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Effect of Aquatic Program Therapy on Dynamic Balance in Down's Syndrome Children

Authors
Somaia Ali Hamed[1], Shahesta Ahmed Osama[2], Al-Shimaa Ramadan Azab[3]
[1]Lecturer at department of physical therapy for pediatrics, Faculty of Physical Therapy, October 6 university
[2]Lecturer at department of physical therapy for orthopedics, Faculty of Physical Therapy, October 6 University
[3]Lecturer at department of Physical Therapy for Growth and Development Disorders in Children and its Surgery , Faculty of Physical Therapy , Cairo University

Abstract
Purpose: *to examine the effect of swimming program therapy on dynamic balance in Down's syndrome patients.*
Subject: *Thirty children suffering from Down's syndrome ranging in age from 8to 12 years from both sexes. Subjects were divided randomly into two groups of an equal numbers, control group which received selected physical therapy program and study group which received the same treatment program while receiving controlled swimming program for three successive months.*
Methods: *The patients Step Width step Length and Speed was evaluated before and after the suggested treatment program by Balance Master System. The data were collected and analyzed using paired and un-paired t-test to compare the difference between the results.*
Results: *this study revealed that there were significant differences of all the measured variables between the control and study groups*
Conclusion: *swimming therapy program has got clear effect when added to the treatment program in Down's syndrome children.*
Key Words: *Down's syndrome, balance, swimming.*

Introduction

Down's syndrome is a genetic syndrome linked to chromosomal malformation caused by additional chromosome 21 [1], clinical symptoms include several impairments such as orthopaedic, cardiovascular, neuromuscular, visual, cognitive and perceptual impairments [2]. It is the most common genetic cause of developmental disability resulting in gross motor and fine motor skills impairments in children [3]. Several studies showed that individuals with Down's syndrome have deficits in eye–hand coordination, strength, balance, laterality, visual motor control and reaction time. [2] Children with Down's syndrome have been noted to have decreased strength of hip abductors and knee extensors compared with normal children. [4]

In Down syndrome, hypotonia along with diminished muscle strength and endurance, makes learning gross motor skills challenging. The ligaments are longer than normal while poorly coordinated movement of hips, feet and shoulders cause strain on ligaments and joints on the long term. [5]

Children with Down's syndrome usually have short arm and legs compared to their trunk length which restrict their ability to learn gross motor skills. For example, shorter legs restrict climbing, motor skills involving balance, such as learning to sit and to stand are more difficult, as a child falls further before their hands reach the ground to protect their fall.[6]

Additionally, postural deficits have been identified in children with Down's syndrome. Conolly et al [7] found that children with Down's syndrome scored significantly lower in the balance subset than the comparison group. Neuro–muscular problems, such as hypotonia, retained primary reflexes, and slow performance of volitional reaction, lead to problems not only with motor functions and cognitive development, but also problems with body balance [8]. This is why children with DS show exaggerated body movements as an answer to destabilized stimulus. Balance reaction is additionally problematic due to inadequate co–contraction caused by muscle weakness, mental retardation, dysfunction in sensory integration processes, cartilage hypoplasia, and improper bone density [9]. A review of balance publications in the literature suggests that children with mild to moderate motor impairment have limited abilities to maintain a state of equilibrium. Etiologies of balance deficits may include neurological and musculoskeletal causes may be interpreted as the fact that a limited movement repertoire causes difficulties in maintaining a state of equilibrium within a given changeable environment.[10] This was also postulated by Kegel [11] The fewer the variations of movement strategies the children perform, the better the balance abilities they present .Most important benefits of the aquatic environment increasing body immunity and endurance, improving function of the circulatory and respiratory system [12]

Materials and Methods

Patient's Inclusive criteria: Thirty children suffering from down 'syndrome They were selected from the outpatient clinic of Faculty of Physical Therapy 6 October University according to the following criteria ,their age ranging from8 to12 years from both sexes ,all children have the ability to understand simple instructions. The study excluded patients who had sever auditory, visual and sever cardiac disorders and children who have loss of functional vision and hearing

Children were randomly assigned into two groups of an equal number. Group (A) study group and Group (B) control which received a designed exercise program with emphasis on balance training , while group A (study) received the same program in addition to controlled swimming training program ,Step Width, step Length and Speed for each child was evaluated before and after three months of treatment by using Balance Master System.

Instrumentation used for evaluation: Balance Master System: assessment of the study and control group was done by using of Balance Master System measuring the following parameter: Step Width, step Length and Speed. The total time required for evaluation of each child was average 20 minutes and the evaluation was conducted before and after three successive months of training program.

Program procedures

Both groups received the following exercise program: Horizontal jumps, vertical jumps, one leg stance with eye open, tandem stance, walking on line, walking on balance beam and jumping on a trampoline. Each activity was given initially for 10 repetitions; it was increased by five repetitions when the child was able to do it with ease. Each exercise was demonstrated before its execution to familiarize each subject. Instructions were repeated until the subject knew what was expected. Subjects were positively reinforced during the entire training programme to ensure their maximum effort during each training session Duration and frequency of training was gradually increase swimming program:

In order to evoke desirable effect. Minimal participation once a week in swimming pool classes was required [13]. Pasek et al [14] recommends even a more frequent participation of 3 times a week – fitted for age, capabilities and limitation.

The swimming program was done in Wadi Degla club; small groups-up to 4 participants in groups increased the level of safety and performance of exercise. The training was conducted by one instructor, while the second person was the supervisor and controller of the whole process. The training was conducted 3 times a week for three successive months.

Results

Paired t-test was used to test if there is a significant difference between pre and post means in each group. Independent samples t-test was used to test if there is a significant difference between means of both groups.

Demographic Data

Thirty patients participated in the study. They were randomly assigned equally into two groups; study group and control group. Independent t-tests were conducted to compare between both groups for the demographic data (age, weight, and height). The independent t-test revealed that there were no statistically significant differences (P>0.05) between subjects in both groups concerning age, weight, and height (Table 1).

Table (1): Descriptive statistics and independent t tests for the participants demographic data for both groups.

	Study group (X±SD)	Control group (X ±SD)	t-value	p-value	Level of significant
Age (years)	9.10 ±0.78	9.11 ±0.67	0.115	0.909	N.S
Weight (kg)	36.53±3.96	36.5±3.96	0.018	0.985	N.S
Height (m)	1.20±0.11	1.21±0.08	-0.054	0.957	N.S

*Significant level is set at alpha level <0.05

Table(2): Paired samples t-test for difference between pre and post means in each group

Group	Variable	Pre mean	Post mean	Mean difference	t-value	p-value	Significance
A	Step width	23.15	20.97	2.18	7.2	0.0001	S
	Step length	32.62	35.41	2.79	8.4	0.0001	S
	Speed	73.85	77.78	3.84	21.3	0.0001	S
B	Step width	23.25	21.07	2.18	9.04	0.0001	S
	Step length	32.57	34.50	1.93	7.02	0.0001	S
	Speed	73.76	76.44	2.57	5.97	0.0001	S

S: Significant NS: Not significant

Table (3): Independent samples t-test for difference between means of both groups

	Variable	Group A mean	Group B mean	Mean difference	t-value	p-value	Significance
Pre	Step width	23.15	23.25	0.1	0.39	0.69	NS
	Step length	32.62	32.57	0.05	0.27	0.78	NS
	Speed	73.85	73.76	0.09	0.23	0.81	NS
Post	Step width	20.97	21.99	1.02	2,60	0.01	S
	Step length	35.41	34.50	0.91	2.57	0.01	S
	Speed	77.78	76.44	1.33	2.72	0.01	S

S: Significant NS: Not significant

Comments

1. There is a significant difference between pre and post means within group A. Step width decreased while step length and speed increased there is a significant difference between pre and post means

within group B. Step width decreased while step length and speed increased.

2. There is no significant difference between pre means of both groups, and there is a significant increase in post step length and speed in group (A) rather than group (B) also there is significant decrease in step width in group (A) rather than group (B).

Discussion

The purpose of this study was to evaluate the effect of swimming training program on dynamic balance in children suffering from Down's syndrome. Thirty children suffering from Down's ranging in age from 8 to 12 years were chosen from the outpatient clinic of the Faculty of Physical Therapy, October 6 University. Both sexes were involved. Subjects were divided randomly into two groups of equal numbers, control group which received selected physical therapy program and study group which received the same treatment program while receiving swimming program for three successive months.

The Halliwick Concept is increasingly used in therapy of children suffering from cerebral palsy,spina bifida , Down syndrome , mental disability, and spinal cord injury as a form of mobilization in the aquatic environment.[15]

Shumway-Cook and Woolacott [16] found that postural responses to loss of balance were slow in young children with Down's syndrome; they concluded that these responses were inefficient for maintaining stability. They also suggested that balance problems in these children occur not due to hypotonia but from defects within higher level postural mechanisms.

Children with Down Syndrome often have delayed communication skills and may have some degree of intellectual disability. This can affect the length of time taken to learn more complex gross motor skills including games and sport. Additional support and more repetition is recommended to tailor instruction, demonstration and hands-on guidance to enable a child with Down Syndrome to learn these skill. [17]

Physical activity in the aquatic environment appears to be one of the most effective pro-health objectives. The significant potentiality to improve posture results from the impact that the aquatic environment has an effect on the human body at rest and during exercise. Among the substantial number of children and youth affected by various condition. [18]

The results of the study revealed a significant difference between pre and post means with in groups A and B. Step width decreased while step length and speed increased.

The post treatment results of this study revealed an improvement in the mean values of the measured variables of the control group which received a selected physical therapy program which confirm the validity of the traditional physical therapy techniques in the treatment of Down's syndrome patients. While there is a significant increase in step length and speed of the study group than control group. And there is a significant decrease in Step width in the study group rather than the control group.

This improvement may be due to the interaction of the hydrostatic pressure of water and the buoyancy force which reduces the static work required to support the body to the minimum, reduce the weight of joint and spine by counterbalance gravity and supporting the body weight, water environment make it easier to assume the correct posture .The improvement in study group may also be due to that .The child in water has much greater freedom of movement in the water and so learning of movement is easier .All swimming strokes and kicking are cellist activities for developing trunk and in order to stay steady and stable in water ,they have to use their trunk muscles all are leading to increase trunk stability. In water environment the child body has continuous sensory pressure on its surface this kind of sensory input [15], which assists in increasing their body awareness working with both the support of water and its resistance, as when children tired, their bodies are supported by water.

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