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Prevalence of balance and postural stability in individuals with unilateral and bilateral osteoarthritis knee using BES test scale

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Abstract

Background: Postural control is of fundamental importance to human actions in unstable conditions, and versatile enough to allow rapid starts of movement. The maintenance of the postural balance depends on the integrity of the sensory interaction by the central nervous system, which involves visual and spatial perception, an effective muscle tone, which adapts quickly to change, and finally muscle strength and joint flexibility.

Osteoarthritis (OA) is a degenerative and progressive joint disease that mainly involves weight-bearing joints such as the hip, knee, and ankle. It is considered as one of the leading causes of lower limb disabilities among the elderly. People with knee OA experience loss of proprioception, which may affect postural stability and risk of fall. OA is more common in women than men, but the prevalence increases dramatically with age.

There are balance impairments associated with aging. Age related decline in the ability of above systems to receive and integrate sensory information contributes to poor balance.

Purpose: To study prevalence of balance and postural stability in individuals with unilateral and bilateral OA knee using BES Test scale.

Method: Observational study consist of 60 diagnosed OA subjects age between 40 to 70 years.

Sampling Method- Simple Random Sampling.

Inclusion Criteria- Male and Female, according to Kellgren – Lawrence classification scale for osteoarthritis severity in individuals grading 1 and 2. Age group from 40 to 70 years. BMI - 18.5kg/m² to 24.9kg/m²

Exclusion Criteria- Any neurological conditions that affects balance. Lower limb joint replacement, knee surgery. Lower limb fractures during past 6 months. Any musculoskeletal congenital problems.

Result: The study shows that there is significant prevalence of balance and postural stability in individuals with unilateral and bilateral OA knee.

Conclusion: The study concludes that the prevalence of balance and postural stability in bilateral OA knee is more than that of unilateral OA knee.

Keywords: Balance and postural stability, osteoarthritis knee

Introduction

Postural control is of fundamental importance to human actions in unstable conditions, and versatile enough to allow rapid starts of movement ^[1]. It has the ability to keep the body stable, due to the maintenance of the projected mass center within the area of support formed by the base feet ^[2-4]. The maintenance of the postural balance depends on the integrity of these systems, but also on the sensory interaction by the central nervous system, which involves visual and spatial perception, an effective muscle tone, which adapts quickly to change, and finally muscle strength and joint flexibility ^[4]. The sensory organization consists of the ability of the CNS in selecting, supplying, and matching the vestibular, visual, and proprioceptive stimuli ^[4].

Osteoarthritis (OA) is a degenerative and progressive joint disease that mainly involves weight-bearing joints such as the hip, knee, and ankle. It is considered as one of the leading causes of lower limb disabilities among the elderly ^[5]. People with knee OA experience loss of proprioception, which may affect postural stability and risk of fall ^[9-11]. OA is more common in women than men, but the prevalence increases dramatically with age ^[12]. There are balance impairments associated with aging.

Age related decline in the ability of above systems to receive and integrate sensory information contributes to poor balance [4]. BES Test is the quantitative assessment tool that aims to identify the disordered systems underlying the postural control responsible for poor functional balance.

1. Problem Statement

To study prevalence of balance and postural stability in individuals with unilateral and bilateral OA knee using BES Test scale.

2. Objective

- To assess Balance and Postural Stability in Unilateral OA knee using Balance Evaluation System Test (BES Test)
- To assess Balance and Postural Stability in Bilateral OA knee using Balance Evaluation System Test (BES Test)
- To find the prevalence rate of Balance and Postural Stability in Individuals with Unilateral and Bilateral OA knee using Balance Evaluation System Test (BES Test).
- To find the difference between Unilateral and Bilateral OA knee using Balance Evaluation System Test (BES Test)

3. Methodology-

- Study design : Observational
- Sampling method : Simple random sampling
- Sample size : 60
- Study area : PCMC
- Population : OA Knee Patients
- Study duration : One time study

A. Inclusion criteria

Male and female, according to Kellgren-Lawrence classification scale for osteoarthritis severity in individuals grading 1 and 2. (Grade 1- Doubtful narrowing of joint space, possible osteophytic lipping & Grade 2- Possible narrowing of joint space, definite osteophytes.)
Age group from 40 to 70 years BMI - 18.5kg/m2 to 24.9kg/m2

B. Exclusion criteria

Any neurological conditions that affects balance. Lower limb joint replacement, knee surgery. Lower limb fractures during past 6 months. Any musculoskeletal congenital problems.

5. Outcome measures

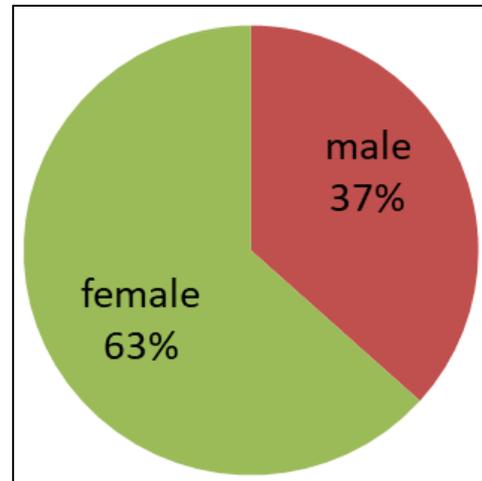
Balance Evaluation – Systems Test (BES Test scale)

6. Procedure

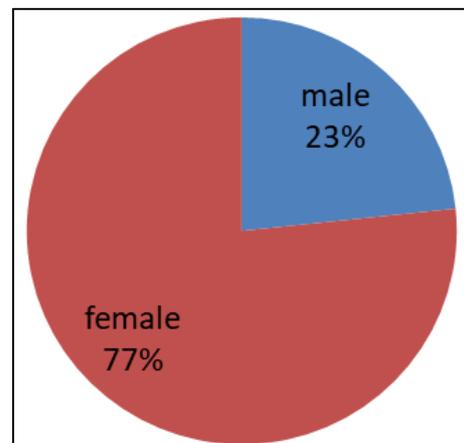
Ethical approval was taken from the ethical committee. Subjects were selected as per the inclusion and exclusion criteria. Written and signed Consent of subjects were taken. Detailed assessment of all the participants was done. The test was performed by using BES Test scale and all the findings were noted.

7. Result and Interpretation

The below graph1 and graph 2 shows the number of male and female population in unilateral and bilateral group.



Graph 1: Unilateral group



Graph 2: Bilateral group

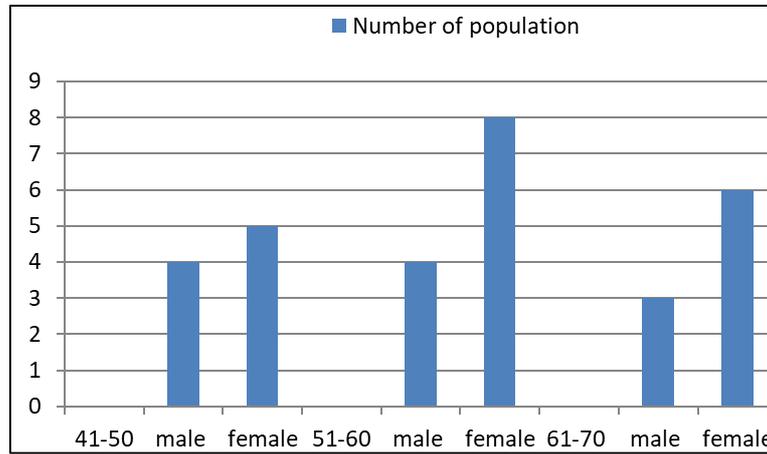
Interpretation: Out of total 30 subjects in unilateral group (graph 1) 37% subjects are male whereas 63% subjects are female. Out of 30 subjects in bilateral group (graph 2) 23% subjects are male whereas 77% subjects are female. Table 1(A & B) and Graph 3(A & B) represents the total number of subjects in the components of BES Test scale in each age group.

Table 1 (A): Represents the total number of subjects in the components of BES Test scale in each age group

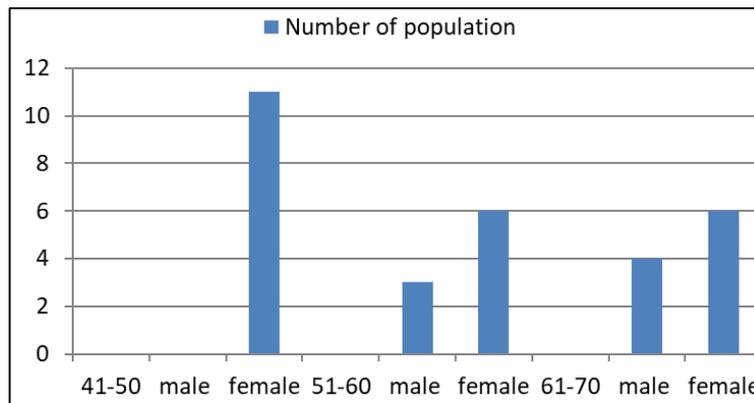
Age group	Unilateral group	Number of population
41-50	Male	4
	Female	5
51-60	Male	4
	Female	8
61-70	Male	3
	Female	6

Table 1 (B): Represents the total number of subjects in the components of BES Test scale in each age group

Age group	Unilateral group	Number of population
41-50	Male	0
	Female	11
51-60	Male	3
	Female	6
61-70	Male	4
	Female	6



Graph 3(A): Unilateral group

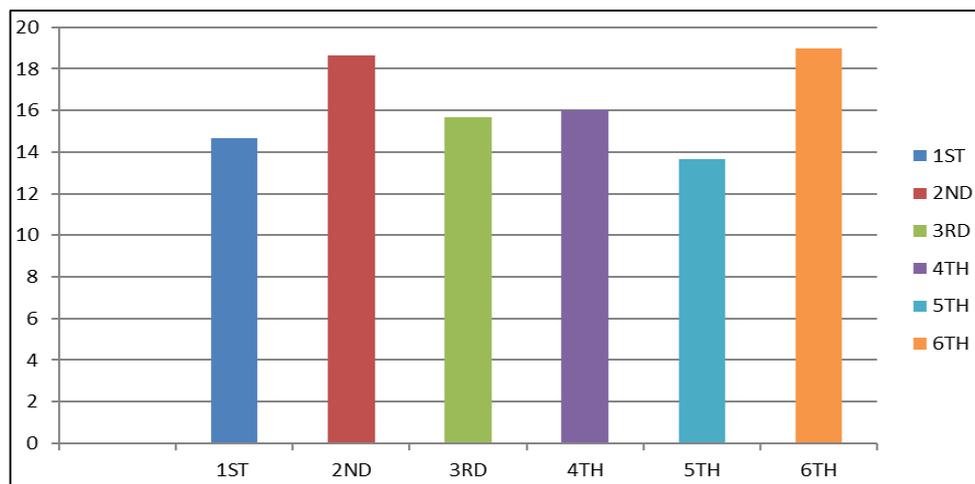


Graph 3(B): Bilateral group

Interpretation

Out of total 30 subjects in unilateral group, from age group 41-50 there were 4 males and 5 females, from age group 51-60 there were 4 males and 8 females and from age group 61-70 there were 3 males and 6 females.

Out of total 30 subjects in bilateral group, from age group 41-50 there were 0 males and 11 females, from age group 51-60 there were 3 males and 6 females and from age group 61-70 there were 4 males and 6 females.

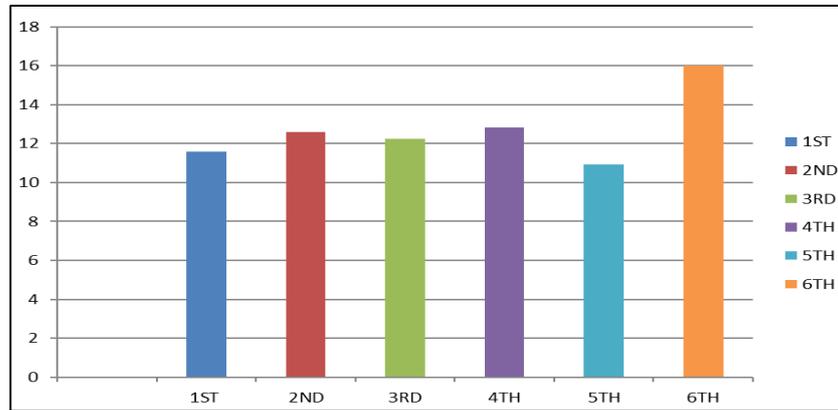


Graph 4: Mean Value of Age Group 41-50 (U/L)

The below graph shows the Mean value of affection in components of BESTest scale from age group 41-50 years in unilateral population.

Interpretation- The mean value among 9 individuals for 1st component (biomechanical constraints) is 14.66, for 2nd

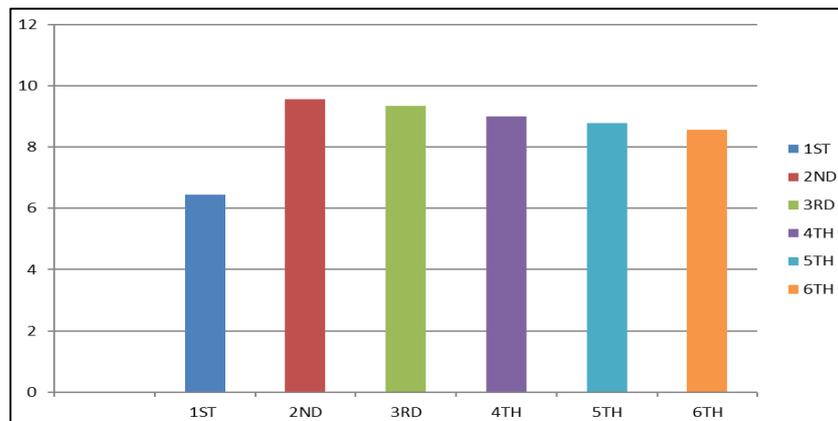
component (stability limit) is 18.66, for 3rd component (transitions) is 15.66, for 4th component (reactive postural response) is 16, for 5th component (sensory orientation) is 13.66 and for 6th component (stability in gait) is 19.



Graph 5: Mean Value of Age Group 51-60 (U/L)

The below graph shows the Mean value of affection in components of BES Test scale from age group 51-60 years in unilateral population.

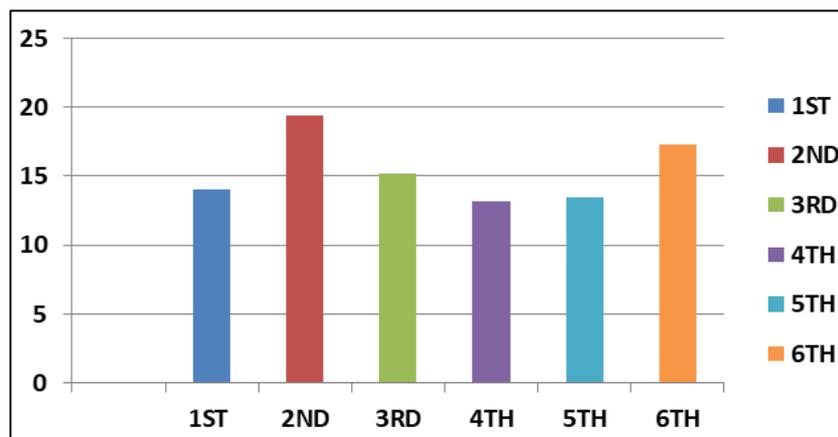
Interpretation- The mean value among 12 individuals for 1st component is 11.58, for 2nd component is 12.58, for 3rd component is 12.25, for 4th component is 12.83, for 5th component is 10.91 and for 6th component is 16.



Graph 6: Mean Value of Age Group 61-70 (U/L)

The below graph shows the Mean value of affection in components of BESTest scale from age group 61-70 years in unilateral population.

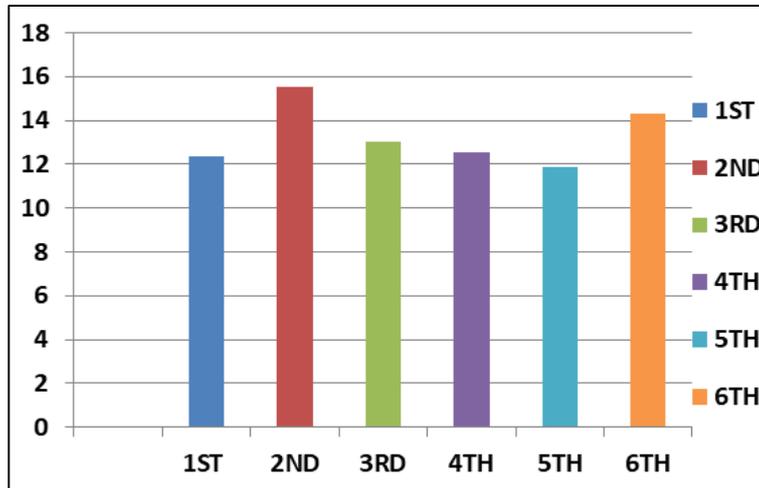
Interpretation- The mean value among 9 individuals for 1st component is 6.44, for 2nd component is 9.55, for 3rd component is 9.33, for 4th component is 9, for 5th component is 8.77 and for 6th component is 8.55.



Graph 7: Mean Value of Age Group 41-50 (B/L)

The below graph shows the Mean value of affection in components of BES Test scale from age group 41-50 years in bilateral population.

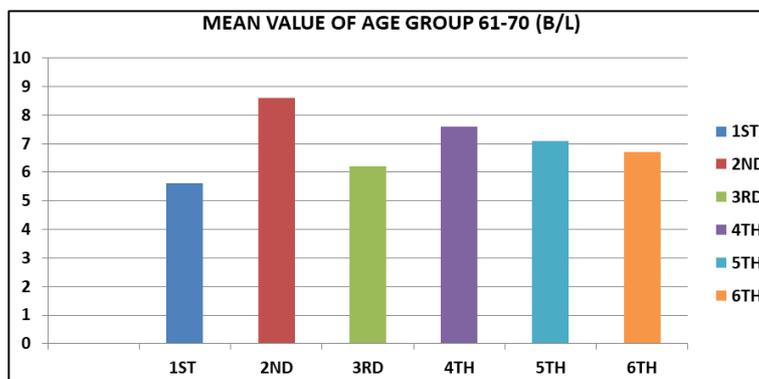
Interpretation: The mean value among 11 individuals for 1st component is 14, for 2nd component is 19.36, for 3rd component is 15.18, for 4th component is 13.18, for 5th component is 13.45 and for 6th component is 17.27.



Graph 8: Mean Value of Age Group 51-60 (B/L)

The below graph shows the Mean value of affection in components of BESTest scale from age group 51-60 years in bilateral population.

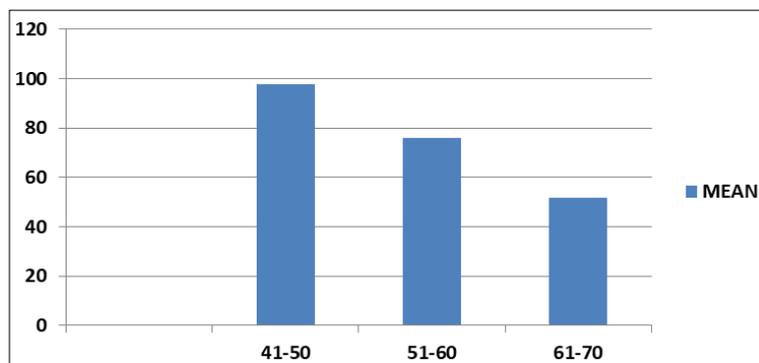
Interpretation: The mean value among 9 individuals for 1st component is 12.33, for 2nd component is 15.55, for 3rd component is 13, for 4th component is 12.55, for 5th component is 11.88 and for 6th component is 14.33



Graph 9: Mean Value of Age Group 61-70 (B/L)

The below graph shows the Mean value of affection in components of BESTest scale from age group 61-70 years in bilateral population.

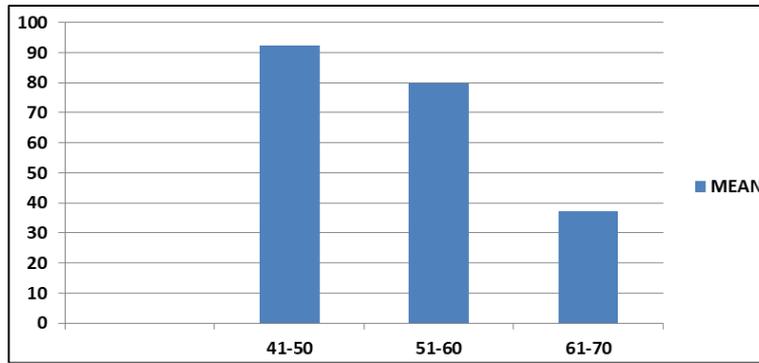
Interpretation: The mean value among 10 individuals for 1st component is 5.6, for 2nd component is 8.6, for 3rd component is 6.2, for 4th component is 7.6, for 5th component is 7.1 and for 6th component is 6.7.



Graph 10: Mean Value of U/L

The below graph shows the mean value of total of all 6 components in unilateral population.

Interpretation: The mean value of total of all 6 components in age group 41-50 is 97.66, in age group 51-60 is 75.75 and in age group 61-70 is 51.66.



Graph 11: Mean Value of B/L

The below graph shows the mean value of total of all 6 components in bilateral population.

Interpretation: The mean value of total of all 6 components in age group 41-50 is 92.45, in age group 51-60 is 79.66 and in age group 61-70 is 37.14

Table 2: shows the P value of all age groups in unilateral and bilateral population.

	Mean Value	P Value
Unilateral (41-50)	97.66	0.009961923
Bilateral (41-50)	92.45	
Unilateral (51-60)	75.75	0.003502514
Bilateral (51-60)	79.66	
Unilateral (61-70)	51.66	0.016449456
BILATERAL (61-70)	37.14	

Interpretation

P value of 41-50 years in unilateral and bilateral population is 0.009961923 which is significant.

P value of 51-60 years in unilateral and bilateral population is 0.003502514 which is significant.

P value of 61-70 years in unilateral and bilateral population is 0.016449456 which is significant.

8. Discussion

Evaluating balance can be an important part of the rehabilitation programs. Balance disorders are growing public health problems due to their association with falls and fall-related injuries. Deficits in lower limb proprioception are associated with knee OA and thus may be postulated as a cause of impaired balance. Decreased postural stability causes difficulties in performing activities of daily living which would affect the patient's quality of life.

Na fiseh Khalaj, Abdul Halim Mokhtar, (2014) *et al* concluded that bilateral knee osteoarthritis impaired the balance and increased the risk of fall, particularly in people with moderate knee osteoarthritis.

Lee PA, Wang TM *et al* aimed to identify the effects of bilateral medial compartment knee OA on the whole-body balance control during level walking, in terms of COM-COP IA and RCIA. Their result suggested that bilateral severe medial compartment knee OA compromised the COM-COP control in older adults during gait, which may be related to the increased risk of falling in this population.

Hassan *et al.* and Wegener *et al.* demonstrated increased postural sway in subjects with knee OA when standing on a firm surface, with eyes open and closed, in both AP and lateral directions. In contrast, Hurley and colleagues were unable to detect a deficit in body sway in individuals with OA, despite the OA group being more unsteady as a whole when compared with controls.

Different assessments and devices are available for evaluation of balance and risk of fall. Some methods were Swaymeter, Balance Performance Monitor and Biodex stability system. Although different assessments were recruited for assessing balance in knee OA patients, the results were in concordance with each other, and demonstrated that individuals with knee OA have impaired balance.

According to our knowledge, very few studies used BES Test scale for assessing balance in individuals with knee OA, as well as, few considered only bilateral mild and moderate knee OA. This recent study which used BES Test scale for balance assessment for both unilateral and bilateral knee OA illustrated that although the total of all 6 components showed affection in both the groups, individuals with bilateral knee OA displayed lower balance and postural stability than that of unilateral knee OA in their components, which means that balance and postural stability is decreased in patients with bilateral knee OA than in unilateral knee OA. Our results support those of previous studies that reported impaired balance and higher risk of fall in knee OA patients compared to healthy controls. Importantly, this impairment was more noticeable in moderate knee OA patients.

9. Conclusion

The above study concludes that the prevalence of balance and postural stability in bilateral OA knee is more than that of unilateral OA knee.

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