

The Effects of Different Times of Day on Dynamic Balance Performance of Persons with Disabilities

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ABSTRACT: The purpose of this research was to investigate the effects of different times of day on dynamic balance performance of persons with disabilities. 20 deaf disabled men (age average 24 ± 0.2) were participated voluntarily in the research. Participants performed dynamic balance test (YBT) in the hours 10:00 and 15:00 and 20:00 of the day. To study the dynamic balance changes during different hours of the day, repeated measures was used. The results showed that the dynamic balance in the morning, afternoon and evening were not significantly different from each other. Although the comparison of the means showed that the performance of the participants in the afternoon had been better than the morning and evening. Generally, it can be said that like healthy people, the balance performance of people with deaf disabilities fluctuates throughout the day. The findings of this study can be used to improve athletic performance, rehabilitation and improvement of injuries, improvement of health and physical fitness.

KEYWORDS: Circadian Rhythm, Balance Performance, the Deaf Disabled, Fluctuation.

INTRODUCTION

Balance is an ability which has been studied from different aspects of the neuropsychological, biomechanics and performance (Phillip et al, 2007). In terms of neurophysiology, the balance is a sensory data interaction from three parts of somatosensory, visual and vestibular system and their processing in the central nervous system and eventually the creation of the dynamic command by the CNS¹ (Phillip et al, 2007). In terms of biomechanics, the balance has been divided into both static and dynamic kind. Static balance is to maintain a state with the fewest movement of the center of pressure that requires very little muscle activity while dynamic balance is defined under the active movement of the pressure center within the supporting surface.

Therefore, depending on whether the changes in the state of dynamic equilibrium, it is also more neuromuscular activity (Kejonen, 2002; Shumway-Cook, 2005; Winter, 1990)

1 . Central Nervous System

The ability to balance on two legs is an essential part of daily activities. Postural control in rehabilitation and most sports play a major role (Schneiders et al, 2012). It should be noted that there are many situations which a stimulus to a sudden leads to loss of balance, and ultimately the injury. Therefore, the evaluation of the ability to maintain balance in athletes / patients with the highest possible accuracy and factors affecting is of utmost importance (Strang et al. 2008). Some of these factors include age, sex, foot shape and circadian rhythms (Waterhouse et al, 2005). Many behavioral and biological functions such as lung function, core body temperature (Waterhouse et al, 2005), mood (Boivin, 1997), reaction time (Reilly et al, 2000), alertness and memory (Johnson, 1992) and cognitive function (Dijk, 1992) have changed during the day.

Among the factors that may affect the balance are circadian rhythms. In relation to the impact on the balance of circadian rhythms, it can be said that most of them originate from mammalian of an internal rhythm located in the suprachiasmatic nucleus (SCN) in upper hypothalamus. Neural outputs are related to suprachiasmatic nucleus with other centers in the hypothalamus and endocrine devices. These centers are causing a lot of volatility and behavioral psychology (Carrier and Monk, 2000).

The problems with hearing disabilities are often considered only from the aspect of communication. However the communication problem is the most common defect caused by hearing loss, other physical problems may also be associated with hearing loss. In this respect, the balance defect with damage to sensory integration and motor development is a hearing impairment, which is often seen in people with disabilities (Myklebust, 1953). According to general systems theory in maintaining physical stability and balance, the sensory systems which include the inner ear vestibular section, visual sense and sensory-somatic feeling play an important role. The damage to the parts of the atrial-cochlear nerve not only results in vestibular-sensory hearing loss, but it may be associated with balance problems due to damage to the vestibular nerve branch and this is the reason why about 40 percent of deaf people are faced with the balance problems (Myklebust, 1964).

In various studies, the equilibrium impairment of hearing disabled is mentioned compared with the normal people. Morsh (1936) dealt with comparing vestibular function of hearing loss and normal comparison in high school. He observed that people with hearing loss compared to normal people showed the weaker results (Morsh, 1936). Gill (1990) compared static and dynamic balance and hearing impaired and normal children and he concluded that hearing-impaired children compared to normal children have less dynamic balance but there is no a significant difference among their static balance (Myklebust, 1953). Almost the findings of most studies have shown that people who the balance of deaf people is less than healthy individuals. Among the variables which may affect the balance of the different are hours of the day.

Little research has been done on the impact of different hours of the day the balance. The research of Philip et al (2007) is among these studies. Their results showed that the dynamic balance was better in the morning than in the afternoon and evening and different hours of the day had not a fixed and specified effect on static postural control and this requires further evaluation. The studies have shown that the balance fluctuates due to circadian rhythms during the day so that at the time during the day, the best performance and at the time during the day, the weakest performance is created for the individual. No study has examined the impact of hourly of the balance of deaf people until now. Since the balance assessment of people with the hearing disability for awareness of the severity and possible disorders and providing the necessary advice to them and their families in terms of environmental and recreational experiences are of utmost importance, therefore, the present research was performed to investigate the effects of different times of day on the performance of dynamic balance of persons with disabilities.

MATERIALS AND METHODS

The present research was applied in terms of purpose and was based on comparative-causative studies and the research project is based on a time series because the variables were measured at different times of the day. The population included all the deaf disabled in Alashtar in 2016 that 20 male people participated for sampling available (age average 24 ± 0.2) in the research. In the phase of performing the research, the researcher referred to Social Welfare Bureau of Alashtar and they received the list of people with the hearing loss covering by the center. Then, they considered the list of all those who had the qualification of the selection by observing. In the next step, the researcher was referred to qualified individuals, after describing the object and purpose of research, among those who would like to participate in the study, 20 patients were selected. Regarding ethical considerations after the consent of people and necessary awareness, they were asked to perform tests on a set day visit. Data collection was done in two days. On the first day, preliminary explanation about measuring and purpose of the test, how the test participants were described in detail and the participants conducted 5 trials to learn with excellence Y (figure1).

Actual measurements of height and leg length (the actual length of the leg from the upper iliac spine - anterior to the medial malleolus to normalize the data) were calculated. Also, the dominant leg was determined with the use of this information that participants with lower extremity which is more likely to kick soccer. Based on the coordination, data collection was done in a day in which the participants were asked to perform) the balance test YBT on three occasions (during the hours of 10:00, 15:00 and 20:00) (Philip et al., 2007). For data analysis, ANOVA with repeated measurements was used. The significance level 0.05 was considered.

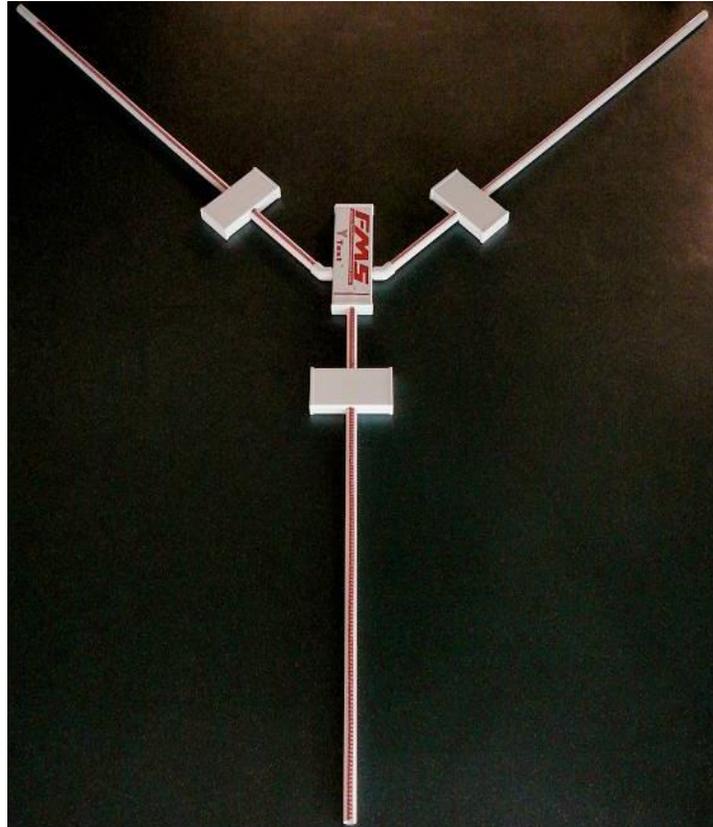


Figure1. Y balance test

RESULTS

Statistical descriptive results related are provided to the distance of separating different hours of the day to achieve dynamic balance in Table 1 and Figure 1. It can be seen that the average distance of the achievement in the afternoon had been better than in the morning and evening.

Table 1. Mean and standard deviation of the distance of the achievement of the dynamic balance.

Day hours	The distance of the achievement (the percent of foot length)
10:00	105.95 ± 2.48
15:00	116.7 ± 2.55
20:00	105.2 ± 1.8

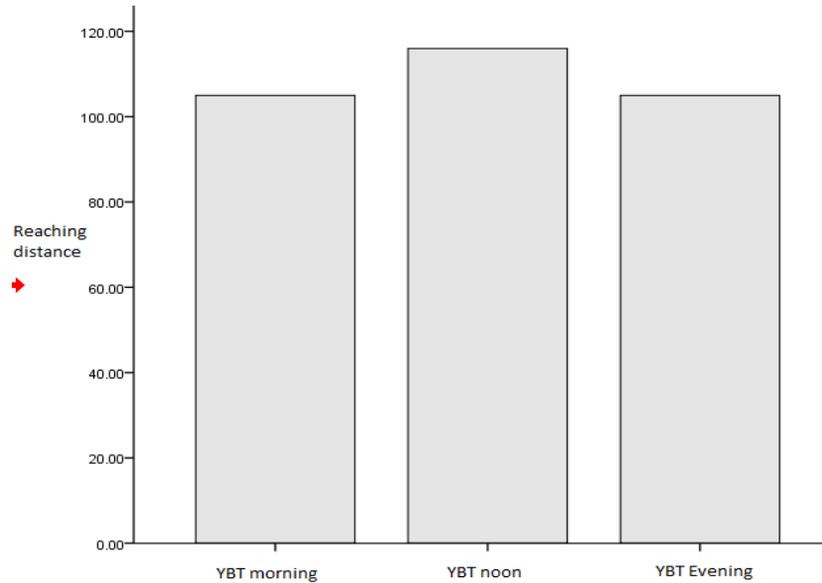


Figure 1. The distance of the achievement of the dynamic balance (cm) in the morning, afternoon and evening.

The results of Kolmogorov - Smirnov (K-S) showed normal distribution of data ($p > 0.05$). To examine the dynamic balance of participants during the day, ANOVA with repeated measures was used. The results are presented in Table 2. The results showed that the performance of dynamic balance in the morning, afternoon and evening was not significantly different from each other ($F_{1, 19} = 1.13$, $P > 0.05$, Table 2).

Table 2. Repeated measurements on comparing the dynamic balance with disabilities at different hours of the day.

Source of variance	SS	df	MS	F	P
Dynamic balance	4.9	1	4.9	1.13	0.3
Error	82.1	19	4.321		

DISCUSSION AND CONCLUSION

The purpose of this research was to investigate the effects of different times of day on the performance of dynamic balance of persons with disabilities. The results showed that there was not seen a significant difference among the scores of the dynamic balance at three times of the participants with the deaf disabilities. The average distance to reach the participants at three times of the morning, afternoon and evening was 105.95, 116.7 and 105.2 cm, respectively. This average shows that although there was not found any significant difference among the different hours of the day, the performance scores were better in the afternoon than the two other times. In explaining this finding, it can be said that the aim of the dynamic balance task was to maintain the stable base of supporting with the maximum possible effort. The achievement for this goal requires contraction, recruitment and integration of environmental information as well as muscle strength and neuromuscular control to create the optimum level for doing the task (Chtourou and Souissi, 2012).

The effect of different times of the day represents the maximum distance achieved in the afternoon. These results were in contrast with the study of Philip et al (2007) which were conducted in healthy people. Their results showed a better performance in the morning than in the afternoon and evening. SEBT was used by the researchers to measure the dynamic balance. This test measures the dynamic balance in eight directions so that for each direction, a score and a total score is calculated for the dynamic balance but Philip et al. (2007) tested the direction of anterior in collecting data among the eight directions. Although the results showed that the female participants had a better performance in the morning, but the man performance was against the female participants but the men had a better performance in the morning. The researchers considered this difference in performance as the difference of two genders in the use of quadriceps so that the women used the quadriceps to control their knee while the men tended to involve hamstring (Gauthier et al, 2001). Since anterior SEBT needs more activity of the quadriceps, maybe the difference in the use of

quadriceps caused the women to perform better in dynamic balance in the morning than in the afternoon and evening. The dynamic balance task used by Philippe et al had two major flaws. First, they used only a direction for measuring the dynamic balance. Second, the results in relation to the men were quite different from the women, because the number of woman participants was higher than the men and this reason resulted in better performance of the dynamic performance in the morning than in the afternoon and evening but YBT was used to measure the dynamic balance in the present.

The balance test was measured in three anterior, anterior-posterior and anterior-medial directions and a dynamic balance score was calculated of them. In fact, the measurements of dynamic balance in research are a better indicator to measure the dynamic balance. However, it should be noted that different variable including both physiological and psychological may yield superior dynamic equilibrium in the afternoon than in the morning and evening. The balance task used in this study was YBT requiring muscle strength, flexibility and coordination research. The changes in these factors during different hours of the day may result in better balance in the afternoon than in the morning and evening. The researchers have shown that the stability and accuracy of service badminton and tennis (Atkinson, 1994) in the afternoon hours are high. These changes are associated with the changes in fatigue and arousal. Circadian rhythms have had similar effects on specific football skills such as dribbling, chip and cross. Circadian rhythms play an important role on the flexibility of the knee joints in the balance of skills so that the researchers have reported the lowest levels of muscular stiffness in the afternoon.

The researchers have not considered the differences in the different hours of the day to the amount of activity assigned to warm up the muscles and they said that the difference of the flexibility affected the rhythmic patterns and Warming up could not reduce the difference between the total flexibility of the body at different hours of the day (Atkinson, 1998). The muscle strength which is among the other factors affecting the dynamic balance, the performance peak is reported in the afternoon no matter what muscle groups are assessed (Relly et al, 2000). Other researchers showed that isokinetic performance parameters (such as peak torque, mean and maximum) were recorded at higher speeds in the afternoon (Reilly and Garrett, 1995). This may be the result of specific rhythmic variations in the speed of muscle strength which the reason is the muscle fibers.

Among the limitations of the study was the low number of the participants. In general it can be said that, like healthy people, people with disabilities deaf balance fluctuate throughout the day. The findings of this study can be used to improve athletic performance, rehabilitation and improvement of injuries, improvement of health and physical fitness.

Conflict of interest

The authors declare no conflict of interest

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