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The Effect of Retro Walking Training on Dynamic Balance in Sedentary Individuals with Hearing Impairment

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ABSTRACT

The study analyzed the possible effects of retro walking exercise techniques on the skill of balance in hearing impaired individuals. The study is a quasi-experimental study and the single group pretest-post-test design among the experiment models was used. The study groups was applied a retro walking exercise for eight weeks. 25 hearing impaired students participated in the study, who had not engaged in any sports branches previously, in the 13-17 age group and did not have any neurological and orthopedical diseases in the last 6 months as the study group. In order to measure dynamic balance, the 'Techno Body ProKin Balance Measurement Device' was used. At the end of the eight week exercise program, the same measurements were taken again and the development level within the group was assessed. The descriptive statistics, arithmetic averages and standard deviation values of the participants' age, height, weight and hearing impairment percentages were determined. It was analyzed whether the data displayed normal distribution. Since it was seen that the data displayed normal distribution, the Paired Sample t-test was done. As a result of the study, it was seen that there was a significant difference between the pretest, post-test mean ranks of the participants' both feet, right and left feet perimeter length (PL) (p<.05). It was seen that this difference was in favor of the post-test when the mean ranks and totals of the scores were taken into consideration. It was seen that there was a significant difference between left foot MECAP pretest and post-test mean ranks as well (p<.05). In addition a significant difference was also found between both feet and right foot MECML values' pretest, post-test mean ranks (p<.05). The results of the study showed that the retro walking exercise program is effective in hearing impaired individuals in terms of improving their dynamic balance skill. Through the findings, it can be said that the use of different, efficient and safe exercise methods such as retro walking should be given importance to for hearing impaired individuals to be more active and do efficient and safe exercises.

Key words: Hearing Impaired, Retro Walking, Dynamic Balance, Sedentary

INTRODUCTION

People primarily need three sensory systems to achieve orientation in space. There are visual, vestibular and proprioceptive (deep sensory) systems (Teasdale et al., 1993). The visual system is the first system which notifies the situations that prevent us from planning our movements and see our path. The vestibular system is a structure which perceives our linear and angular motions. The proprioceptive system consists of receptors which are sensitive to the positions and speeds of body segments, their contact with other objects and gravity (Winter, 1995).

The visual system transmits the pictures of where the objects around us are and where we are positioned according to our environment. During the movements of the head and the body, it makes it possible to hold the objects and places around us in our point and area of sight and carries out its function. Certain watching movements and certain reflexes create sense of depth and make extremely important contributions to balance. It is known that patients with bad eye- sight and have astigmatism experience balance problems. It is also know that individuals with balance problems experience greater difficulties in the dark or when their eyes are closed (Shumway-Cook & Horak, 1986).

Walking exercises that can be designed in a suitable manner for individuals with balance problems are cost-effective and accessible. It is known that these exercises are effective in reducing cardiovascular diseases (Boone-Heinonen et al. 2009), obesity (Morabia & Costanza, 2004; Pucher et al., 2010) and symptoms of depression (Robertson et al., 2012; Armstrong & Edwards, 2004). In addition, walking is the most common form of physical activity in the UK and USA (Craig et al., 2009).

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Retro, is a prefix which means "backwards" in Latin. Walking backwards, countermarching is also known as retro walking. Moving backwards, doing the opposite of a normal movement is called retro movement (Yan et al., 2015). Retro movements reduce the load that falls on the joints of lower extremities and increase muscle power. Thus, they minimize the negative effects which may arise during practices and exercises. Additionally, the length of the step during retro movements are shorter compared to forwards movements. This increases step speed and in turn consumption of energy (Cha et al., 2016). In numerous studies carried out with students, it has been reported that retro movements have positive effects on students' basic motor skills and in particular on balance, strength and flexibility skills (Anandhi & Nivethika, 2018; Jetly & Sharma, 2018).

In several researches (Hochberg et al., 2012, Krishnan & Goswami, 2018), it is stated that retro walking, in other words backward walking is also proposed for the treatment of OA knee patients. Various benefits of retro walking are emphasized. It helps to activate different muscles, change direction of forces and various joint mechanics and reduces the compression loads. Retro walking supports conventional therapy. It helps to diminish the disability and improve the quality of life.

While running and walking backwards, we move without relying on our eyesight. This develops our other senses, primarily hearing, more. Besides, balance and proprioception (body's skill of perceiving movements within joints and joint position) also increase (Jetly & Sharma, 2018). In children with hearing impairments, static and dynamic balance skills are affected depending on age, gender, etiology and level of hearing loss. Balance losses are experienced more intensely in children with severe hearing loss and affects their life greatly. In this respect, positive effects of physical activities have been found in terms of the development of balance skills of individuals with hearing impairments and if these types of activities are turned into a habit, it is possible to improve damaged vestibular coordination structures and balance skills (Gheysen et al., 2008). At this point, the use of exercise techniques which are thought to improve balance skills such as retro walking in hearing impaired individuals with the purpose of developing and improving these skills will facilitate doing activities which they have difficulty with in their daily life.

It is known that hearing impaired individuals have insufficient balance skills due to damages that are present in their vestibular system from birth or take place later on in their lives. In this study, the effect of retro walking activities on the dynamic balance skills of hearing impaired individuals who lack the required visual input as well to achieve balance was analyzed. When the studies in the literature were reviewed, it was seen that the effects of retro walking on the development of various skills were studied. However, none of these studies dealt with hearing impaired individuals. Therefore, it is considered that analyzing the effects of retro walking on the development of balance skills of hearing impaired individuals who have balance problems will contribute to the literature. Additionally, designing the physical education course content of hearing impaired students by taking into account their disability will help these students gain skills that will facilitate their daily lives. In this context, retro walking practices will guide the design of various activities in physical education classes in practice. It is thought that the development of the mentioned activities through the study's findings will support practical applications in physical education.

METHOD

Study Group (Population-Sample)

The study is a quasi-experimental study and the single group pretest-post-test design among the experiment models was used. The study group went through retro walking exercise for eight weeks.

A total of 25 hearing impaired students were volunteered to participate in the study, after the required legal permissions were taken and permission was taken from their parents after they were informed with a consent form in line with the Helsinki Criteria. Hearing impaired students, who had not engaged in any sports branches previously, in the 13-17 age group and did not have any neurological and orthopedical diseases in the last 6 months participated in the study.

Data Collection Tools

The participants were informed about the measurement tools and important points about the measurement process was explained before they were involved with test measurements. With the purpose of introducing the devices and showing how the measurements were going to be done, the participants were asked to try out after example trial measurements were taken by the researchers. The participants were asked to do two trial measurements and the best score were recorded to the measurement forms to be used in the evaluation. In order to measure dynamic balance, the "Techno Body ProKin Balance Measurement Device" was used (Figure 1).

Figure 1. Techno body prokin balance measurement device

After the eight week exercise program, the same measurements were redone and the development level of the group was analyzed.

Dynamic Balance Measurement

The Techno Body ProKin balance device, is an electronic balance measurement device which measures dynamic balance with eyes open and with both feet and single foot (right-left). While the participants stand on the device, they try to keep their balance by moving inside the circle seen on the computer screen. Before the measurement, the device is set, connected to the computer and the names of the participants are written on the measurement form. There are three separate measurement headpieces as easy, medium and difficult. The device gives 5 different data for both feet and two feet separately and the best data obtained from the two applications is included in the analysis (Akın, 2013). The evaluation was done over the average (MECAP) between the perimeter length (PL), the average between the values obtained on the anterior-posterior axis and the average (MECML) between the values obtained over the medial-lateral axis (MECML).

In the study, the easy measurement headpiece was used. The participants were included in the study after they were informed about the test protocol. The screen was placed in a position the participants could easily see. After the participants stated they were ready for the test, the measurement was initiated. The test was done with both arms open and it was applied for thirty second when it was done with both feet and it was applied for ten seconds with right and left feet separately. When the participants lost balance and fell or stepped off the platform before the test ended, the measurement was repeated. The test was applied twice and the best result was recorded on the measurement forms (Korkmaz & Akın, 2019). The test is shown in Figure 2.

Collection of Data/Procedure

The study group was applied retro movements for 30 minutes 3 times a week within scope of the program. The retro movement series consists of the movements explained below and these were applied for 30 minutes.

1. Running backwards by pulling the knees to the stomach
2. Running backwards by pulling the feet towards the hips
3. Doing slalom (changing direction) right and left while running backwards
4. Going backwards with large cross steps
5. Running backwards by skipping (The foot is changed with each step. While one-foot skips, the other foot is pulled towards the stomach)
6. Running backwards with swift steps, with the legs and toes stretched and stretching the legs to the front (The body in a slightly bent backwards position)
7. Running backwards with swift steps, with the legs and toes stretched and extending the feet backwards (The body in a slightly bent forward position)

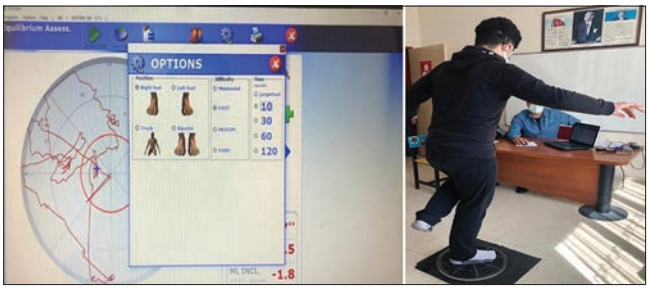

Figure 2. Dynamic balance measurements

Analysis of the Data

The descriptive statistics, arithmetic averages and standard deviation values of the participants' age, height, weight and hearing impairment percentages were determined. It was analyzed whether the data displayed normal distribution or not. Since the data displayed normal distribution, the pretest and post-test results were compared with the Paired Sample t-test.

RESULTS AND DISCUSSION

The descriptive statistics of the participants are displayed in Table 1.

As it can be seen in Table 2, there is a statistically significant difference between the both feet, right and left feet perimeter length (PL) pretest and post-test mean ranks of the participants (p<.05). It can be seen that this difference is in favor of post-test when the mean rank and totals of the scores are taken into consideration. It can be seen that there is a statistically significant difference between left foot MECAP pretest and post-test mean ranks as well (p<.05). In addition, a statistically significant different was seen between the both feet and right foot MECML values' pretest and post-test mean ranks (p<.05).

DISCUSSION

The 25 hearing impaired participants of the study had similar physical and hearing impairment levels. Equilibrium balance was measured with the Techno Body Balance Device. When the equilibrium dynamic balance test results were analyzed, a significant difference was found between both feet, right and left foot perimeter length (PL) pretest and post-test values (p<.05). A significant difference was

Table 1. The descriptive statistics of age, height, weight and impairment rates of the participants in the study

	n	*M*	*SD*
Age	24	16.08	1.32
Height	24	163.92	9.42
Weight	24	54.00	11.75
Hearing impairment degree	24	55.80	9.95

Table 2. The Paired sample t-test findings related to the comparison of the study group's pre-test and post-test dynamic balance values

	n	Test	*M*	*SD*	*t*	*p*
BOTH FEET PL	24	Pre-test	511.31	99.92	8.27	0.000*
		Post-test	418.04	99.90		
BOTH FEET MECAP	24	Pre-test	0.87	2.85	1.26	0.210
		Post-test	0.27	1.37		
BOTH FEET MECML	24	Pre-test	-1.84	2.14	-2.73	0.010*
		Post-test	-0.84	1.97		
RIGHT PL	24	Pre-test	197.92	46.19	5.56	0.000*
		Post-test	153.03	30.45		
RIGHT MECAP	24	Pre-test	0.79	2.97	0.34	0.730
		Post-test	0.50	2.48		
RIGHT MECML	24	Pre-test	-1.96	3.00	-2.42	0.020*
		Post-test	-0,43	2.62		
LEFT PL	24	Pre-test	203.06	34.90	6.72	0.000*
		Post-test	163.97	27.33		
LEFT MECAP	24	Pre-test	1.47	2.53	2.80	0.010*
		Post-test	0.05	1.68		
LEFT MECML	24	Pre-test	-1.80	2.33	0.89	0.380
		Post-test	-2.33	2.56		

PL: Total covered distance
MECAP: Oscillating movement to the front and back
MECML: Oscillating movement to the right and left.
*p<.05

found between left foot MECAP pretest and post-test values as well (p<.05). In addition, a significant difference was found between both feet and right foot MECML values' pretest and post-test values (*p*<.05). However, no significant difference was found between both feet and right foot MECAP, left foot MECML values' pretest and post-test values (*p*>.05).

In the literature, there are studies similar to this study which deal with the effect of retro movements on the skill of balance. In one of these studies carried out with a patient group of 30 people consisting of women and men aged 40-60 with osteoarthritis, it has been shown that retro movement exercises reduce pain in patients with osteoarthritis and that these exercises are more effective compared to traditional treatment methods in improving balance and functional performance (Manisha et al., 2015).

In another study carried out with 60 university students that lasted for one and a half years, it was seen that retro movements are more effective in developing flexibility, strength and balance compared to walking forwards (Jetly & Sharma,2018).

In Hackney and Earhart's study (2009) study on Parkinson patients and Manckoundia et al.'s (2008) study on adults experiencing balance loss, it was found that retro movements have a positive effect on balance properties in the experiment groups. In Fritz et al.'s (2013) study on 130 adults, it was determined that retro exercises' balance and mobility properties are better.

In a study carried out with 16 healthy male children (age: 7.19 ± 0.40 years) on the development of balance, while the experiment group was applied a backward walking exercise program for 12 weeks (twice a week and 25 minutes each), the control group was not applied any exercise programs. At the end of 12 weeks, it was seen that the balance of the experiment group was better than the control group (Hao & Chen, 2011).

In a study in which 40 individuals consisting of female and male university students aged 17-25 with normal body mass index were separated to two groups randomly, while group A was applied retro walking and active stretching exercises, group B was only applied active stretching exercises 3 times a week for 4 weeks (Group A: retro walking for 6 minutes on the treadmill and 3×15 second of active stretching; Group B: 3×15 seconds of active stretching). As a result of the study, it was seen that the dynamic balance measurements of Group A were better compared to Group B (Anandhi & Nivethika, 2018).

In Chand et al.'s (2013) study with a group of 30 female and male university students, 15 students were applied retro walking for 6 weeks 3 times a week (Group 1) and 15 students were applied passive static stretching (Group 2). At the end of the 6 week exercise program, it was found that significant improvements took place in the hamstring muscle length of the group which was applied the retro walking exercise and that retro walking exercises have significantly increased both static and dynamic balance performance.

Pandya and Tank (2020) have done a study in which they analyzed the effects of retro walking on hamstring muscle-flexibility and dynamic balance with university students for 4 weeks with 3 séances a week. As a result, it was observed that there was a statistically significant improvement in both hamstring muscle flexibility and dynamic balance values.

In Öztürk's (2019) study in which retro walking exercises were applied to 32 male children aged 9-13 years for 8 weeks, a statistically positive significant difference was found between dynamic balance and leg strength values. In a similar study, Duman (2019) has applied retro walking exercises to a total of 279 participants aged 14-18 for 8 weeks and determined that dynamic balance skills developed both in females and males.

As a result of studies dealing with retro walking, it has been shown that dynamic balance values develop. These studies have been carried out with groups involving the elderly, children, patients with knee problems and Parkinson's disease. These findings support our study. However, no studies were found which analyzed the effect of retro movements in the hearing impaired on dynamic balance. In the light of these findings, our study becomes even more important. It is considered that as hearing impaired individuals do retro movements, the proprioceptive sensory system works more actively due to the inactivation of visual data flow as well. Therefore, the data on body position and movements which the brain receives play an important role in balance development. This may be considered as one of the reasons for the development of dynamic balance in our study.

This controlled study aimed at analyzing the effects of a retro walking exercise program on dynamic balance skills

in hearing impaired individuals. The results of this study showed that the retro walking exercise program is effective in improving dynamic balance skills in hearing impaired individuals.

CONCLUSION

As a result, the use of different, efficient and safe exercise methods such as retro walking should be given importance to for hearing impaired individuals to be more active and do efficient and safe exercises. It is considered that besides the balance skills of hearing impaired individuals, their basic bio motor properties such as strength and flexibility will also develop by this means.

In the light of these studies these suggestions can be listed:

- Due to the deformed inner ear structure of hearing impaired individuals, it is considered that short-term studies have very little effect on the performance of the measured skills and that if longer studies are carried out with hearing impaired sedentary individuals, better results will be achieved.
- Different bio motor skills of hearing impaired individuals can be tested as well.
- Younger age groups can be studied.
- Retro walking exercises can be included in all physical activities for the hearing impaired individuals.
- Physical education classes in the hearing impaired schools can be added to the curriculum.
- This research can be also conducted with the individuals who have different disabilities (such as blind etc.).

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