RESEARCH ARTICLE

IMPAIRMENT OF BALANCE BY USING SWAY METER IN ELDERLY POPULATION

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ARTICLE INFO

ABSTRACT

Abstract: Balance is required for maintaining a position, remaining stable while moving from one position to another, performing acts of daily living, and moving freely in the community. Good balance depends on accurate and adequate information from the senses. Postural control involves controlling body's position in space for dual purpose of stability and orientation.

Aim and Objectives:
- To study the prevalence of impairment of balance by using sway meter in elderly population with eye open and with eye close.
- To study the prevalence of impairment of balance by using sway meter in elderly population with eye close and eye open.

Materials
- Digital SwayMeter (Arduino, strain gauge sensors)
- Graph Paper

Methodology:
- The subjects were instructed to keep their hand by their sides during standing. Subjects were informed about procedure before starting. Duration of each trial is 30 second. The subjects were also instructed to stand on sole with insole strain gauge sensors.
- During the time period the microcontroller (arduino) calibrates the sway in subjects through graph and measurements were noted for particular area of weight bearing that is anterior, posterior, left lateral or right lateral
- The procedure was repeated for each trial. A total of 6 trials include 3 trials with eyes open and other 3 trials with eyes closed. Maximum deviation in 3 trials were taken for analysis.

Results: The analytical data was collected. In eye open condition, In anterior direction 4% of subjects had sway <1cm, 56% of subjects had sway in 1.1-2cm, 32% had sway in 2.1-3cm and remaining 4% had sway in 3.1-4cm. In posterior direction, 12% of subjects had sway <1cm, 68% of subjects had sway in 1.1-2cm, 8% had sway in 2.1-3cm and remaining 4% had sway in 3.1-4cm. In lateral direction, 4% of subjects had sway<1cm, 64% of subjects had sway in 1.1-2cm , 20% had sway in 2.1-3cm and remaining 8% had sway in 3.1-4cm. In different age groups with eye open 2.05 in 50-60year young population, 1.8 in 70-80 year old population. In eye closed condition, In anterior direction, 12% of subjects had sway <1cm, 56% of subjects had sway in 1.1-2cm, 20% had sway in 2.1-3cm and remaining 12% had sway in 3.1-4cm. In posterior direction, 8% of subjects had sway <1cm, 56% of subjects had sway in 1.1-2cm,16% had sway in 2.1-3cm and remaining 4% had sway in 3.1-4cm. In lateral direction, 4% of subjects had sway<1cm, 56% of subjects had sway in 1.1-2cm, 28% had sway in 2.1-3cm and remaining 8% had sway in 3.1-4cm. In different age groups with eye closed 2.1 in 60-70 year middle population and 1.83 in 50-60year young population.

Conclusion: Hence, there was 100% sway in all through directions with eye open and eye close.

INTRODUCTION

Balance is defined as the ability to maintain the projected Centre of Motion (COM) within the limits of Base Of Support (BOS). During quiet stance phase there is separate Centre of Pressure (COP) under each foot. The net COP lies between the feet and depends on each limb support.

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Researches done on stance postural control showed that no one stands still; instead the body sways in small amounts, mostly forward and backward. The device (Sway meter) consists of arduino potentiometer and insole pressure sensors which will help to detect the direction of sway and the pressure on foot. It is useful field test which is light weight and has short administration and data processing time. The sway meter involves electronic devices which are very cheap and handy for the research purposes. The sway meter has been used in numerous studies of balance.

Aims and Objectives

- To study the prevalence of impairment of balance by using sway meter in elderly population.
- To study the prevalence of impairment of balance by using sway meter in elderly population with eye close and eye open.
- To study the prevalence of impairment of balance by using sway meter in different age groups mainly 50-60, 60-70 and 70-80 that is young old, middle old and old population respectively.

MATERIAL AND METHODS

Procedure

- The subjects were instructed to keep their hand by their sides during standing. Subjects were informed about procedure before starting. Duration of each trial is 30 second. The subjects were also instructed to stand on sole with insole strain gauge sensors.
- During the time period the microcontroller (arduino) calibrates the sway in subjects through graph and measurements were noted for particular area of weight bearing that is anterior, posterior, left lateral or right lateral
- The procedure was repeated for each trial. A total of 6 trials include 3 trials with eyes open and other 3 trials with eyes closed. Maximum deviation in 3 trials were taken for analysis.

RESULTS

The sway with eye open and with eye close in all age group was 100% in anterior direction and there is no significant difference in the study Shyam et al(2015) they obtained result on the normal individual.

Conclusion: Study concluded that this study supports the newly developed digital sway meter as a clinical tool for identifying sways in various directions(Anterior, Posterior and Lateral)similarly 100% sway was observed in anterior direction with eye open and eye close in all age groups.

Aim and Objectives

- To study the prevalence of impairment of balance by using sway meter in elderly population.
- To study the prevalence of impairment of balance by using sway meter in elderly population with eye close and eye open.
- To study the prevalence of impairment of balance by using sway meter in different age groups mainly 50-60, 60-70 and 70-80 that is young old, middle old and old population respectively.

Material and Methodology

Study Design:- Observational study

Sampling technique: Simple Random Sampling.

1. **Sample size**:- 80

2. **Study setting**: Physiotherapy OPD, D.V.V.P.F's, Ahmednagar.
3. **Study duration**:- 6 months
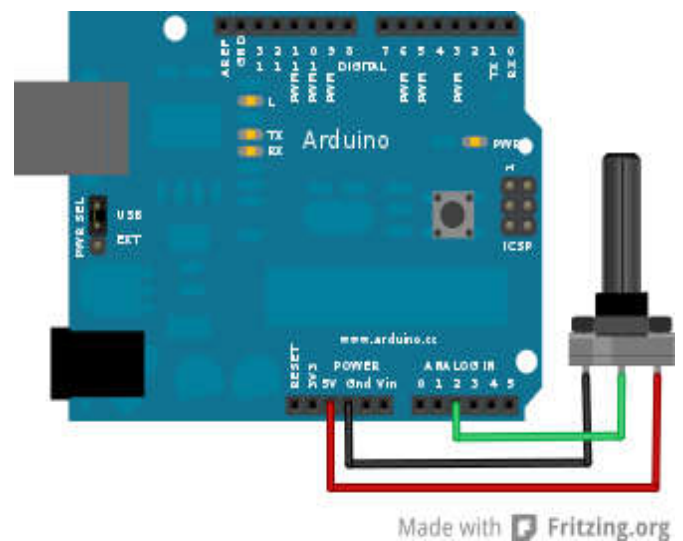4. **Selection criteria:**

Inclusion criteria

- Individual age group of 50-60, 60-70, 70-80 years of people.
- Both genders
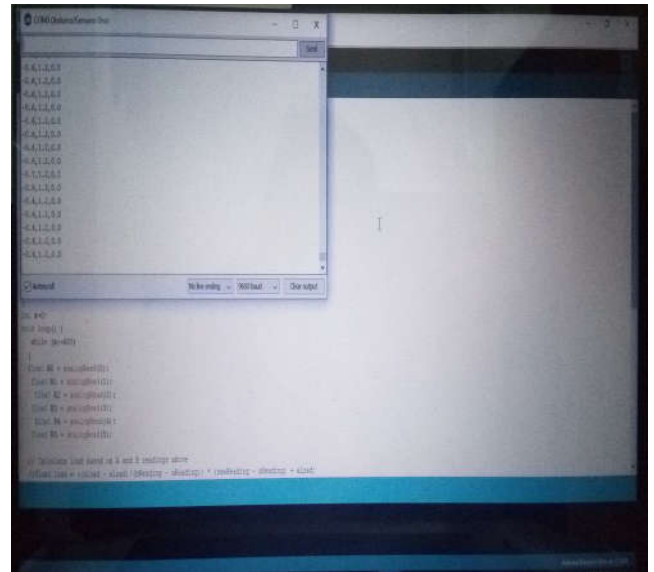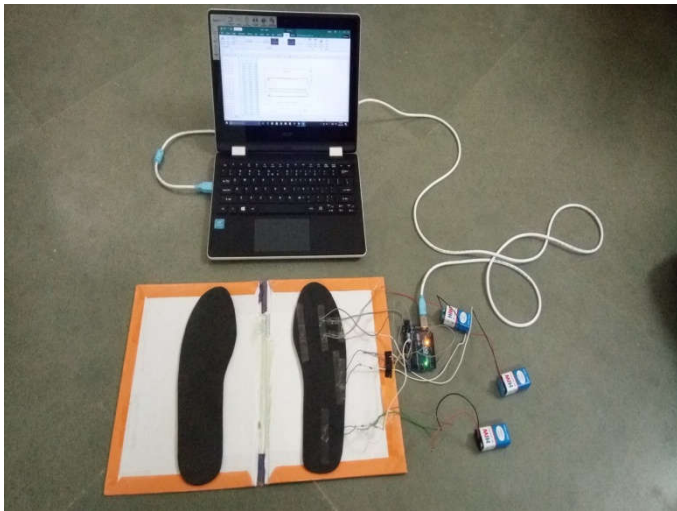- Willing to participate.

Exclusion criteria

- Any musculoskeletal injuries like fracture.
- Subject with recent surgeries
- Any neurological conditions such as spinal cord injury, stroke, paralysis etc.

Feasibility: Study is feasible as the institute is situated near rural area so that the number of elderly people are easily available. So that the study can be completed in prescribed time and sample size and results of the study can be clinically implemented.

Digital Sway-meter

Made with Fritzing.org

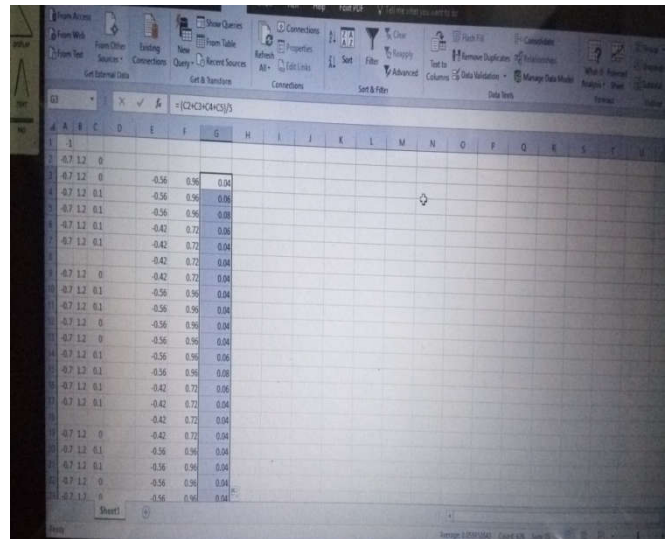While calculating values in Software

Procedure:

- The subjects were instructed to keep their hand by their sides during standing. Subjects were informed about procedure before starting. Duration of each trial is 30 second. The subjects were also instructed to stand on sole with insole strain gauge sensors.
- During the time period the microcontroller (arduino) calibrates the sway in subjects through graph and measurements were noted for particular area of weight bearing that is anterior, posterior, left lateral or right lateral
- The procedure was repeated for each trial. A total of 6 trials include 3 trials with eyes open and other 3 trials with eyes closed. Maximum deviation in 3 trials weretaken for analysis.

While adding values in Excel Sheet

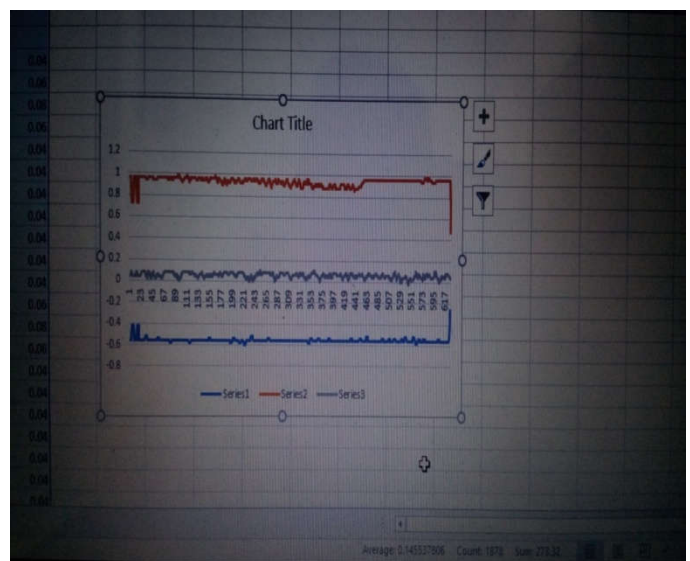While measuring sway by using sway meter
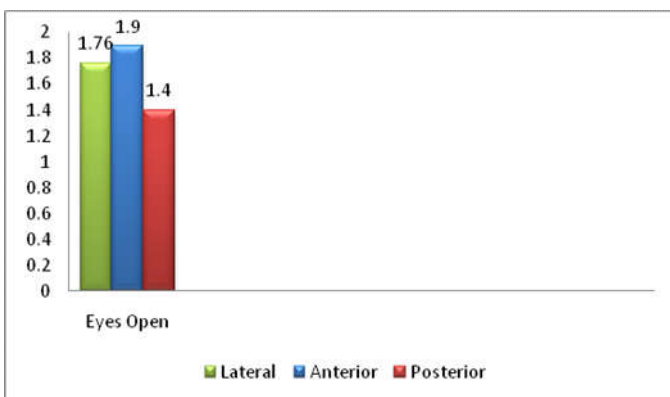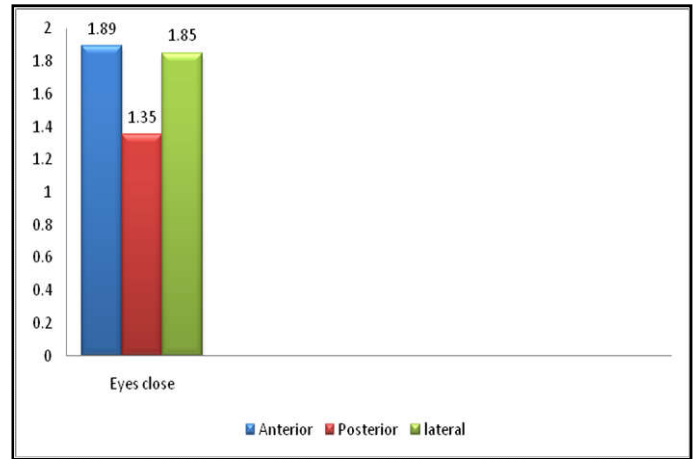

Chart Title in Software

While taking with eyes open
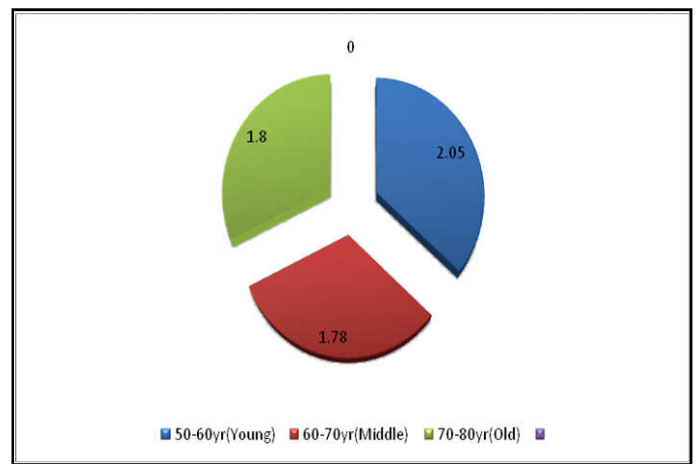

While taking with eyes close
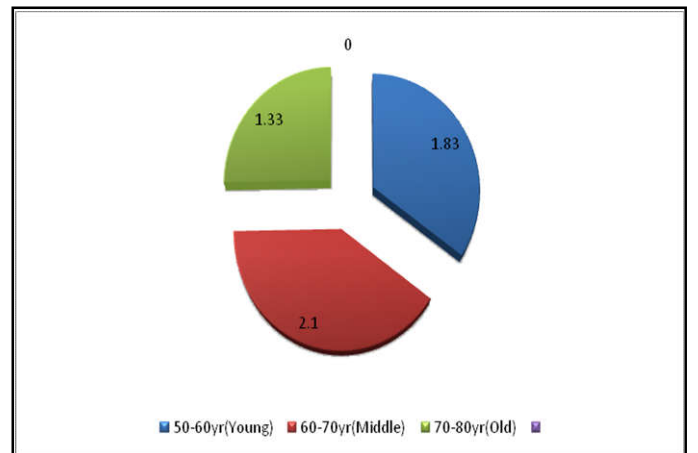
Graphical presentation:

Graph 1. Sway with Eye Open

Graph 2. Sway with Eyes close

Graph 3. Eyes open in different age groups

Graph 4. Eyes close in different age groups

Data Analysis

	<1cm	1.1-2	2.1-3	3.1-4
Ant(EO)	4	56	32	4
Post(EO)	12	68	8	4
Lat(EO)	4	64	20	8
Ant(EC)	12	56	20	12
Post(EC)	8	56	16	4
Lat(EC)	4	56	28	8
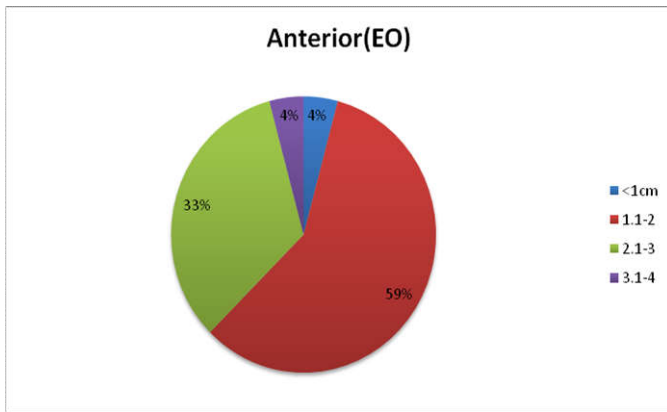
Graph 5. Sway in anterior direction with eye open

Graph 6. Sway in posterior direction with eye open

Graph 7. Sway in lateral direction with eyes open

Graph 8. Sway in anterior direction with eyes close
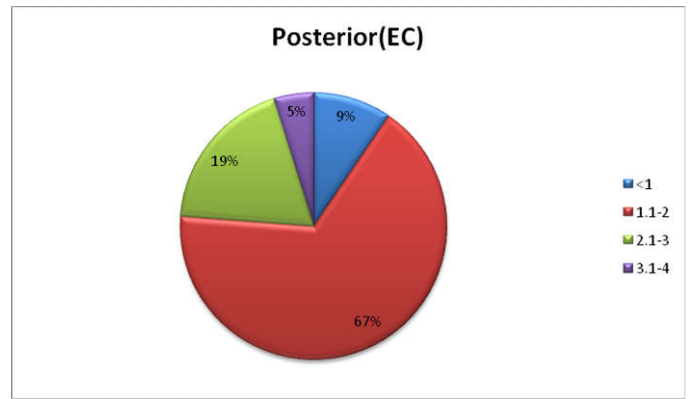
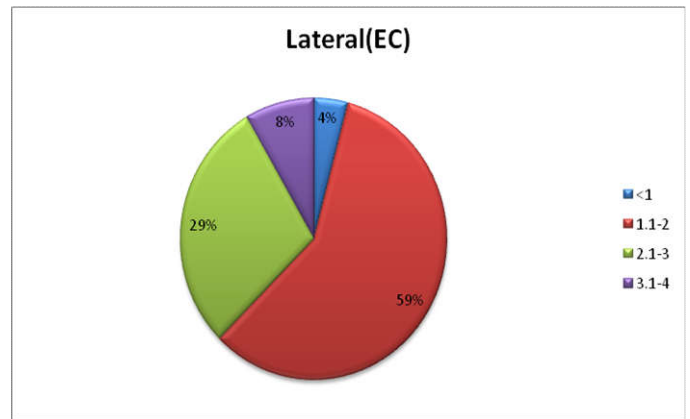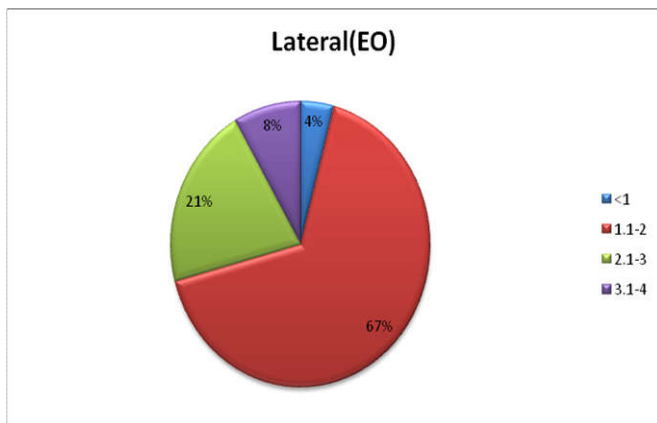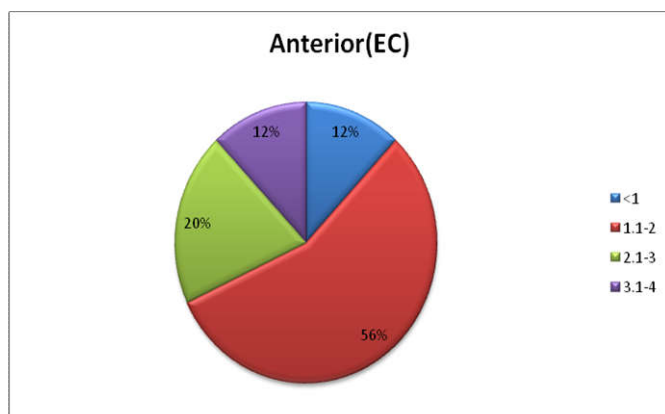
Graph 9. Sway in posterior direction with eyes close
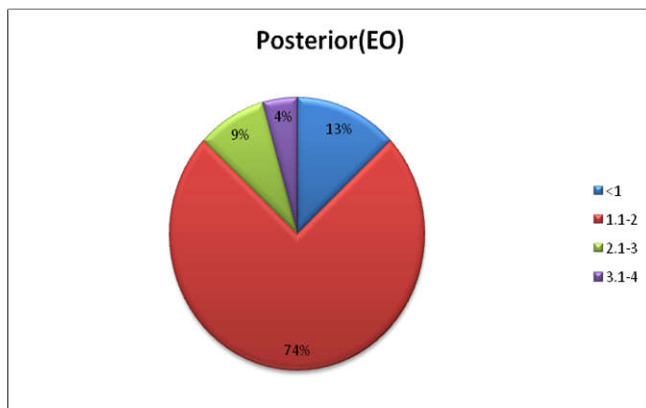
Graph 10. Sway in lateral direction with eyes close

RESULTS

The data collected for sway in all three directions with eye open and eye close was analysed. In eye open condition,

Graph 5 Shows sway in anterior direction with eye open. In anterior direction4% of subjects had sway <1cm, 56% of subjects had sway in 1.1-2cm, 32% had sway in 2.1-3cm and remaining 4% had sway in 3.1-4cm.

Graph 6 Shows sway in posterior direction with eye open. In posterior direction, 12% of subjects had sway <1cm, 68% of subjects had sway in 1.1-2cm, 8% had sway in 2.1-3cm and remaining 4% had sway in 3.1-4cm.

Graph 7 Shows sway in lateral direction with eye open. In lateral direction, 4% of subjects had sway<1cm,64% of subjects had sway in 1.1-2cm , 20% had sway in 2.1-3cm and remaining 8% had sway in 3.1-4cm.

Graph 3 Shows sway in different age group with eye open. In different age groups with eye open 2.05 in 50-60year young population, 1.8 in 70-80 year old population. In eye closed condition,

Graph 8 Shows sway in anterior direction with eye close. In anterior direction, 12% of subjects had sway <1cm, 56% of subjects had sway in 1.1-2cm, 20% had sway in 2.1-3cm and remaining 12% had sway in 3.1-4cm.

Graph 9 Shows sway in posterior direction with eye close. In posterior direction, 8% of subjects had sway <1cm, 56% of

subjects had sway in 1.1-2cm,16% had sway in 2.1-3cm and remaining 4% had sway in 3.1-4cm.

Graph 10 Shows sway in lateral direction with eye close. In lateral direction, 4% of subjects had sway<1cm, 56% of subjects had sway in 1.1-2cm, 28% had sway in 2.1-3cm and remaining 8% had sway in 3.1-4cm.

Graph 4 Shows sway in different age groups with eye close. In different age groups with eye closed 2.1 in 60-70 year middle population and 1.83 in 50-60year young population.

DISCUSSION

The newly developed and validated digital sway meter was used in all subjects including different age groups 50-60year, 60-70 year and 70-80 year. The measurement was taken on the flat surface with eye open and with eye closed, in all three directions(Anterior, Posterior and Lateral). In my study, with eye open anterior direction 4% of sway in <1cm,56% of sway was observed in 1.1-2cm and 32% in2.1-3cm and 4% in 3.1-4cm, posterior direction 12% of sway in<1cm,68% in 1.1-2cm, 8% in 2.1-3cm and 4% in 3.1-4cm, and lateral direction 4% of sway in <1cm, 64% in 1.1-2cm, 20% in 2.1-3cm and 8% in 3.1-4cm. Balance disorders in the elderly population occurs due to weakness in the core stability muscles, altered muscle activation patterns, loss of proprioception, and inability to control normal postural sway. Due to aging fear of fall increases and therefore there are many chances that the person sways in direction either anteriorly, posteriorly or laterally. With eye closed anterior direction 12% of sway in<1cm,56% in 1.1.-2cm, 20% in 2.1-3cm and 12% in 3.1-4cm, posterior direction 8%of sway in<1cm,56% in 1.1-2cm, 16% in 2.1-3cm, and 4% in 3.1-4cm,and lateral direction 4% of sway in<1cm,56% in 1.1-2cm, 28% in 2.1-3cm, and 8% in 3.1-4cm. Year 2015Shyam et al have conducted similar study and they obtained result on normal individual, with eye open anterior direction (100%) 0.1 to 2 cm sway was observed. In my study sway was measured in two different conditions i.e with deyes open and with eyes closed in three different age groups i.e 50-60year, 60-70year, and 70-80year. There is 90.4% sway was observed in anterior direction, 89.6% sway in lateral direction in age group 50-60year with eye open. There is 78.4% sway was observed in anterior direction, 73.6% sway in posterior direction in age group 60-70year with eye open.

There is 21.6% sway observed in anterior direction, 17.6% sway in posterior direction in age group 70-80year. There is 76% sway was observed in anterior direction, 74.8% sway in lateral direction in age group 50-60year with eye close. There is 92.8% sway was observed in anterior direction, 80.08% sway in lateral direction in age group 60-70year with eye close. There is 30% sway was observed in anterior direction, 21.6% in posterior direction in age group 70-80year with eye close.

Conclusion

From the above study it has been concluded that this study supports the newly developed digital sway meter as a clinical tool for identifying sways in various directions(Anterior, Posterior and Lateral)similarly 100% sway was observed in anterior direction with eye open and eye close in all age groups.

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