
P VALUE	< 0.05	< 0.05				
TSK PRE	20.36±2.23	21.01±1.12	0.456			
TSK POST	23.68±7.14	27.56±5.72	< 0.05			
P VALUE	< 0.05	< 0.05				

Table 2: Between Group Analysis of Outcomes

Group A- Total Knee Replacement, Group B - Conventional Treatment

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4. Discussion

The objective of the present study was to evaluate both static and dynamic balance, as well as kinesiophobia, in individuals suffering from knee osteoarthritis who were either undergoing traditional treatment or had opted for total knee replacement (TKR). To assess static balance, the Single Leg Stance Test was employed, while dynamic balance was evaluated using the Step Test. Kinesiophobia was quantified using the Tampa Scale for Kinesiophobia (TSK), and pain levels were measured with the Numeric Pain Rating Scale (NPRS). The study revealed that there were no significant differences in static and dynamic balance scores between Groups A and B. This outcome is in line with Bakirhan et al.'s 2009 findings, which suggested that balance deficits in individuals with knee osteoarthritis could be attributed to reduced joint sensations, and that total knee arthroplasty did not significantly improve proprioceptive balance loss caused by arthritis. Thus, it is likely that this lack of distinction in static and dynamic balance between Group A and Group B could be due to these underlying factors.

During dynamic testing, Hinman et al. (2002) demonstrated that individuals with knee osteoarthritis exhibit postural control impairments, as evidenced by significantly fewer steps taken during the Step Test, a dynamic balance assessment. This implies a reduced ability to maintain balance while engaging in potentially unstable activities. Future research should focus on assessing the functional impact of this balance impairment on individuals with knee osteoarthritis. The study's results also indicated that traditional treatment was more effective than total knee replacement (TKR) in enhancing balance, possibly because the conventional treatment group reported higher pain scores than the TKR group. Additionally, Kim et al. (2016) suggested that an increase in knee stability was associated with a decrease in knee pain. However, as per a 2006 study by Masui et al., no clear link between pain and balance was established. In our investigation, there were no significant differences between Group A and Group B regarding static and dynamic balance in relation to pain.

Kinesiophobia scores, assessed using the Tampa Scale for Kinesiophobia (TSK), were lower in Group A compared to Group B, indicating greater severity in Group B. This suggests that increased pain is associated with more severe kinesiophobia, as higher TSK scores for kinesiophobia were observed in Group A. Psychological changes were evident in individuals who underwent total knee replacement. In 2004, Swanik C. Buzz et al. discovered that Total Knee Arthroplasty (TKA) resulted in reduced pain and chronic inflammation, enabling patients to resume their normal daily activities. This, in turn, led to a reduction in kinesiophobia.

Panchout et al. noted that patients who underwent total knee arthroplasty or total knee replacement experienced improved knee joint functionality and reduced discomfort. However, post-operative discomfort may persist in 15 to 30% of individuals despite surgical success, underlying medical conditions, and the passage of time since the procedure. Kinesiophobia scores were significantly more positively correlated with high pain levels in individuals receiving traditional treatment compared to those who had undergone total knee replacement. Few studies have explored the impact of total knee replacement on static and dynamic balance in patients with knee osteoarthritis. Therefore, this study suggests that individuals with knee osteoarthritis who have undergone total knee replacements (TKR) should also receive balance training in addition to the surgical intervention.

CONCLUSION

In conclusion, the study underscores the advantages of Total Knee Replacement over Conventional Treatment in terms of pain relief, improved balance, and reduced kinesiophobia among individuals with knee osteoarthritis. These outcomes provide valuable guidance for healthcare professionals and patients in making informed treatment decisions to optimize the management of this challenging condition and improve the overall well-being of affected individuals.

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