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Comparison of Postural Sway in Young and Geriatric Individuals in Standing Posture on Balance Master

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Abstract: ***Background: This study is intended to find out the effect of aging on postural sway in older individuals. While performing ADL activities, requires performing more than one task simultaneously. In this study we are comparing between two population adults and geriatric. As the age increases, because of the degenerative changes balance decreases. Methodology: In this study, standing posture is used for balance examination with the use of balance master. Healthy young and older individuals are taken for examination and on balance master, postural sway was measured. Sensamove balance master has (0.510 – 0.815) intraclass correlation coefficient reliability and (0.535 – 0.705) pearson correlation coefficient validity as compared to gold standard force plate. Result: This study showed balance performances, in adults 97.25% and in geriatric 88% in standing task, 91.75% in adults, front deviation was 0.13 º and in geriatric, 0.67 º; in adults, back deviation was0.27 º and in geriatric, it was 0.65 º; in adults, right deviation was 0.14 º and in geriatric, it was 0.76 º; in adults, left deviation was 0.18 º and in geriatric, it was 0.58 º. Conclusion: There is significantly increased postural sway in geriatric population as compared to adults.***

Keywords: Standing posture, balance master, postural sway

1. Introduction

Postural stability is defined as the ability to maintain or control the centre of mass in relation to the base of support.[1-3] Balancing is the process by which postural stability is maintained.[4]

The control of the posture is maintained by a complex central sensorimotor system which integrates information from the vestibular, visual, and somatosensory systems. This coordinates posture mechanisms in such a way than neural command to the posture-stabilizing muscles of leg and trunk can be corrected almost instantaneously for deviation in balance.[5]

Postural control involves cognitive as well as sensory processes in the organization and integration of sensory information under both static and dynamic conditions.[6,7] These cognitive processes could include the attention needed to perform the task, arousal, motivation and judgment.[8]Postural adjustment requires cognitive processing and more attention.[9]Attention described as the capacity or resources for processing information.[10]

Cognitive processing plays an important role in motor performance[11]. A series of cognitive processes are proposed to be involved in executing a motor skill, including stimulus identification, response selection and schema retrieval from long term memory.[10,11]

Significant declines in all the major sensory and motor inputs that contribute to balance with age have been reported[12-19], although it has not been shown whether there are variable rates of decline among these systems and in consequence whether there are age-associated changes in the importance of each of these sensory systems to balance control. In a previous paper, sensory and motor contributions to stability were examined in elderly institutionalized subjects[20].

The aim of this study was first to estimate the level of the central reorganization process by investigating the automaticity in upright standing in the elderly by simultaneous performance of balance. Secondly, to show whether an important characteristic of the central reorganization process of postural control after the gradual decrease in the somatosensory system in the older population is present. Thirdly, an attempt has been made to integrate rehabilitation practices with aspects of neuroscience.

Most studies that have assessed associations between sensory systems and increased body sway on firm surfaces have shown that impaired vibration sense shows the strongest correlation[21-24]. Whilst a number of studies have not found a significant association between impaired proprioception and increased body sway, this could be because of the acknowledged imprecision of the clinical tests used[22,24].

In a previous study of hostel residents, Lord et al. found that both reduced proprioception as measured quantitatively and tactile sensitivity were related to increased sway[20]. Only one study, that by Lichtenstein et al., has reported a significant association between vision (near visual acuity) and sway, whilst a number of reports have found negligible associations between vestibular function and sway[20,22].

Lord et al. have extended this work by examining which sensory and motor factors are associated with sway when peripheral input has been altered, that is by having subjects stand on a compliant (foam rubber) surface. Under this

condition with eyes open, reduced vision and strength, in addition to impaired peripheral input, were significantly associated with increased sway, whilst under this condition with eyes closed, strength and reaction time played significant roles[20].

Therapists should take into account the role that concurrent cognitive tasks play in the performance of simple motor skill such as standing. They should incorporate more opportunities to practice dual tasks in the clinical setting to better prepare patient or person to adequately respond and adapt to their everyday environments and to prevent the risk of fall.[21]

Many daily activities require performing more than one task simultaneously, such as standing while engaging in a conversation. By asking individuals to perform two concurrent tasks, we are able to evaluate how attentional capacity can be shared and how performance is affected.

2. Methodology

1. Participants

Healthy geriatric population and adults, age group above 60 for geriatric individual and age group between 20-40 were included in our study. Data was collected from the different areas of Ahmedabad. Both genders were taken for the study. Written consent forms were taken from all the participants.

Inclusion criteria:

- Age group above 60 for geriatric and 20-40 for adults
- Both the genders were included

Exclusion Criteria:

- Previous injury that can affect balance
- Any neurological and cognitive impairment
- Balance disorder and visual disorders

2. Apparatus

The sensamove balance master apparatus was used in this study. It consists of a spinning top, with the USB is a laptop and the matching program connected. Thus, the test can be done almost anywhere. In many studies authors have found that sensamove balance master has 0.510 – 0.815 intraclass correlation coefficient reliability and 0.535 – 0.705 pearson correlation coefficient validity as compared to gold standard force plate[37]. In other studies they found that sensamove balance master is reliable and valid to check for balance and they compared the results with berg balance scale, functional reach test, Tinetti – test[38].

3. Measurement Procedure

Subjects were instructed to remove their shoes but not socks. 15 seconds practice trail was administered. After practicing the trails, the subject was asked to stand on the balance master. Subject was asked to stand on balance master for 30 seconds.

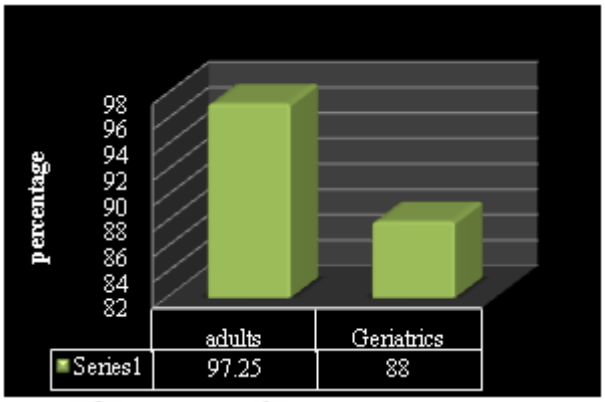
4. Subject's Position:

Standing with hand by the side.

3. Results

Table 1: Descriptive Statistic For Front, Back, Left and Right Postural Sway (in Degrees) in Standing Posture for Geriatric and Adults. (Mean Values)

Standing Balance	Adults	Geriatric
Performance (%)	97.25	88
Front Deviation	0.13	0.67
Back Deviation	0.27	0.65
Right Deviation	0.14	0.76
Left Deviation	0.18	0.58



Graph 1: Balance Performance in Standing Still in Percentage

4. Discussion

This study was conducted to investigate the effect of aging in geriatric population in standing on balance master. Postural sway was compared with adult parameters in all the directions for geriatric population.

In this study subjects were standing on balance master for 30 seconds and the data were compared between two population i.e. adults and geriatric with percentage of postural sway, front, back, left and right deviation by using Balance Master to analyze balance in our study standing still shows 97.25% for adults and 88% in geriatric population.

Postural control in the elderly was studied using a cognitive approach. The results of this study show a significant increase in postural sway under single-task conditions in older subjects compared with younger ones. There is also a significant increase in postural sway in both age groups while performing dual-task tests. The study showed that postural adjustments require cognitive processing and more attention[9]

In our study the postural sway in all the directions were, front deviation in adults it was 0.13º and in geriatric it was 0.67º; back deviation in adults it was 0.27º and in geriatric it was 0.65º; right deviation in adults it was 0.14º and in geriatric it was 0.76; left deviation in adults it was 0.18º and in geriatric it was 0.58º.

Teasdale et al.showed that as the sensory information decreased, the postural task became increasingly difficult for older subjects and required more of their attention capacity[26].

The same trends of results were found in two other studies. These findings suggest that the central reorganization process accompanies a decrease in the somatosensory system in old subjects. Our study suggests that there is a successful central reorganization process at the same level of interference in both age groups[27,28].

Some authors found that aging slows monosynaptic ankle reflexes in old people. These findings of age decrements in monosynaptic reflexes seem reasonable, because the speed with which neural impulses travel along peripheral nerves is slowed with age[29,30,31].

Our study found that there is greater decrement in performance of balance in standing posture compared to geriatric population. This results shows that there may be decrease in the somatosensory functions in older population as well as because of the degenerative changes, can be the reason for reduced balance.

-In sum, the present results demonstrated that postural sway during standing on a compliant surface was greater when the difficulty of the concurrent cognitive task increased. This finding supports the notion that cognition and motor performance are related[32].

Older individuals experience deterioration of the sensory systems involved in postural control, hence, the central nervous system might need more attention to maintain appropriate control of posture to compensate for this reduction in sensory information[34-36].

Shumway Cook et al found the same decrement in performance of postural stability between young and old healthy adults. A more challenging postural condition such as standing on a compliant surface or the performance of a secondary cognitive task in postural stability varies between the two groups. These authors found that in contrast to the young and healthy, the older adults with a history of falls and postural stability problems were significantly affected by a simple cognitive task[33].

5. Conclusion

There was significant increase in postural sway in all the directions and balance performance in older individuals compared to adult age groups.

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