

Original article:

Does physiotherapy intervention helps to reduce postural sway?

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Abstract

Introduction: The control of standing balance is a task of maintaining the body's centre of mass (COM) within the limits of the base of support, achieved by producing forces on the support surfaces (predominantly under the feet while standing). Excursions of the centre of pressure (COP), the point of application of the ground reaction force, measured by a forceplate has been widely used to represent postural sway, as an index of balance control.

Material and method : Total 40 no. of participants are participated in this study according to purposive sampling. The inclusion criteria for participants are age 65 – 75 years old, both genders are included and musculoskeletal conditions like cervical spondylosis. And who are having severe neurological, cardiac conditions, recent fractures and surgeries etc are excluded. With the help of sway meter we have measured the postural sway and after that they received their conventional physiotherapy for one week and again we have recorded the postural sway.

Result: Using the prism software we have calculated the p value by using two way ANOVA for eye open floor (column & row factor is 0.002 & 0.128), eye open foam (column and row factor is 0.1832 & 0.0001), eye closed floor (column and row factor is 0.0001 & 0.0063), eye closed foam (column and row factor is 0.0001 & 0.1222).

Conclusion: From our study it concludes that there is more postural sway in anterior and posterior direction as compared to right and left direction. And it also concludes that whatever the participants they received their conventional physiotherapy is helpful to reduce postural sway in cervical spondylosis condition.

Introduction

The control of standing balance is a task of maintaining the body's centre of mass (COM) within the limits of the base of support, achieved by producing forces on the support surfaces (predominantly under the feet while standing). Excursions of the centre of pressure (COP), the point of application of the ground reaction force, measured by a forceplate has been widely used to represent postural sway, as an index of balance control.^{1,2}

Postural control involves controlling body's position in space for dual purpose of stability and orientation.³ Postural stability or balance is defined as the ability to maintain the projected Center of motion (COM) within the

limits of Base of Support (BOS). During quiet stance there is a separate Center of Pressure (COP) under each foot. The net COP lies between the feet and depends on each limb support. Normally no one stands erect, instead the body sways in small amount, mainly forward and backward. Thus quiet stance is characterized by small amount of spontaneous postural sway.⁴ Researches done on stance postural control showed that no one stands absolutely erect, instead of the body sway in small amounts, mostly in forward and backward. Thus quiet stance is characterized by small amounts of spontaneous postural sway. Some of the methods used to measure postural sway employ postural grid,⁵ sway meter,⁶ and sophisticated instrument like posturography.⁸

Lord et al in (1991),^{6, 9} proposed that body sway during a bipedal stance could be measured using a sway meter. Lord et al in (1996) used the sway meter to find the maximum balance range in a randomized control trial and concluded that it has good test-retest reliability and can be used to analyze posture without use of expensive experimental equipment such as electronic force plate platform. Sway meter can be considered as a cost effective but efficient method to measure postural sway.^{10, 11} Sherrington (1991), found that sway measurements obtained with sway meter are strongly correlated with measurements obtained from a force plate, i.e. with movement of centre of pressure.^{6,9}

The musculoskeletal disorders like cervical spondylosis are affecting the postural sway, in which it affects the proprioception and increases postural sway.^{12, 13, and 14} Purpose of this study was to examine: 1) Dose physiotherapy intervention helps to reduce postural sway. 3) The immediate test-retest repeatability of postural sway measures obtained from the Sway meter. 4) The validity of the Sway meter against the floor & foam surface.

Material and Methodology

Sampling technique – Purposive sampling.

It is an experimental study conducted at Padmashree Dr. Vitthalrao Vikhe Patil Medical College; Ahmednagar. Permission to carry out Research was obtained from Institutional Ethical committee. Proper instruction and explanation about study was given to participants. The participants in the Age group of 65-75 years, Both genders were selected and who are having musculoskeletal problem like, cervical and MMSE (mini mental state examination) score should be >24. And the participants who are not able to follow commands, any severe medical conditions like neurological condition, cardiac condition etc.,

any recent fracture & recent surgery they were are excluded from our study. Total 40 participants were included for the study. The material used were sway meter, graph paper, blocks for holding graph paper, height adjustable table, floor and foam surface.

The device (sway meter) consists of inflexible 40cm long rod with vertically mounted pen at its end (Fig. 1). The rod was mounted 20cm wide metal plate which will be fitted at the level of PSIS (Posterior superior iliac spine) over lower back of participants by firm belt. Sway meter offers 1 degree of freedom between belt and pen as it's free to move. The pen recorded participants' postural sway on sheet of graph paper which is placed over the table.

The distance between the feet around 3 inches. The graph sheets were placed behind the subject. Graph sheet were level in such a way that, the rod of sway meter were maintained in horizontal position during starting the measurement (Fig. 1). Graph sheet secured during measurement to prevent displacement. The individuals asked to remove their foot ware and stand on 1st floor and then on foam surface.

The subjects were instructed to keep their hand by their sides during standing. Duration of each trial will 30 second. A starting point was marked on the graph paper (Fig. 2). At end of the 30 sec. The rod of the sway meter was taken away from the graph sheet and 5-10 sec. rest given during trial.

The procedure was repeated for each trial. A total of six trials was taken including, 3 trial with eyes opened on floor and foam and 3 for eyes closed on floor and foam. Maximum duration for all trial will be 6-7 min. maximum deviation in 3 trials will be taken for analysis.

The postural sway measurement is taken on before their conventional therapy and after that participant has received the respective conventional

physiotherapy for their condition i.e. cervical spondylosis. For cervical spondylosis participants has received hot water fomentation, cervical traction, TENS (Transcutaneous Electrical Nerve Stimulation), active range of motion exercises and isometric neck exercise for 5 times per week. And after 1 week again the same procedure is repeated and postural sway measurement is taken.



Fig.1 - Pictorial representation of the assessment of postural sway using the Sway meter

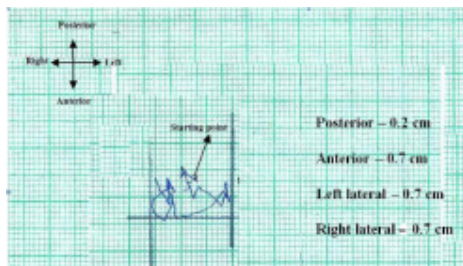


Fig.2 – Graphical representation of postural sway meter (with eye opened).

Result

For cervical eye closed floor (fig. 1) the p value for pre & post anterior sway is 0.0133 which is

statistically significant, and correlation coefficient r is 0.9524 and for pre & post posterior sway the p value is 0.0805 which is statistically not significant and correlation coefficient r is 0.9865, while comparing pre & post anterior and posterior sway, p value for column & row factor is 0.002 & 0.128, for column factor statistical value is significant and for row factor it is not significant.

For cervical eye closed foam (fig. 2) the p value for pre & post anterior sway is 0.0007 which is statistically significant and correlation coefficient r is 0.9967 and p value for pre & post posterior sway is 0.1013 which is statistically not significant and correlation coefficient r is 0.7398, and while comparing pre & post anterior and posterior sway, p value for column and row factor is 0.1832 & 0.0001, for column factor statistical value is significant and for row factor it is not significant.

For cervical eye open floor(fig. 3) the p value for pre & post anterior sway is 0.0353 which is statistically significant and correlation coefficient r is 0.9395 and p value for pre & post posterior sway is 0.0202 which is statistically significant and correlation coefficient r is 0.9765, and while comparing pre & post anterior and posterior sway, p value for column and row factor is 0.0001 & 0.0063, for column and row factor statistical value is significant.

For cervical eye open foam (fig. 4) the p value for pre & post anterior sway is 0.022 which is statistically significant and correlation coefficient r is 0.9255 and p value for pre & post posterior sway is 0.0353 which is statistically significant and correlation coefficient r is 0.9957, and while comparing pre & post anterior and posterior sway, p value for column and row factor is 0.0001 & 0.1222, for column factor statistical value is significant and for row factor it is not significant.

Fig. 1

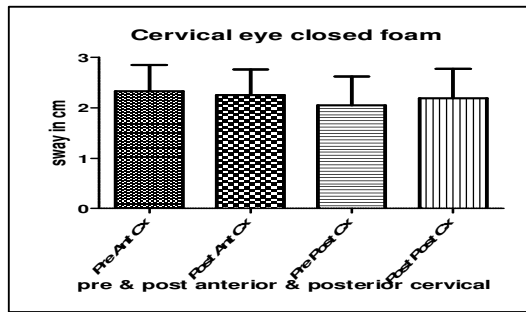


Fig. 2

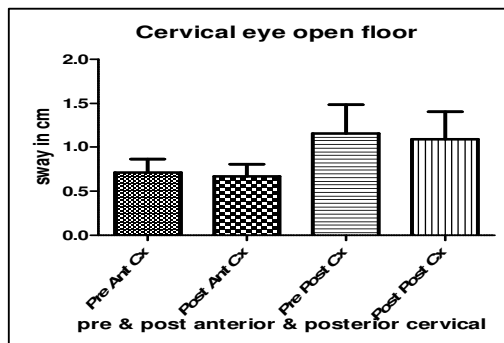
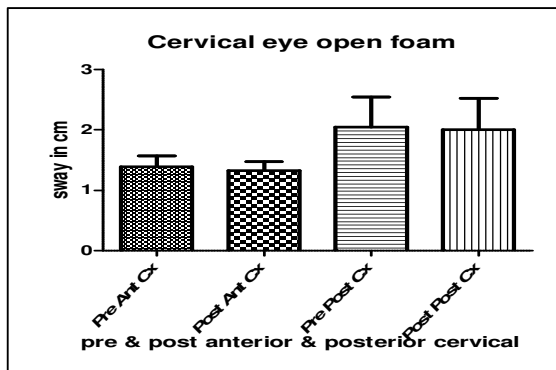


Fig. 3



Discussion

Control of the whole body COM is the primary goal of the balance system. The COP-COM position separation varies across individuals and conditions. In this study elderly individuals who age from 65-75 years are having more postural sway in anterior direction and posterior direction as compared to right lateral direction and left lateral direction by using sway meter in eye opened floor, eye closed floor, eye open foam, eye closed foam

And these participants are having the musculoskeletal conditions cervical spondylosis, lumbar spondylosis and osteoarthritis. In year of 1991 and 1996, Lord and Arnold,^{6, 9} the Sway meter is a reliable tool for assessing postural sway and discriminates between performance of young and older people across multiple sensory conditions. They found that the older adults having greater AP displacement, (F1, 473 = 23.84, $p < 0.0001$) (sway measured in mm, floor – eye open-

20.36, eye closed – 26.09, Foam – eye open 25.90, eye closed – 46.80) in presence of their medical conditions like musculoskeletal conditions. And in our study also the sway is more on anterior and posterior direction in participants along with their musculoskeletal condition.(sway measures in cm, floor – eye open – 1.10, eye closed – 1.14, foam – eye open – 1.98, eye closed – 2.83)

In other studies, in year of 2011, Ramchandran et al¹⁵ they studied about normative data in young individuals which shown that there is more postural sway in anterior direction and posterior direction, near about 50 % participant in eye open condition having anterior sway which is 1.1 to 2 cm and posterior sway in participants also having same reading while in eye closed condition 46.6 % of participants are having anterior sway which is 1.1 to 2 cm and 43.3 % participants having posterior sway which is 1 cm. Some individuals are not having postural sway on right lateral direction (23.3 %) and on left lateral direction (18.3 %). In our study there is pre and post values are compared but both are showing AP displacement is more in participant. (Pre value, Anterior: eye open floor – 1.10 cm, eye closed floor – 1.14 cm, Posterior: eye opened floor – 1.12 cm, eye closed floor – 1.20 cm, Anterior: eye open foam – 1.98 cm, eye close foam – 2.83 cm, Posterior: eye open foam – 2.03 cm, eye close foam – 2.65 cm)(Post value, Anterior: eye open floor – 1.01 cm, eye close floor – 1.13 cm, Posterior – eye open floor – 1.06 cm, eye closed floor - 1.15 cm, Anterior: eye open foam – 1.84 cm, eye close foam – 2.61 cm, Posterior: eye open foam – 1.90 cm, eye close foam – 2.48 cm)

In year of 2012, Ruhe and Walker¹⁶ they found postural sway in neck pain individual's i.e. cervical spondylosis. They conclude that there is more postural sway on anterior and posterior direction as compared to right and left direction

And Patients with neck pain exhibit greater postural instability than healthy controls, signified by greater COP excursions irrespective of the COP parameter chosen. And Ruhe and Walker²¹ they studied postural sway in low back pain individuals and lumbar spondylosis individuals which concluded that there is more sway in anterior and posterior direction.

This conventional physiotherapy is help to reduce pain, improve muscle power and also help to improve proprioception in participant And these factors is causing to increases postural sway and which leads to increases risk of fall in among elderly population and also increases risk of musculoskeletal injuries .

In our study there is less amount of postural sway in right lateral direction as compared to left lateral direction, because of 96 % of the participants are having right side dominance so they was having more control on right side, but no supportive data could be found in literatures reviewed. In this study the sway is more on anterior direction and posterior as compared to right lateral and left lateral direction. This could be because of wand phenomenon explained by Dennet.²²Wand phenomenon due to the tactile/kinesthetic system of the individuals which helps to a man to feel an object through another object, like feeling a banana through a knife, feeling the road through walking stick. Due to this wand effect individual could have felt the sway in the posterior direction and attempt to control the movement. So comment from the subject was obtained regarding to control postural sway and discomfort with the application of instrument. 70 % of the subject said that they attempted to control their sway. None of the subject felt discomfort with the application of instrumentation. Considering this fact in studies like this in future will be more valuable information on postural sway in standing.

Clinical Implication

1. Sway meter is useful to find out postural sway in elderly patients.
2. It easy to use and cost effective instrument.
3. It can also used to measure balance in the patients who are having balance impairment and with the help of this we can give them balance training.

Conclusion

From our study it has been concluded that the sways increases in anterior and posterior direction than right lateral and left lateral in condition of cervical spondylosis. And it also concluded that whatever the conventional therapy is received by participants is helping to reduce postural sway in elderly population.

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