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[ORIGINAL ARTICLE]

Association of Postural Sway with Kellengren Lawrence Grade II and III of Osteoarthritis of Knee Joint among Elderly Population.

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ABSTRACT :

Background: Postural sway is very common in elderly population. It is mainly associated with balance. There are two factors, Decreased proprioception –which leads to sway when walking and increased reliance on vision. Vestibular weakness – as the person ages it's common to have a vestibular deficit which affects gaze stability and ability to turn head which affects balance. This may cause fall and increase the risk of injury.

Objective:

1. To investigate the postural sway according to different grades of OA knee.2. To find out association of postural sway with different grades of OA knee. 3. To find out postural sway in both males and females. 4. To find out postural sway in different age groups in elderly (young old, middle old and old- old).

Methodology: It was a cross-sectional study. Total 60 elderly patients with OA knee were included using simple random sampling method and baseline data was collected from them as well as postural sway was measured. The postural sway test was performed with eyes open and eyes closed conditions in Osteoarthritis knee patients for sway in all four directions. The data was collected and analyzed.

Result: All 60 subjects having more sway in anterior and left lateral direction with both eyes open and eyes closed condition compared to their sway in posterior and right lateral direction.

Conclusion: This study concludes that more sway was observed in anterior and left lateral direction both with eyes opened and eyes closed compared to posterior and right lateral direction in all Grade II ,Grade III patients, all male and female ,young old and middle old subjects. While in old patients the sway was found more in anterior and right lateral direction compared to posterior and left lateral direction.

Keywords: Elderly population, Osteoarthritis of knee, postural sway, Postural Sway Meter

Introduction:

The knee is the most commonly injured weight bearing joint, and Osteoarthritis of the knee is known to be a risk factor for fall injuries[1]. Knee osteoarthritis (OA) causes changes not only within the tissues within the articular cartilage, but also the ligaments, tendons, and periarticular tissues including the muscle[2,3] . It is widely known that patients with Osteoarthritis knee have a disability in their proprioception compared to similar age controls[4,5]. Postural sway is defined as the movement of the body in still position. Balance is generally defined as a person's ability to maintain or restore the equilibrium state of upright stance, without having to change the base of support[6]. Studies have suggested falls in the elderly are attributed to difficulties adapting one's balance in response to changes in sensory information[7]. As well as increased sway within the anterior-posterior and medio-lateral directions compared to young adults[8]. Plain radiography is a mainstay in the diagnosis of OA[9]. Kellgren and Lawrence (KL) proposed a five-grade classification scheme and examined plain radiographs of eight joints[9]. In our study, self-made sway meter was used which was constructed on the guidelines of lord and Sherrington's sway meter. It is

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a useful field test, as it is lightweight, has short administration and data processing time. Knee joint osteoarthritis has been known to cause proprioceptive deficit leading to difficulty in maintaining the balance and increasing postural sway. Also there is a lack in literature regarding the association between postural sway and knee osteoarthritis. Thus, assessment can be carried out in a variety of community settings and health care facilities [10].

Material and Methodology:

This was an Observational, Cross- sectional study. A total 60 elderly patients ,were recruited using Simple random sampling (purposive) method at Vikhe Patil Hospital physiotherapy department along with various community settings in Ahmednagar . The study material used was Sway meter, Graph paper, foot print, Cardiac table, Pen. The inclusion criteria was both males and females, elderly patients (age group 65 -86 year) with Osteoarthritis diagnosed by the physiotherapist based on Kellengren and Lawrence grading, willing to participate in study. While the exclusion criteria was any musculoskeletal injuries like fracture at knee, any neurological condition like PNI (Peripheral Nerve Injury), and subject with recent surgery.

Fig 1 : Postural Sway Meter

Fig2: Grap hshowing measurements

Fig. 3: Foot print

Procedure:

This study was done to find out the postural sway among elderly OA knee (unilateral and bilateral) patients ,using postural sway meter. The entire procedure involved in the study was explained to each participant and their written informed consent taken. The postural sway meter is made up of firm belt and 40 cm inflexible rod with vertically mounted pen at its end is attached to it. The rod is mounted with 20 cm wide metal plate which will be fitted at the level of Posterior superior iliac spine (PSIS). The postural sway was recorded on sheet of graph paper (in milli-meters) which was place over the table height of which was modified according to PSIS heights of patients. Normally postural sway were seen in anterior, posterior, right, and left direction. The individual was asked to stand upright by keeping the hands by the side of body. The patients had also been instructed to stand bare foot on the foot prints. The distance between the feet was 3 inches. Total 6 trials were done, 3 with eyes open and 3 with eyes closed and the maximum of the 3 readings was taken for analysis.5-10 seconds rest can be given during trial, but they were not allowed to move away from the foot print.

If the patient moved away from the footprint the reading was taken again. After the end of each trial, the non- measuring period was informed to the subject. The procedure was repeated for each trial. The duration of each trial was 30 sec .Maximum duration for all trial was be 6-7 minutes [12]

Fig 4 : KL Grading of OA Knee

Fig. 5: Postural sway assessment

Fig 6: Knee joint AP view

Fig 7: Knee joint lateral view

Result:

The postural sway test was performed with eyes open and eyes closed conditions in OA knee patients for sway in all four directions. The data was collected and analyzed. Descriptive statistical analysis was done of the collected to associate postural sway with Kellengren Lawrence grade II and III of osteoarthritis of knee joint among elderly population.

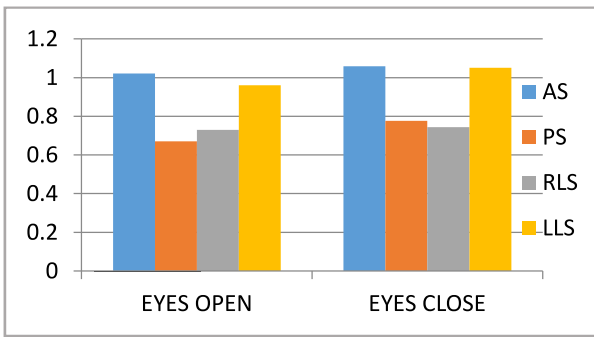**Table 1:** Postural Sway in total subjects

Total - 60	Postural Sway (in mm) (eyes open)				Postural Sway (in mm) (eyes close)			
	Anterior sway (AS)	Posterior sway (PS)	Right Lateral Sway (RLS)	Left Lateral Sway (LLS)	Anterior sway (AS)	Posterior Sway	Right Lateral Sway	Left Lateral Sway
MEAN±SD (68.0508± 11.2194)	1.0±0.4	0.7±0.4	0.75±0.42	1.00±0.4	1.1±0.4	0.7±0.4	0.7±0.3	1.0±0.4
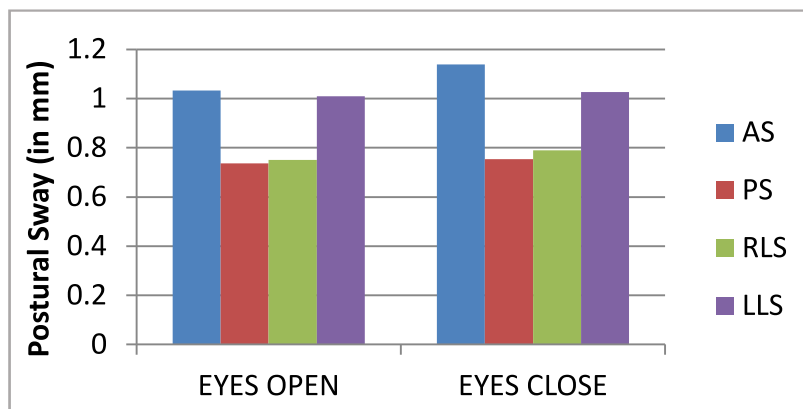
Graph 1: shows that all 60 subjects having more sway in anterior and left lateral direction with both eyes open and eyes closed condition compared to their sway in posterior and right lateral direction.
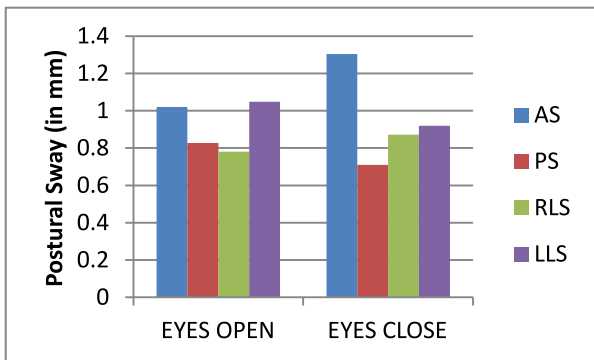
Table 2: Postural Sway in grade II OA knee

Total 60 participants (out of which 19 are with grade III OA)	Postural Sway (EO)				Postural Sway (EC)			
	AS	PS	RLS	LLS	AS	PS	RLS	LLS
MEAN±SD (71.4±7.4)	1.02±0.4	0.8±0.4	0.7±0.3	1.0±0.4	1.3±0.5	0.7±0.3	0.8±0.3	0.9± 0.3

Graph 2 : shows the postural sway in Grade - II OA Knee patients. Total 60 subjects (out of which 32 subjects were with grade II OA knee), with eyes open condition the sway was found more in anterior direction. And with eyes closed condition the sway was found more in anterior and left lateral direction.
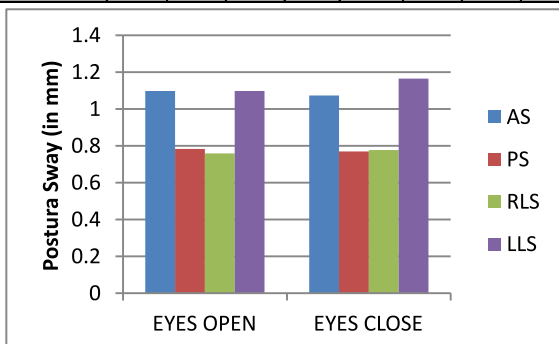
Table 3: Postural Sway in grade III OA knee

Graph 3: Shows postural sway in Grade-III OA Knee patients. Total 60 participants (out of which 19 are with grade III OA), with eyes open condition sway was found more in anterior and left lateral direction. And with eyes closed condition the sway was found more in anterior direction.

Table 4: Postural Sway in Grade IV OA knee

GRADE-IV OA	Postural Sway (EO)				Postural Sway (EC)			
Total 60 participants (out of which 9 are with grade IV OA)	AS	PS	RLS	LLS	AS	PS	RLS	LLS
MEAN±SD (65.5±6.2)	1.0 ± 0.3	0.7 ± 0.5	0.7 ± 0.2	**1.0 ± 0.4**	**1.0 ± 0.1**	0.7 ± 0.3	0.7 ± 0.3	**1.1 ± 0.4**

Graph 4: shows postural sway in Grade-IV OA Knee patients. Total 9 subjects were there, and the sway was found more in anterior and left lateral direction both with eyes open and eyes closed conditions.

Table 5 :
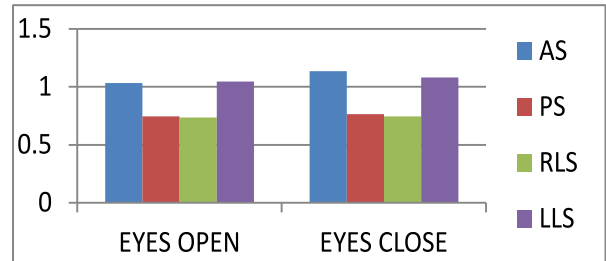
Graph 5 : shows postural sway in Young Old patients (Age -65-75). Total 48 subjects were there, and the sway was found more in anterior and left lateral direction both with eyes open and eyes closed conditions.
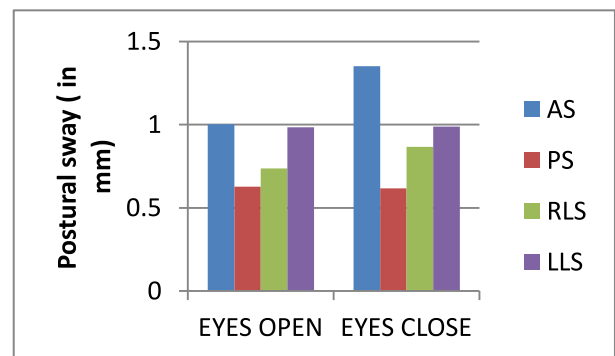
Table 6 :

| MIDDLE OLD (76-85)	Postural Sway (EO)				Postural Sway (EC)			
(TOTAL -7)	AS	PS	RLS	LLS	AS	PS	RLS	LLS
MEAN±SD (77.7±1.7)	**1.0± 0.2**	0.6± 0.3	0.7± 0.2	0.9± 0.3	**1.3± 0.4**	0.6± 0.2	0.8± 0.3	0.98± 0.2

Graph 6: shows postural sway in Middle Old patients (Age -75-85). Total 7 subjects were there, and the sway was found more in anterior direction both with eyes open and eyes closed conditions.

Table 7 :

OLD OLD(86 AND ABOVE)	Postural Sway (EO)				Postural Sway (EC)			
(TOTAL - 5)	AS	PS	RLS	LLS	AS	PS	RLS	LLS
MEAN±SD (83.4± 6.76757)	**1.06± 0.66**	0.81± 0.38	0.8± 0.4	0.6± 0.4	0.87± 0.959114	0.8± 0.5	**1.1± 0.1**	0.5± 0.3

Table 7: shows postural sway in Old Old (age 75-85) patients. Total 5 subjects were there, with eyes open condition the sway was found more in anterior direction compared to sway in posterior, right and left lateral direction. And with eyes closed condition the sway was found more in right lateral direction compared to sway in anterior, posterior and left lateral direction.
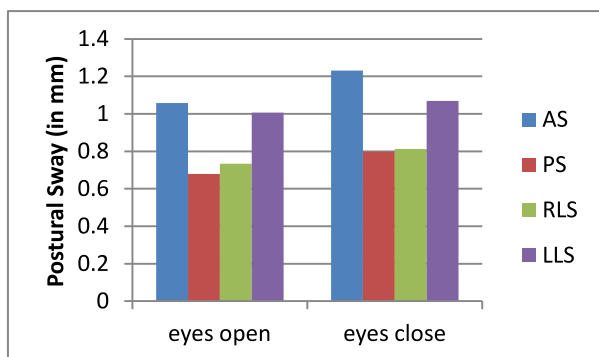
Table No.8
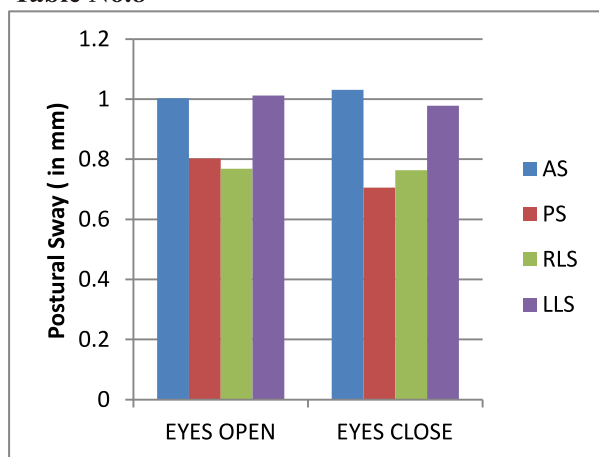
Graph 8: shows postural sway in Male subjects. Total 28 subjects were there, with eyes open condition the sway was found more in anterior and left lateral direction. And with eyes closed condition the sway was found more in anterior direction.

Table No.9

FEMALE	Postural Sway (EO)				Postural Sway (EC)			
(TOTAL -32)	AS	PS	RLS	LLS	AS	PS	RLS	LLS
MEAN± **SD** 67.4± 7.3	1.0± **0.4**	0.6± 0.3	0.7± 0.4	1.0± **0.3**	1.2± **0.5**	0.7± 0.3	0.8± 0.3	1.0± **0.4**

Graph 9: shows postural sway in Female subjects. Total 32 subjects were there, and the sway was found more in anterior and left lateral direction both with eyes open and eyes closed conditions.

Discussion:

The most commonly used and validated manual postural sway meter was used in all subjects including different age groups i.e 65-74year (young old, total participants - 48), 76-85 year (middle old, total participants -7) and 86 year and above (old-old, total participants-5). The measurement was taken on the flat surface with eye open and with eye closed, in all four directions (Anterior, Posterior, Right and Left Lateral).

Table no .1 shows total sway (in 60 subjects) with eyes open condition in anterior direction was 1.03233, in posterior direction 0.73in right lateral direction 0.75, in left lateral direction1.00867.[13]

In eyes closed condition, total sway (in 60 subjects) found was in anterior direction 1.138, in posterior direction 0.75417, in right lateral direction 0.7895, in left lateral direction 1.02633.

In eyes open condition, according to aging criteria in the age group of 65-74 years (total-48 participants) in anterior direction the sway found was 1.03375,in posterior direction0.745417, in Right lateral direction 0.73667, in Left lateral direction 1.04688. In the age group 75 -85 years (total-7 participants) in anterior direction the sway found was 1.002857 ,in posterior direction 0.627143 , in Right lateral direction 0.73571 , in Left lateral direction 0.98286. In the age group of 86 years and above (total-5 participants) in anterior direction the sway found was 1.35,in posterior direction 0.617143, in Right lateral direction 0.865714, in Left lateral direction 0.988571.

In eyes close condition, in the age group of 65-74 years (total-48 participants) in anterior direction the sway found was 1.135, in posterior direction 0.764792, in Right lateral direction 0.745625, in Left lateral direction 1.079375. In the age group 75 -85 years (total-7 participants) in anterior direction the sway found was1.35, in posterior direction 0.617143 , in Right lateral direction 0.865714 , in Left lateral direction 0.988571. In the age group of 86 years and above (total-5 participants) in anterior direction the sway found was 0.87 in posterior direction 0.844 , in Right lateral direction 1.104, in Left lateral direction0.57 .

In eyes open condition, according to KL grading system in individuals with Grade –II OA (total-32 participants), in anterior direction the sway found was 1.02125, in posterior direction 0.670938, in Right lateral direction 0.729688, in Left lateral

direction 0.960313. In individuals with Grade – III OA (total-19 participants), in anterior direction the sway found was 1.02,in posterior direction 0.826316, in Right lateral direction 0.780526, in Left lateral direction 1.047895. In individuals with Grade – IV OA (total-9 participants), in anterior direction the sway found was 1.0977778, in posterior direction 0.783333, in Right lateral direction 0.757778, in Left lateral direction 1.097778.

In eyes close condition, in individuals with Grade –II OA (total-32 participants), in anterior direction the sway found was 1.058125, in posterior direction 0.776875, in Right lateral direction 0.744375, in Left lateral direction 1.05125. In individuals with Grade – III OA (total-19 participants), in anterior direction the sway found was 1.303684,in posterior direction 0.708947, in Right lateral direction 0.871579, in Left lateral direction 0.918947. In individuals with Grade – IV OA (total-9 participants) in anterior direction the sway found was 1.072222, in posterior direction 0.768889, in Right lateral direction 0.776667 in Left lateral direction 1.164444.

In eyes open condition, in Male subjects (total-28 participants), in anterior direction the sway found was 1.003214, in posterior direction 0.8025, in Right lateral direction 0.76786, in Left lateral direction 1.01214.

In eyes close condition, in Male subjects (total-28 participants), in anterior direction the sway found was 1.031071, in posterior direction 0.705, in Right lateral direction 0.763571, in Left lateral direction 0.978214.

In eyes open condition, in Female subjects (total-32 participants), in anterior direction the sway found was 1.057813, in posterior direction O.679688, in Right lateral direction 0.73438, in Left lateral direction 1.00563.[14]

In eyes close condition, in Female subjects (total-32 participants), in anterior direction the sway found was 1.231563, in posterior direction 0.797188, in Right lateral direction 0.812188, in Left lateral direction 1.068438.

This study showed some similarity with the study done by an author Miss. Dakshayani Gholap et.al(13) to find out normative values of postural sway of healthy elderly population using postural sway meter.

Clinical Implication: The purpose was to find Association of postural sway with KL grading. This study was carried out to evaluate static standing balance using postural sway meter in individuals with symptomatic knee OA with different grades according to KL grading system. This may cause fall and increase the risk of injury. As the values for postural sway in elderly population according to different grades of OA Knee are not available, they were obtained through this study.

Conclusion:

This study concludes that More sway was observed in anterior and left lateral direction both with eyes opened and eyes closed in all Grade II and Grade III OA knee patients, in all males and females and young old and middle old subjects. While in old-old subjects the sway was found more in anterior and right lateral direction .

Limitation:

Out of total study population, some individuals are with unilateral OA Knee.

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