ORIGINAL RESEARCH PAPER

Physiotherapy

EFFECT OF SENSORIMOTOR ACTIVITIES AND RESISTANCE TRAINING ON BALANCE IN CHILDREN WITH DOWN'S SYNDROME

KEY WORDS: Down's Syndrome, Sensory- motor training, Resistance training Unilateral limb stance

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ABSTRACT

Objective: To assess the effect of sensorimotor activities and resistance exercises on balance in children with Down's syndrome

Methodology: 3 special schools were identified in south Bangalore. Permission was taken for conducting the program. Upon screening, children with Down's syndrome who met the inclusion criteria were included. Unilateral stance time was assessed and baseline values were noted. Intervention program was administered as a supervised group session for 45 min per session twice a week for 3 months. A total of 24 sessions were completed. Balance outcomes were re- assessed after 3 months. Data was analyzed using Wilcoxon Signed Ranked Test.

Results: Unilateral stance time for both dominant and non dominant legs showed significant difference of p=0.007 and p=0.002 respectively.

Conclusion: In children with Down's syndrome, sensorimotor activities and resistance training are effective in improving Unilateral stance time.

INTRODUCTION

Down's syndrome is a genetic disorder. In India the incidence of Down syndrome is variously reported from 1:600 to 1:800 live births.[1] It is a common cause of neurodevelopmental disability (Harris and Shea, 1991) that includes hypotonia, joint laxity, delayed achievement of motor milestones, and disturbances in postural control. In a longitudinal study, Connolly et al. found that children with Down syndrome continued to have problems with postural stability into adolescence. The neuropathology associated with Down syndrome, including a smaller cerebellum and brainstem, is thought to be a factor in these deficits[2,3].

Dyer et al make a mention of hypotonicity to have a negative impact on the proprioceptive feedback and the overall efficiency of muscle co-contraction and postural control is affected. [4] Shumway Cook & Wollacot also discuss the balance reactions occur at a slower rate compared to age matched normal children. The loss of postural control and balance is also contributed by the increased mobility of joints.[5]

Therefore strategies to improving postural stability may lead to better overall functional motor performance. Proprioceptive input, together with integration of tactile and vestibular information, provides the child with awareness of position of his body in space and movement and it increases tone.[5,6] This input involves any type of activities which gives compression and distraction of the joints. The role of vestibular system in sensory integration is very important. It plays a vital/ integrative role, contributing towards the large range of functions from acquiring balance reaction to enhancing perception. The vestibular receptors in the inner ear respond to movement of head and inputs can be either excitatory (playful) or inhibitory (rocking). It is the change in direction that is important rather than movement itself. Therefore input can be through a variety of ways like moving quickly up into their bouncing up and down on his feet, rotation or spinning. Tactile and vestibular information provides the child with the awareness of the position.[7]

Down syndrome children always need some extra stimulation and help so that they can achieve the status of being independent individuals[8] So, this study was conducted with an objective to find out the combined effect of sensorimotor activities and resistance training on Unilateral Stance time in children with Downs Syndrome.

MATERIALS AND METHODS

Three day care schools catering to special children were identified in South Bangalore. A general physiotherapy screening carried out on a total of 110 children in these 3 special schools, identified 26 children with Down syndrome. Permission was sought from the respective school principals for conducting an intervention program. Once the permission was granted, the parents of the selected children were individually spoken to or contacted on telephone as some of these children are looked after by caretakers. Informed verbal consent was obtained from all parents.

Out of these 26 children, 20 who were able to follow the commands and instructions, no history of cardiac illness or musculoskeletal injury of lower limb were chosen for the intervention program. Baseline assessment was taken for balance and strength.

Assessment of balance was done by recording unilateral stance time for each leg. A study of test-retest reliability of balance test suggested that single leg standing is a reliable test and can be used to monitor balance control in children with Down's syndrome.[9] To familiarize children with testing and to establish a stable estimate of each child's abilities, measurements were taken 2 or 3 times and the best value was taken. The number of measurement sessions and timing of the measurements varied because of the children's schedules. At the baseline, the leg for which unilateral stance time was greater was considered as the dominant leg.

An exercise program was designed keeping in mind the principles of vestibular and proprioceptive rehabilitation. The exercise program consisted of 2 components- Sensorimotor activities and Strength training.

The exercise program was constructed with literature reference work which consisted of 30 minutes of sensorimotor activities and 15 min of strength training. [10]

Sensorimotor and proprioceptive activities consisted of toe standing, heel standing, toe walking, tandem walking, forward and backward jump, sideways jump, unilateral standing and kicking sideways.[10]

The children also practiced balance on standing on foam with both legs with eyes open and closed. The activities were done as a part of their routine games in a rather playful manner.

Strength training was given for 3 prominent lower limb muscle groups viz. Hip extensors, Hip Abductors and Knee extensors. The resistance was determined individually by 10 Repetition Maximum method. [11, 12] Exercise intervention was given in the form of group exercises at a frequency of 2 sessions per week for 24 sessions.

At the end of 2 months reassessment was done using same outcome measures- Unilateral stance time and 10 RM. Children did not undergo any other physiotherapy intervention but routine activities were not interrupted.

RESULTS AND DISCUSSION

The results at the end of 2 months show following findings in balance.

TABLE 1: No. of sessions completed and Difference in pre and post unilateral stance time at the end of 2 months

NO. SESSI-ONS COMPLETED	DOMINANT PRE	DOMINANT POST	DIFFERENCE	NON-DOMINANT PRE	NON-DOMINANT POST	DIFFERENCE
	Time in sec.	Time in sec.		Time in sec.	Time in sec.	
6	1	2.32	1.32	1	4.73	3.73
6	6	11.1	5.1	19.8	19	0.8
8	16.59	9.33	7.94	13.04	15.14	2.1
8	14	18.02	4.02	9	11.46	2.46
9	10	12	2	7.69	13.55	5.86
11	3.63	10.05	6.42	3.91	7.98	4.07
12	6.09	16.02	9.93	3.78	7.51	3.73
12	15.49	16	0.51	8	12.27	4.27
12	7	12.61	5.61	10.23	13.98	3.75
12	20	26.7	6.7	13.85	18.03	4.18
12	6.8	15.23	8.43	6	12.06	6.06
12	8.51	26.15	17.64	5.55	13.6	8.05
13	5.39	13.29	7.9	2.4	20.65	18.25
13	4	4.82	0.82	3	3	0

Out of the 25 children who were included in the exercise program only 14 children completed at least 6 sessions and were hence taken for analysis. 11 children who completed less than 6 sessions because of absenteeism and illness were excluded.

There is a statistically significant improvement p=0.007 for dominant side and p=0.002 for non dominant side as checked with Wilcoxon Signed Rank Test for unilateral stance time in the 14 subjects who completed at least 6 sessions. However we cannot comment conclusively as we can see in the Table: 1 that there is a wide difference from 1 sec to 16.59 sec for baseline values of unilateral stance time among the individuals. Some of the reasons may be the inability of the Down's children to understand, unfamiliar/new situation i.e. activities in which they had never participated before. The reasons for a higher baseline values could be because of a few children who participated in athletic/sports activities in school and the activity used for evaluation might have mirrored the sports activities they were doing and have been familiar with. This needs to be further evaluated.

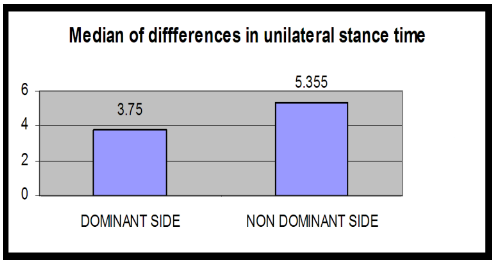

Fig 1: Median difference in Unilateral Stance Time

The non-dominant side (5.35 sec) showed a better median difference in unilateral stance time duration compared to the dominant side (3.77 sec). The post intervention improvement seen varies greatly from 0.8sec to 18.25 sec. Maximum improvement appears to have occurred in those who attended 12 sessions in 6 weeks. We did not come across any studies which talk about the number of sessions or quantum of improvement to compare, but they give the kind of exercises that we have followed. We suggest that 12 sessions in 6 weeks could be optimum. However, we cannot conclusively comment upon this because we have not taken intermittent data. This could be done in the future with the help of some standardized test.

Limitations and recommendations: The study was conducted on a small size; number of dropout was very high. The population studied was non- homogenous in its characteristics such as age, gender, type of down syndrome(True Trisomy 21, with Trisomy 21 Mosaicism and translocation involving chromosome 21), or initial functional activity level and Intelligence Quotient (IQ).

Studies using a control group are needed to determine whether changes in unilateral stance time are due to the exercise program, maturation, chance, or some other factor. Further studies are needed to determine the most effective training intensity, duration, and activities. The duration of the current study was limited and a longer program with intermittent evaluation may result in variable outcomes than the present findings. Age related changes in response to exercises also requires to be considered and may be addressed in future studies.

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