

Effects of Vestibular Physiotherapy Protocol on Children with Developmental Coordination Disorder in the Prevention of Fall

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Abstract

Background: Developmental Coordination Disorder (DCD) is a disorder in which motor coordination is impaired substantially and also affects the Activities of Daily Life (ADL) and academic performances as defined in the diagnostic and statistical manual of the mental disorder 4th edition (DSM IV). Developmental coordination disorder is more common in boys than girls. 73% to 87% of developmental coordination disorder children have difficulty in maintaining posture. Vestibular rehabilitation therapy is the accountable for balance maintenance and stability.

Objective: To find out the effectiveness of vestibular rehabilitation therapy on children with developmental coordination disorder in the prevention of falls.

Methodology: A quasi- experimental study was done in pre and post test type on 30 samples with age group of 8– 13 years children with Developmental coordination disorder for the duration of six weeks. The vestibular rehabilitation therapy was used as the intervention for the improvement of balance and the prevention of falls.

Outcome Measures: DCDQ' 07 Questionnaire, Timed Up and Go Test (TUGT) and Pediatric Balance Scale (PBS).

Results: There is a significant difference in the pre and post test of TUG test and PBS after the intervention. ($p < 0.05$)

Conclusion: The vestibular physiotherapy protocol increases the posture controlling ability and declines the risk of falls from low to moderately low in children with Developmental coordination disorder.

Keywords: Developmental Coordination Disorder (DCD), Poor postural control, vestibular rehabilitation, Paediatric balance scale (PBS) and Timed up and go test (TUGT).

I. INTRODUCTION

The Developmental Co-ordination Disorder is a disorder in which motor coordination is substantially impaired and also affects the ADL (activities of daily life) and academic performances and the symptoms of Developmental Coordination Disorder have no relation in any neuro medical condition such as cerebral palsy and learning disabilities as defined in the text book of diagnostic and statistical manual of the mental disorder 4th edition (DSM IV)¹. The collection of

defects in proprioception, coordination and planning of motor events in an orderly manner can cause Developmental Coordination Disorder². Developmental coordination disorder is a condition which is more common in boys than girls³. Defect in the development of nervous system in Developmental Coordination Disorder interferes with the daily life activities participation⁴. There are four standards on which Developmental Coordination Disorder is based: The accession and implementation of harmonized motor skills is considerably below the expected given the individual's sequential age and occasion for skill learning and use. Difficulties are exhibited as tactless as well as slowness and imprecision of performance of motor skills. The motor skills shortage substantially and constantly affects the daily life activities suitable to sequential age and collides with academic/ school productivity, prevocational and vocational activities, respite and play. Appearance of symptoms occurs in starting period of development. Shortfalls of motor skills are not interpreted better by intellectual disability (or) visual impairment and are not ascribable to the neurological condition affecting movement¹. High prevalence of developmental coordination disorder is seen among the age group of 8 to 13 years where at least one kid in a class has developmental coordination disorder. Extremely prevailing disorder is Developmental Coordination disorder in School going population with 1.8-6% where their Activities of Daily Life and School Performance is affected^{5,1}. The ability for maintaining balance is a tedious process in which various structures are involved: sensory afferents, integrative centre of the central nervous system (CNS) and efferent motor neurons⁶. In general, centre of mass of a person should be at the S2 level and the line of gravity should fall within the base of support to maintain and alter the position of the body in space is termed as balance⁷. 73% to 87% of developmental coordination disorder children have difficulty in maintaining posture⁸. Sensory organization is part of postural control which orients sensory feedback from somatosensory, visual, vestibular source that are analysed in the central nervous system⁹. Below normal level postural control and defect in the sensory organization are the clinical representation of developmental coordination disorder children⁸. Vestibular

rehabilitation was first evolved in 1940 by Cawthorne and Cooksey to treat Peripheral vestibular disorder. Vestibular rehabilitation therapy is the accountable for balance maintenance and stability. The target of vestibular rehabilitation therapy is to enhance the balance and spatial adaptation. The VRT programme consist of: (i) Habituation exercises: Patients with vertigo are asked to perform movements that would activate a sensation of vertiginous episodes to habituate them. (ii) Exercises that are delineated to extend the vestibulo- ocular reflex and to stabilize the visual input so as to increase the harmonization of movements of the ocular muscles in regard to movements of head and neck. (iii) Exercises to control posture: on the basis of activities they exhibitin regard to changes in the one or more sensory afferences for the need of improvement of visual, vestibular and proprioceptive systems integration. (iv) Cardiovascular conditioning exercises: aerobic exercises with reduced intensity to promote the fitness physically⁶. The purpose of the study is to evaluate the effectiveness of vestibular rehabilitation therapy on children with developmental coordination disorder in order to prevent falls.

Aim of the Study

To find effects of a vestibular physiotherapy protocol on children with developmental coordination disorder in the prevention of falls.

Need of the Study

The exercises training methods are based on generalized physical conditioning programmes, with no previous studies having implemented detailed intervention protocols specifically, for the training of the structures involved in balance in children with DCD.

II. METHODOLOGY

STUDY DESIGN	: Quasi-Experimental Study
STUDY TYPE	: Pre and post type
SAMPLING METHOD	: Convenient sampling
SAMPLE SIZE	: 30 Subjects
STUDY DURATION	: 6 weeks
STUDY SETTING	:SRM NIGHTINGALE SCHOOL, West Mambalam, Chennai.

Inclusion Criteria

Age:8 – 13 years

Gender:Both boys and girls

Children with Developmental Coordination Disorder (DCD)

Exclusion Criteria

Epilepsy

Inability to walk independently

Neurological pathologies (**Example – Cerebral Palsy**)

Muscular pathologies (Example – Duchenne Muscular Dystrophy) Visual pathologies. MATERIALS USED

Height charts Weighing machine

2 Portable chairs and inch tape Stop watch

Procedure

A quasi experimental study in pre and post test type was conducted with children in SRM NIGHTINGALE SCHOOL.

The subjects were selected according to inclusion and exclusion criteria and informed consent was obtained from the parents of the individuals after giving the detailed explanation on the need of the study. DCDQ' 07 questionnaire had been distributed to the teachers and parents of the children who were suspected with reduced sports activity and poor academic performances. Having done the DCDQ'07 scoring, 30 subjects were selected for this study. The subjects were checked for Timed Up and Go Test (TUGT) and Paediatric Balance Scale (PBS) and the score was noted as pre test scorings. As a result of pre test scores, the subjects were considered to have moderate to low risk of fall. Then the subjects were given the instructions and demonstrations for how to complete the each and every exercise in the intervention programme. The subjects were monitored then and there, and the movements were corrected whenever the exercises were performed wrongly.

The exercise regimen was started with postural control exercises which was asked to be performed by the children for the repetition of 10 times. Then exercise for eye muscles and gaze stabilization was given for 5 repetitions and walking for 10 minutes was added as aerobic exercises which is also called general conditioning exercises. Exercises involving upper extremity movements and gaze stabilization exercises were performed in the sitting position. These exercises were performed for first three weeks of intervention.

For the next three weeks, additionally the postural control exercises were asked to be performed in eyes closed position. The subjects had been given liberty to walk off in the middle of the intervention if they wish to do so. Fortunately, all 30 subjects completed the 6 weeks of intervention successfully. Then Timed Up and Go Test (TUGT) and Paediatric Balance Scale (PBS) scores were taken as post test readings. The statistical analysis was done between the pre and post test readings with SPSS Software (version.20).

Outcome Measures

Anthropometric measurements: It is a measurement of height and weight which is used to assess the BMI and built of the individual.

Timed Up and Go Test (TUGT): It is the test to assess the dynamic balance of the individual.

Paediatric Balance Scale (PBS): It is the scale with 14

elements to analyze the ability to maintain balance in children.

DCDQ' 07: This is the questionnaire to find out where the child has Developmental Coordination Disorder (DCD).

III. STATISTICAL ANALYSIS

The collected data was tabulated and the International Business Machine (IBM) Statistical package for social science (SPSS) version 20 for windows was used for data analysis. The statistical tool used in this study was paired 't' test for analysis of pre test and post test value of Paediatric Balance Scale (PBS) and Timed Up and Go Test (TUGT).

TABLE I

Comparison Of Pre And Post Test Of Pediatric Balance Scale

Test	Mean	N	Mean difference	Std. Deviation	T- test	Sig: (2-tailed)
PRE PBS	47.7333	30		2.50425		
POST PBS	48.1667	30	-.43333	2.46469	-2.904	.007

This table shows the mean value of pre-test of Paediatric balance scale (PBS) which is 47.733 and post-test of Paediatric balance scale (PBS) which is 48.17. Hence this

clearly indicates that there is a significant difference between the pre and post test values since the p value is 0.007 ($p < 0.05$).

GRAPH I

COMPARISON OF PRE AND POST TEST OF PEDIATRIC BALANCE SCALE

X axis- mean Y axis- score

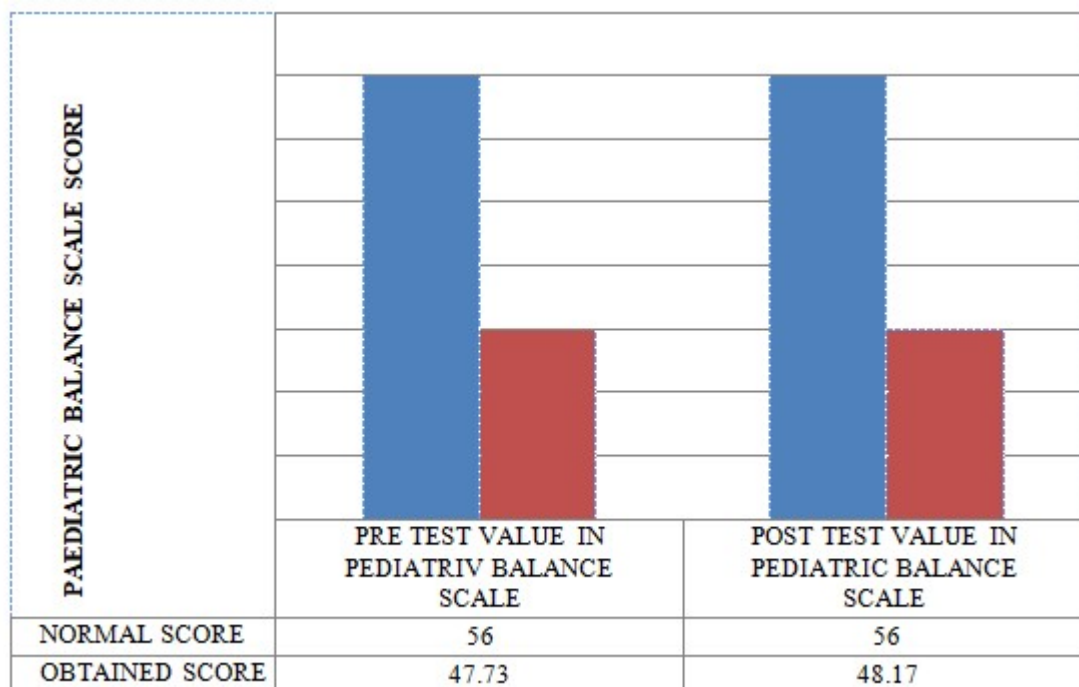


TABLE II
COMPARISON OF PRE AND POST TEST OF TIMED UP AND GO TEST

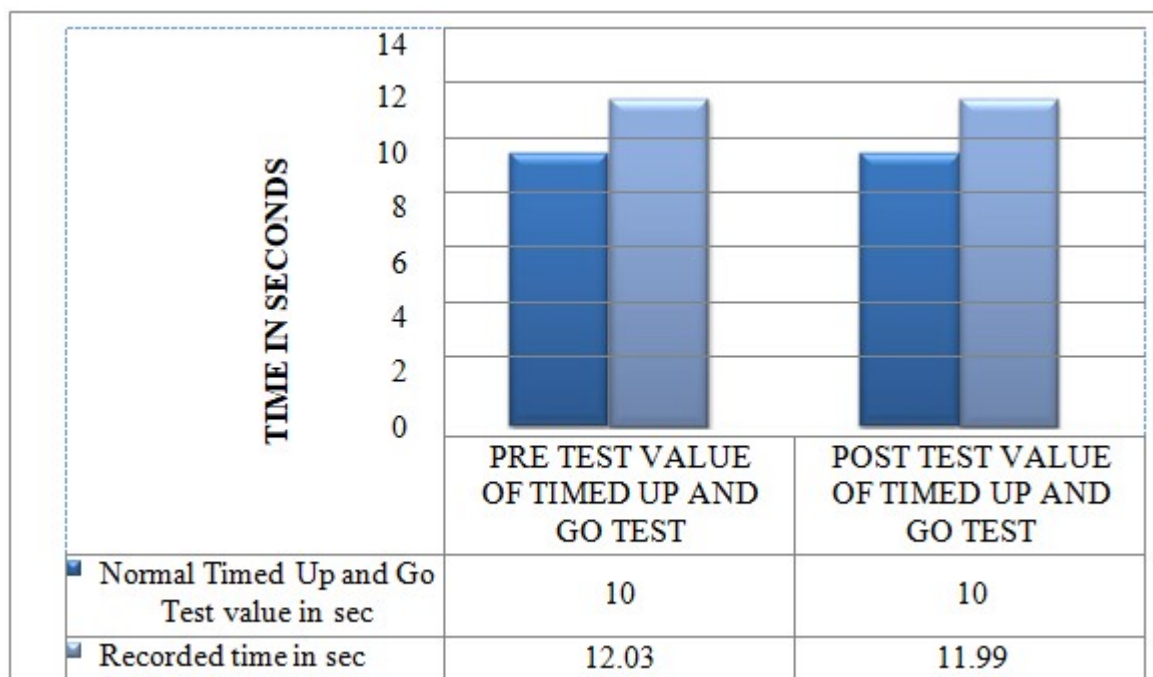
Test	Mean	N	Mean difference	Std. Deviation	T- test	Sig: (2-tailed)
PRE TUGT	12.030	30	.04000	.91053	3.890	0.001
POST TUGT	11.990	30		.90453		

In accordance to table II, the pre test mean value of Timed Up and Go test is 12.030 and post test mean value of Timed Up and Go test is 11.990. The p value of pre-test and post- test of

Timed up and go test is 0.001 which is less than 0.05 which indicates that it is significant.

GRAPH II
COMPARISON OF PRE AND POST TEST OF TIMED UP AND GO TEST

X axis- mean (in seconds) Y axis- time (in seconds)



IV. RESULTS

According to the table I and graph I, Paediatric Balance Scale (PBS) score was improved from pre test average of 47.73 to post test average of 48.17 with the difference mean -.433 at 95% confidence interval with $p=0.007$ ($p<0.05$). Table II and graph II shows improvement on balance using Timed Up and Go Test (TUGT) was found to be from 12.030sec to 11.990sec, with the difference mean with paired t test of 0.040 at 95% confidence interval of the difference with p value of 0.001.

V. DISCUSSION

The current study was done to find out the effectiveness of vestibular rehabilitation therapy on children with developmental coordination disorder. This study supports the idea that there was improvement in balance after giving the

vestibular physiotherapy protocol. Developmental coordination disorder (DCD) happens once a delay within the development of motor skills, or issue coordinative movements, leads to a kid being unable to perform everyday tasks¹⁰. Developmental Coordination Disorder has high prevalence in school going population which is accompanied by poor academic performance¹. In the present study, 30 subjects were participated with the age group of 8 to 13 years. After giving a comprehensive elucidation of the programme and detailed explanation of main parts of training and Vestibular Rehabilitation Therapy (VRT) exercises were asked to be performed together with 5 to 10 repetitions in variation according to every single exercise, with further interval of rest for the duration of 6 weeks. The Timed Up and Go Test (TUGT) and Paediatric Balance Scale (PBS) were taken as outcome measures for the pre and post test evaluation. Having done the statistical analysis, difference mean was obtained

between pre test and post test of both Timed Up and Go Test (TUGT) and Paediatric Balance Scale (PBS) at 95% of Confidence interval with the p value less than 0.05. In general, Developmental Coordination Disorder (DCD) children have delay in the central pattern generation for maintaining posture and they have higher prevalence of 73% to 87% of balance problem as reported by authors like Macnab et al. Lack of stability during postural control when eyes are opened and closed is increased among developmental coordination disorder children⁹. This study was articulated to delineate the significance of vestibular physiotherapy and it was done in a preventive motive to control falls among developmental coordination disorder children. Literature says that Vestibular Rehabilitation Therapy can be applied for all the ages. For this reason, vestibular rehabilitation exercise programme has been administered in order to improve the balance among the developmental coordination disorder children. The exercise regimen consists of exercises for controlling the posture which involves repetitive alternate movements of the major joints which sets the vestibular system to maintain posture for the adaptation to the various factors that affects the balance. The exercise regimen also includes gaze stabilization exercises and aerobic exercises which predominantly elevates the capacity to maintain balance and prevents the falls prevention. Since the intervention used in this study has proved to be beneficial it can be included in the rehabilitation regimen for Developmental Coordination Disorder in the curative and preventive motive. In accordance with the physiology behind Vestibular Rehabilitation Therapy (VRT), it predominantly affects the distinct neural circuits: vestibular parabrachial and raphe nuclear vestibular network which is ascending pathway that conditions balance. (Analisa Meli et al) This present study goes hand in hand with the study done by authors like Italo R. T. Medeiros said that the vestibular rehabilitation therapy was proved to be 56.3% in children with peripheral vestibular disorders. Authors like Sara Cortes Amador found that the vestibular rehabilitation therapy (VRT) was proved to be effective in improving the balance among the people with intellectual disability. Another author called Fong who have done a taekwondo training to improve the postural control among Developmental coordination disorder with the age group of 7 years and 18 years. This study proves that there is improvement after three months of intervention.

VI. CONCLUSION

Reduction in the risk of falls to a small extent (i.e., from low risk to moderately low risk) and improved capacity of postural control was obtained among Developmental Coordination Disorder (DCD) after the intervention of vestibular rehabilitation therapy (VRT). Hence, this study attained a positive conclusion.

VII. LIMITATIONS AND RECOMMENDATIONS

Limitations

Sample size was small.

There was no control group.

No long term followup has been studied.

Recommendations

A comparative study can be done between with control group and the experimental group with the same intervention.

Studies can be done for improvement of hand proficiency among Developmental coordination disorder by dexterity encouraging interventions.

Studies can be done to correlate the anthropometric measurements and balance problems among Developmental coordination disorder children.

Some studies can also be done to bring out overall Developmental coordination disorder rehabilitation.

Age group between 5 to 13 years can be taken as sample.

Comparison can be done between the 2 genders (males and females).

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