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RESEARCH ARTICLE

ASSOCIATION OF BODY SWAY AMONG FALLERS AND NON FALLERS ELDERLY POPULATION – CROSS SECTIONAL STUDY

Dr. Aishwarya Sanjay Sidhaye[1,*] and Dr. Shyam Devidas Ganvir[2]

[1]First year MPT student Speciality –Community Medical Sciences, DVVPF'S College of physiotherapy, Ahmadnagar Maharashtra, India
[2]M.P.Th. Ph.D. principal of DVVPF'S College of physiotherapy, Ahmednagar, Maharashtra, India

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Glossary of Abbreviations:
BMI: body mass index.
EO: eyes open condition
EC: eyes closed condition.

ABSTRACT

Background: About one third of the community dwellers over the age of 65 and persons over the age 80 will fall each year. Fall is an unexplained event that results in a person inadvertently coming to the rest on the floor, ground or lower level. Falls are extremely common among the older adult population, account for the substantial morbidity and mortality. Postural control involves controlling body's position in space for dual purpose of stability, balance and orientation. Postural stability or balance is the ability to maintain the projected centre of motion within the limit of base of support. Physiological changes of normal aging may increases the risk of falls.eg-with the normal aging there is diminished input from the visual, proprioceptive, and vestibular system which may results in alteration of balance. **Purpose:** The purpose of this study is to find the association of body sway among community dwelling elderly population with and without having history of falls. **Subject and method:** 12 subjects were selected on the basis of inclusion and exclusion criteria. Subjects were selected by convenient sampling method. They were divided into 2 groups of fallers and non-fallers. To evaluate body sway among elderly, the body sway meter had been use. The body sway among elderly having history of falls and without falls had been measure, with keeping their eyes open and closed. **Result:** The body sway was analyzed and compared within community dwelling elderly population which were fallers and non fallers, by unpaired t test (pvalue = <0.0001). Age was compared in between groups and it comes not significant. The BMI in the participant had come significant. When body sway compared in elderly, the sway observed greater among people having previous history of falls. **Conclusion:** The patients having previous falls history are having more body sway that means they are at high risk of falls; than the elderly without falls history. BMI in the participants with falls history was seen higher than participants without having falls history.

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INTRODUCTION

Globally, the population is ageing and the World Health Organization (WHO) predicts that, by 2050, the population aged 60 years or more will double, whilst those aged 80 years or more will number 400 million persons (Singh at al., 2014). Ageing, an inevitable process, is commonly measured by chronological age and, as a convention, a person aged 65 years or more is often referred to as 'elderly'(Singh at al., 2014). Balance is generally defined as a person's ability to maintain or restore the equilibrium status of upright stance, without having to change the base of support and is crucial aspect to avoid injury for elderly people.

Corresponding author: **Dr. Aishwarya Sanjay Sidhaye**
First year MPT student Speciality –Community Medical Sciences, DVVPF'S College of physiotherapy, Ahmadnagar Maharashtra, India

As like the body equilibrium and sway gets affected it may results generally in to falls. Falls are one of the most common health concerns facing elderly persons todayAbout one third of the community dwellers over the age of 65 and persons over the age 80 will fall each year. Fall is defined as any unexplained event that results in a person inadvertently coming to the rest on the floor, ground or lower level.(Buragadda S, at al,2012)Falls are extremely common among the older adult population, account for the substantial morbidity and mortality, and are often potentially preventable. Fear of falling is also common in among elderly fallers; and fear of falling has been associated with impaired mobility and decreased functional status (Ghahramani M, at al, 2016) A risk of falling due to body imbalance has been reported based on the results of force platform balance measures (Pajala S,at al, 2008).

The balance is also assessed as the amount of the postural sway (also called as body sway) of the human body. Body sway is defined as the slight postural movements made by individuals in order to maintain a balance position, and can be measured by the total displacement of center of mass relative to the base of support over time (Tejal C. N.at al, 2015) .Body sway has been assessed for static balance and dynamic balance conditions, depending on whether the base is stationary or moving**;** static balance can be measured by simple technology such as using body sway meter (Tejal C. N.at al, 2015) . The body sway may measure in ant sway, post sway, and lateral sway.Postural control is the main necessity for standing and walking independently and it is usually assessed by measuring the amount of postural sway of the human body. Human body normally sways as a result of breathing, or shifting body weight from one foot to another but it can increase due to age and disease (Davidson BS 2004) While many studies have concluded that there is an association between age and postural swaystudies have just identified a tendency or no special relation (Brocklehurst JC at al) As all the above measures will affects the person's ability to maintain balance and to doing the day to day activities like walking.Walking is one of the most common of all human movement; it exists to transport the body safely and efficiently across ground level, uphill or downhill (Pajala S, at al, 2008) Gait and balance disorders are common in older adults and are major cause of falls in this population. They are associated with increase morbidity and mortality as well as reduce level of function. Common causes include arthritis and orthostatic hypo-tension; however most gait and balance disorders involve multiple contributing factors.Hence there are many studies which are carried on body alignment and gait pattern, also body sway within elderly with using various electrical sensor's and computerized sensor's but none of the studies has been done on fallers about relation between body sway emphasize on rural population with the help of manual sway meter. So this study is being carried out to know the relationship between body sway within fallers or non-fallers .

MATERIALS AND METHODS

Study design: cross sectional study.

Study setting: senior citizen club , old age home.

Study population: patient aged 60 and more, patient with and without having falls history.

Study material: Pen, graph paper, foot print, sway meter (handmade), table .

Sample size: 12

Procedure: samples are recruited according to convenient sampling method from senior citizen clubs and old age home care hospital Physiotherapy Outpatient Department Ethical committee of DVVPF's college of physiotherapy, Ahmednagar. Consent was taken from the participants and they were selected according to inclusion and exclusion criteria. All the baseline characteristics were taken. Participants were assessed and then included in the study. The procedure of measurement of body sway had been explain to participants and conducted. Data was collected and analyzed.

Body sway meter: The sway meter is a useful field test, as it is compact, lightweight, has short administrating and data processing time. Thus, assessment can be conducted in variety of community settings and health care facilities.

- Several research groups have found the sway meter to be feasible for use in different populations of young and older people.
- It is a self-made instrument which is made up of with firm belt and 40 cm rod which is attached to it. Firm belt tie over the level of PSIS (posterior superior iliac spine) and that 40 cm rod with the pen attached to it.

Normally postural sway are seen anterior, posterior, right, and left. According to Lord and Sherrington's study.

RESULTS

Analysis was performed on Graph Pad In Stat Version 3.10, 32 bit for windows. Analysis was performed on 12 sample with and without having history of falls. The mean and ± SD for age was 65.28 ± 3.2 and 66.14 ± 7.0 within fallers and nonfallers respectively. Baseline BMI mean SD was 24.51 ± 1.14 and 21.42 ± 1.99 within fallers and non fallers respectively. P value for BMI was 0.0040 is considered significant (table1) . Also body sway was measured within fallers and non fallers in anterior , posterior , right and left lateral respectively. The body sway was significantly higher among the elderly who were having falls than elderly without falls history. Study shows that there is significant relationship between the two variables, That is postural sway and previous falls.

Also it is seen that there had increased lateral postural sway in which p value< 0.001.and anterior and posterior sway were also present. In eyes closed condition, body sway had been compare within the fallers and non fallers, (table2) so we have seen the significant relationship among them ,($p<0.005$). in eyes open condition, if body sway had been compere ,within fallers and non fallers, (table3) so significant relationship had seen only among lt lat postural sway condition, the mean±SD were 0.95±0.24 and 0.77±0.17 respectively, ($p=0.009$). If the body sway among only fallers group in EO condition compared to EC,(table4), the significant relationship was seen among lt lat sway the mean±SD were 0.95±0.24 and 1.22±0.26 respectively,($p=0.07$). Also if the body sway among only non fallers group in EO condition compared to EC, (table5) , there was no significant relationship seen among them .

Table 1. baseline characteristics

	Fallers	Non fallers	
	mean±SD	mean±SD	P value
Age	65.28 ± 3.2	66.14 ± 7.0	0.77
BMI	24.51 ± 1.14	21.42 ± 1.99	0.004

Table 2. eyes closed condition in relation with fallers and non fallers.

	Fallers	Non fallers	
	mean±SD	mean±SD	p value
Ant	1.07±0.47	0.67±0.11	0.02
Post	1.02±0.32	0.62±0.17	0.007
Rt lat	1.12±0.17	0.81±0.18	0.02
Lt lat	1.22±0.26	0.65±0.26	0.0009

Table 3. eyes open condition in relation with fallers and non fallers

	Fallers	Non fallers	
	mean±SD	mean±SD	p value
Ant	0.95±0.43	0.74±0.17	0.24
Post	0.78±0.35	0.74±0.05	0.7
Rt lat	1.30±0.41	0.81±0.18	0.05
Lt lat	0.95±0.24	0.77±0.17	0.009

Table 4. fallers in comparison with EO and EC conditions

	Eyes open	Eyes closed	
	mean±SD	mean±SD	p value
Ant	0.95±0.43	1.07±0.47	0.6
Post	0.78±0.35	1.02±0.32	0.2
Rt lat	1.3±0.41	1.12±0.17	0.3
Lt lat	0.95±0.24	1.22±0.26	0.007

Table 5. non fallers in comparison with EO and EC conditions

	Eyes open	Eyes closed	
	mean±SD	mean±SD	p value
Ant	0.74±0.17	0.67±0.11	0.3
Post	0.74±0.05	0.62±0.17	0.6
Rt lat	0.84±0.09	0.81±0.18	0.7
Lt lat	0.77±0.17	0.65±0.26	0.05

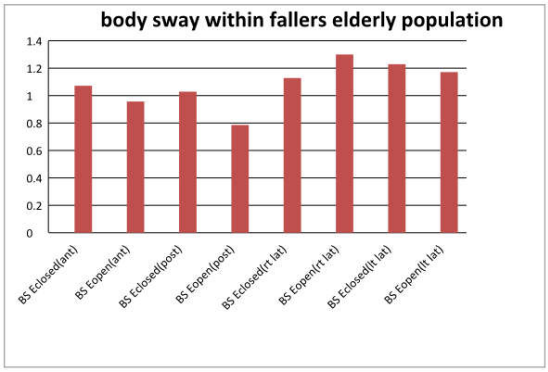

Fig 1. Graphs are showing difference in body sway among falles and non fallers elderly populations

DISCUSSION

The present study suggested that, elderly with having previous falls history have more postural sway in lateral as well as posterior side, also the elderly which are having previous falls history and higher BMI will show more body sway in quiet standing. Maxime Dutil *et al*. (2013) also did the study to know the impact of obesity on balance control in community dweller elderly women. In their study for balance measurements they had been use the forced platform. And their results show that obese older women had increased CoP speed, which could be interpreted as decreased postural stability.As they said It could be the effect of an increased inertia (proportional to the mass); it might also be due to an increased muscular effort associated with controlling the larger mass. A reduced balance control is observed with aging and is related to an increase in the CoP speed. This has been associated with increased risk of falling. This is the reson, that in our present study the elderly with having greater BMI have high postural instability or sway. Jonas Johansson *et al*.(2017) also did the study to know Increased postural sway during quiet stance as a risk factor for prospective falls in community dwelling elderly individuals. In their study postural sway was measured during eyes-open (EO) and eyes-closed (EC) trials using the Wii Balance board.

Also the Functional mobility, muscle strength, objective physical activity and cognitive performance were also measured. Participants reported incident falls 6 and 12 months after the examination. .As they said the objective static balance test is viable for fall risk assessment, although falls commonly occur during body movement and weight shifting .also they revealed that postural sway during quiet stance independently predicted incident falls after adjustment for multiple con founders, such as objective PA, functional mobility, presence of CVD and cognitive function, in a large cohort of 70-year-old men and women. This is the reson, that in our present study the elderly,which are having previous history of falls may showed greter postural sway , It would also be of interest to evaluate objective measures of postural sway against the fall risk assessment tool ,which holistically approaches risk of falls.B S Hassan *et al*. (2001) in their study.

Static postural sway, proprioception, and maximal voluntary quadriceps contraction in patients with knee osteoarthritis and normal control subjects, they concluded that the sway more in both lateral and antero posterior directions (under conditions of quiet standing position with eyes closed); (*b*) are less accurate in reproducing the criterion angle; (*c*) exert less force during voluntary isometric contraction of the quadriceps; and (*d*) have less activation of the quadriceps muscle. These diVerences persisted after controlling for weight ($p<0.001$).also in our study we also had seen the maximum postural sway was in posterior as well as in lt lateral sides among both fallers and non fallers group community dwelling elderly population.

Limitations

- Sample size was too small.

Future scope

- Study shoud be in relation with the BMI and body sway to see exact relation to future falls among young population .
- Future work will include further experimental work on more subjects including young, middle-aged and older people and more extensive analysis of data to develop an effective indicator of fall

Conflict of intrest: There were no conflict of interest.

Funding sources: no funding sources was given.

Conclusion

The patients having previous falls history are having more body sway that means they are at high risk of falls; than the elderly without falls history. Higher BMI in the participants may be one of the reason for falls in community dwelling elderly.

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