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The effect of physical training on static balance in young people with intellectual disability

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ABSTRACT

Intellectual disability affects all spheres of people's lives who suffer from it. It lowers the level of intellectual functioning, often stigmatizes, characteristically changing features, and decreases motor performance. Unfortunately, modern medicine cannot cure intellectual disability; however, there is a chance to improve the quality of life of people with mental retardation by means of physical exercises and by enhancing coordination, the quality of gait and efficiency in performing everyday activities. This paper deals with observations of static balance in 40 young females and males with mild Down syndrome, out of which 20 were subjected to a three-month sensorimotor training programme. The participants performed exercises with rehabilitation balls and air pillows twice a week, and the remaining persons constituted a control group. The balance platform test conducted at the beginning of the experiment revealed that the level of static one-legged balance was similar in both groups. A significant difference was noted in the length of the path of the general centre of gravity (COG) and the time frame in which the vertical projection of COG remained within the 13 mm radius circle, between the result of the test conducted under visual control and with the eyes closed, both in the group of the participants performing exercises and the ones who did not do them. After the training sessions the results of both tests improved in the group of the persons subjected to the training programme, however differences between the groups were not statistically significant, apart from the comparison of the time of keeping COG within the 13 mm radius circle at the beginning and at the end of the experiment by the participants who were physically active. Our results lead to a conclusion that exercises with the use of unstable surfaces improve deep sensibility in people with mild mental retardation.

1. Introduction

Intellectual disability is a complex dysfunction difficult to define accurately; it considerably hinders the functioning of people suffering from it in all spheres of their lives, affects their mental sphere and behaviour, disturbing both self-perception and inter-personal relations, which to a considerable degree decreases the quality of coexistence in society. Mental retardation negatively affects the life of a disabled person also by lowering their motor development, which is

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manifested by poor visual and motor coordination, limited precision of movements, inhibition and difficulties in learning new forms of activities.

Persons with intellectual disability are worse at performing motor tasks which require combination of two activities (tossing and catching a ball, performing run-up jumps, tossing a ball up in the air after a leap), they also often have difficulties in developing praxis skills. Additionally disturbed body sensibility and poor spatial orientation considerably decrease the level of static and dynamic balances, which is manifested by awkward movements and increases the risk of falls. The above mentioned results in worsening the performance of everyday self-management activities and decreases chances to participate in the life of a group of healthy peers or a possibility to find at least simple gainful employment. All these factors often make persons with intellectual disability alienated from society and experience lack of acceptance, which further decreases their self-assessment and motivation.

1.1. Objectives

This paper presents an assessment of the impact of physical exercises with the use of unstable surfaces on the level of static balance in persons with mild intellectual disability. Two one-legged standing trials with the eyes open and closed allowed observing changes in using information from the deep sensibility receptors for maintaining a stable position of the body. Showing whether sensorimotor exercises can improve the quality of deep sensibility in mentally retarded young people, and whether it would be advantageous to implement them in the general programme of increasing the efficiency of those people, was the superior objective of the experiment.

2. Methods

2.1. Participants

The experiment comprised a total of 40 participants with mild intellectual disability, students of a Special Education and Care Centre. The group consisted of 20 females and 20 males, aged 16–18 years (the average 16.8 years). Down syndrome was the cause of mild retardation of the participants and none of the persons taking part in the study suffered from dysfunctions of the musculoskeletal system or another accompanying ailment.

2.2. Procedure

The assessment of the level of basic somatic build characteristics, i.e. body weight and height, was conducted and the body mass index was calculated on its basis. Body weight was assessed on the *Tanita* scales to an accuracy of 0.1 kg, body height was measured within 1 mm by means of a calibrated anthropometer, and the quality of static balance was estimated employing the *Emi duo* balance. Observations were made during one-legged standing on the extremity chosen by the participant, first with the eyes open then closed.

The length of the path covered in 30 s by COG of the person standing on the platform was noted and the result was recorded in millimetres. Moreover, we estimated the percentage of time in which the vertical projection of the participant's COG remained within the 13 mm radius circle. The tests describing the level of balance were selected taking into account their simplicity and accuracy of the variables description; the longer the vertical projection path of COG, the smaller the stability of the participant. Simultaneously, the time frame expressed in percentages, in which COG was kept within the circle of a small radius, allowed to state whether a considerable length of the path did not result from a one-time bigger swaying of the person with an overall good postural balance. The above mentioned tests were also used by other authors (Carneiro, Santos-Pontelli, Colafêmina, Carneiro, & Ferriolli, 2010; Martinez-Mendez, Sekine, & Tamura, 2011).

After the first test the whole group was randomly divided into two groups of the same size (20 participants), keeping an appropriate ratio between the number of females and males. The first group consisted of young people subjected to a training programme which targeted at improving the quality of balance, and for consecutive 12 weeks they participated twice a week in a 45-min training session consisting of exercises on rehabilitation balls and air pillows, exercises in balance positions, standing and walking on surfaces with different structures and degrees of stability. The exercises performed by the subjects are: prone- and back-lying rocking on a rehabilitation ball, prone-lying in hand support on a rehabilitation ball (lower extremities straight in knee joints, placed in trunk extension), in kneeling position with hands and knees resting on rehabilitation pillows, attempts at keeping balance and alternate upper right and left limb raising to horizontal position, keeping the correct sitting posture on a rehabilitation ball, balancing the pelvis in the sagittal plane while sitting on the ball, balancing the pelvis in the frontal plane with alternate right and left foot raising above the floor, standing on two-feet on a rehabilitation pillow, attempt at performing a knee bend while standing on a rehabilitation pillow, walking barefoot on a spiked gum mat, walking barefoot on a 10 cm thick soft exercise mat, walking along the gym and stepping on rehabilitation pillows of different thickness.

After completing a 3-month training, the balance test was conducted a new in the way described above and with the use of the same measurement devices.