



TO FIND OUT THE EFFECTIVENESS OF STANDARDISED WALKING OBSTACLE COURSE (SWOC) IN CHILDREN WITH DOWN'S SYNDROME.

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BACKGROUND & PURPOSE: In Down's syndrome children movement is a critical aspect of life in their ability to walk and to perform functional task. There is an extra small chromosome present on the 21st pair of chromosomes in 91 percent of DS cases. Joint laxity, Excessive hip abduction, hip external rotation, asymmetrical or excessive range of motion and difficulty in initiating movement are mostly seen in the individuals with DS. So, because of all this they avoid weight bearing, weight shifts and trunk rotation and also have difficulty with equilibrium, balance, protective response and graded muscle movement. Hence, the main purpose of the study is to determine the effectiveness of Standardized Walking Obstacle Course in children with DS for improving balance, motor, and sensory functions. **METHODOLOGY:** 30 subjects were recruited based on inclusion and exclusion criteria those who have DS with the age group 3-17 years. 30 participants have completed the SWOC 3 days/week for 4 weeks. TUG, PBS and SWOC were taken as an outcome measure. All the parameters were used pre and post treatment. **RESULT:** Result were statistically analyzed using paired t test by using SPSS version 25 and excel 2019, there was significant improvement seen in TUG, PBS and SWOC in DS children with significant level of $P < 0.05$. **CONCLUSION:** This study concludes that 4 weeks of SWOC has shown the significant effect on improving balance, motor and sensory function in DS children. SWOC brings the positive effects by improving speed, balance, ability to walk with objects in hand and walk with obstacle in between the pathway in DS children. **KEY-WORDS:** Down's Syndrome, balance, Motor and Sensory function, Pediatric Balance Scale, Time Up and Go Test, Standardized walking obstacle course.

INTRODUCTION:

A common chromosomal abnormality associated with mental retardation in humans and multiple congenital malformations is known as Down's Syndrome.¹ 0.1% is a world- wide incidence in live births of Down's Syndrome,² 1 per 850 to 900 live births in India is the incidences for Down's Syndrome. Glasson et al. 2002, said that in last 50 years the lives of DS children have changed and Arumugam et al. 2016 and Holmes et al. 2014, have mentioned that up to 60 years of age there is a rise in the survival rate to 95% in the early 2000s, from less than 50% in the mid-1990s.²

Complications of Down syndrome include certain birth defects, learning problems, and abnormal facial features facial features. An individual may also have heart defects and problems with vision and hearing. Symptoms can occur a bit differently in each child. Physical characteristics: Diminished rate of growth and physical development, most people with Down syndrome do not reach average adult height, An atypical head shape. The head may be smaller than average (microcephaly), with a flat area at the back (occiput), Eyes that slant upward toward the edge

of the face (up slanting palpebral fissures) and an excess fold of skin over the inner corner of the eyes (epicanthal folds), White spots in the colored part of the eyes, Small or overfolded ears, a flat nasal bridge, and a small mouth with low oral muscle tone and a protruding tongue, Short, broad hands with short fingers and a single crease spanning the width of the palm (single palmar crease), Decreased muscle tone Developmental characteristics, Delayed cognitive development, usually within the mild to moderate range of mental retardation. An occasional individual, usually with a mosaic genotype, may have an IQ in the average range, Delayed and atypical speech and language development, with expressive language being more delayed than receptive language, Delayed development of social skills, Delayed motor skills

Possible coexistence of other developmental disorders, mental health or behavioural conditions (such as attention deficit hyperactivity disorder, oppositional defiant disorder, or pervasive developmental disorders/autism)

Examination is the most important thing in physiotherapy for patient's evaluation and management. Standardised walking obstacle course is one of the new functional measurement tools for children which helps in testing reliable time in seconds, the number of steps, number of stumbles and sum of the steps off the path.¹⁵ In this study standardised walking obstacle course is used as treatment protocol for obstacle walking in down's syndrome children. Pre and post score were measured with the help of outcome measures like: TUG, PBS and SWOC itself was used as treatment and evaluation tool both in this study.

In this, children were taught to walk in pathway of standardized walking obstacle course which was 39.5 ft in length, 36 inch in width, and includes 30 degrees right, 70 degrees right and 90 degrees of left turns. The obstacles like bolster, crutches, shag rug and colourful mat were kept in between some distance in the pathway by which children must step over and turn around the obstacles placed along in the pathway.¹⁵

INCLUSION CRITERIA:

- Participants who have the ability to follow the simple directions
- Patients will be taken with the parent's permission.
- Age between 5 to 15 years who has been diagnosed with Down Syndrome by their physician
- Participants who can walk without any assistive devices.
- Participants who do not have any cardiopulmonary comorbidity.
- Participants who have MMSE score between 10-18
- Both genders male and female
- Able to follow command.

EXCLUSION CRITERIA:

- Any of the neurological condition which impair balance.
- Any of musculoskeletal condition like fracture, joint replacement, ligament injury/tear etc which could possibly impair balance.
- Any of the serious cardiac problems
- Any visual or auditory impairment

METHODOLOGY:

Ethical approval was given from Parul University. Children were selected from the Prabhat Foundation, Ahmedabad and then children were included in this study after receiving ethical approval from the university. After that assessment of the children were done and those children who meet the inclusion criteria were included in this study. The consent of the DS children was taken from their parents after explaining the interventions to them. The following tool were taken as out- come measure:

- TIMED UP AND GO TEST
- PEDIATRIC BALANCE SCALE
- STANDARDIZED WALKING OBSTACLE COURSE

Children were assessed for Timed up and go test, Paediatric balance scale and standardized walking obstacle course before starting the obstacle course on Down Syndrome. After completing the obstacle course for 4 weeks children were assessed using the same outcome measures.

SWOC was used as an evaluation tool pre and post of the procedure of treatment, to evaluate stability and speed during gait in terms of time in seconds, number of steps, number of stumbles and sum of steps off the path under 3 different methods:

- Walk with free arms.
- Walk with tray.
- Walk with shaded glasses.

PROCEDURE OF SWOC (n=30)

In this, children were taught to walk in pathway of standardized walking obstacle course which was 39.5 ft in length, 36 inch in width, and includes 30 degrees right, 70 degrees right and 90 degrees of left turns. The obstacles like bolster, crutches, shag rug and colourful mat were kept in between some distance in the pathway by which children have to step over and turn around the obstacles placed along in the pathway.

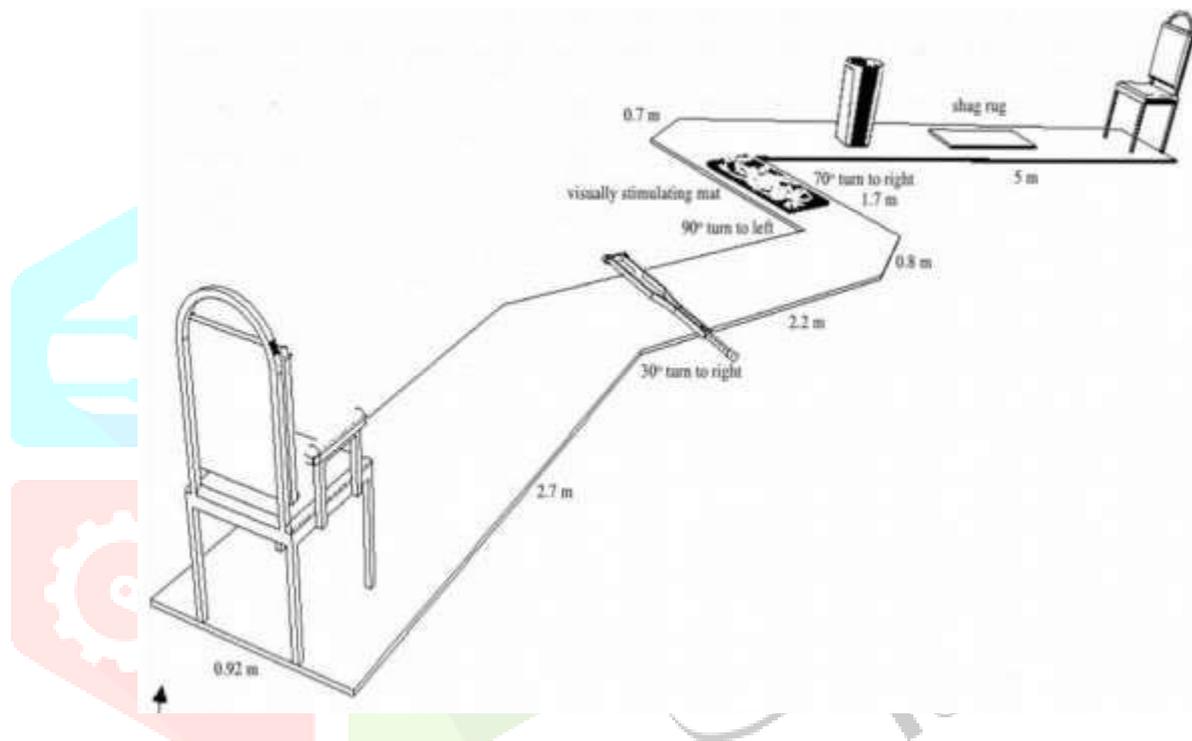


Fig 1.1: Pathway of SWOC This session lasts up to 15 minutes:

- Walking with free hand
- Walking with tray in hands
- Walking with shaded glasses

Pre testing: All the children were evaluated by Pediatric Balance Scale, Timed Up and Go test, cadence and Standardized Walking Obstacle Course before 4 weeks.

Post testing: Pediatric Balance Scale, Standardized Walking Obstacle Course, Cadence and Timed Up and Go tests were evaluated again at the end of 4 weeks to find out the effect of obstacle course on children with Down Syndrome.

STATISTICAL ANALYSIS

The collected data were analyzed using statistically package of social sciences (SPSS) version 25.0 and Excel version 2019. The parametric test was used in statistical analysis because the distribution of data was normal. Demographic values were compared within the groups using paired t-test with p value < 0.01.

RESULT:

30 Down's Syndrome children were included in this study from which 17 were boys and 13 were girls. Down's Syndrome children were included in this study, who had fulfilled the inclusion criteria and then Standardized Walking Obstacle Course were given to them as a treatment for the improvement of their balance, cognitive

TABLE-1: MEAN AGE OF CHILDREN BASED ON GENDER

AGE GROUP	NUMBER	MEAN AGE	SD
MALE	17	11.29	3.31
FEMALE	13	11.46	2.53

TABLE-2: EFFECT OF SWOC: TUG PRE-MEAN AND POST MEAN

OUTCOME MEASURE	PRE	POST	MEAN±SD	T value	P value
TUG	18.10	15.17	2.933±1.437	11.182	<0.001

Table 2 shows the mean score of pre-TUG= 18.10 and mean score of Post TUG= 15.17 of Down syndrome children.

TABLE-3: EFFECT OF SWOC: PBS PRE-MEAN AND POST MEAN

OUTCOME MEASURE	PRE	POST	MEAN±SD	T value	P value
PBS	44.30	53.17	8.867±1.332	36.455	<0.001

Table 3 shows the mean score of pre-PBS= 44.30 and mean score of post PBS= 53.17 of Down syndrome children.

TABLE- 4: EFFECT OF SWOC: CADENCE PRE MEAN AND POST MEAN

VARIABLE	PRE	POST	MEAN±SD	T value	P value
CADENCE	99.43	89.77	9.667±8.930	5.29	<0.001

Table 4 shows the mean score of pre-Cadence= 99.43 and mean score of post Cadence=89.77 of Down syndrome children.

TABLE-5: EFFECT OF SWOC: SWOC PRE MEAN AND POST MEAN

OUTCOME MEASURE (SWOC)	PRE	POST	MEAN±SD	T Value	P Value
Walk Time	91.67	79.30	12.367±5.301	12.777	<0.001
Walk Steps	89.77	80.43	9.333±3.407	15.004	<0.001
Stumbles	2.07	0.00	2.067±1.461	7.750	<0.001
Steps off	2.97	1.17	1.8±0.886	11.119	<0.001
Walk with tray time	98.13	82.20	15.933±6.963	12.534	<0.001
Walk with glasses time	98.87	81.37	17.500±7.510	12.764	<0.001

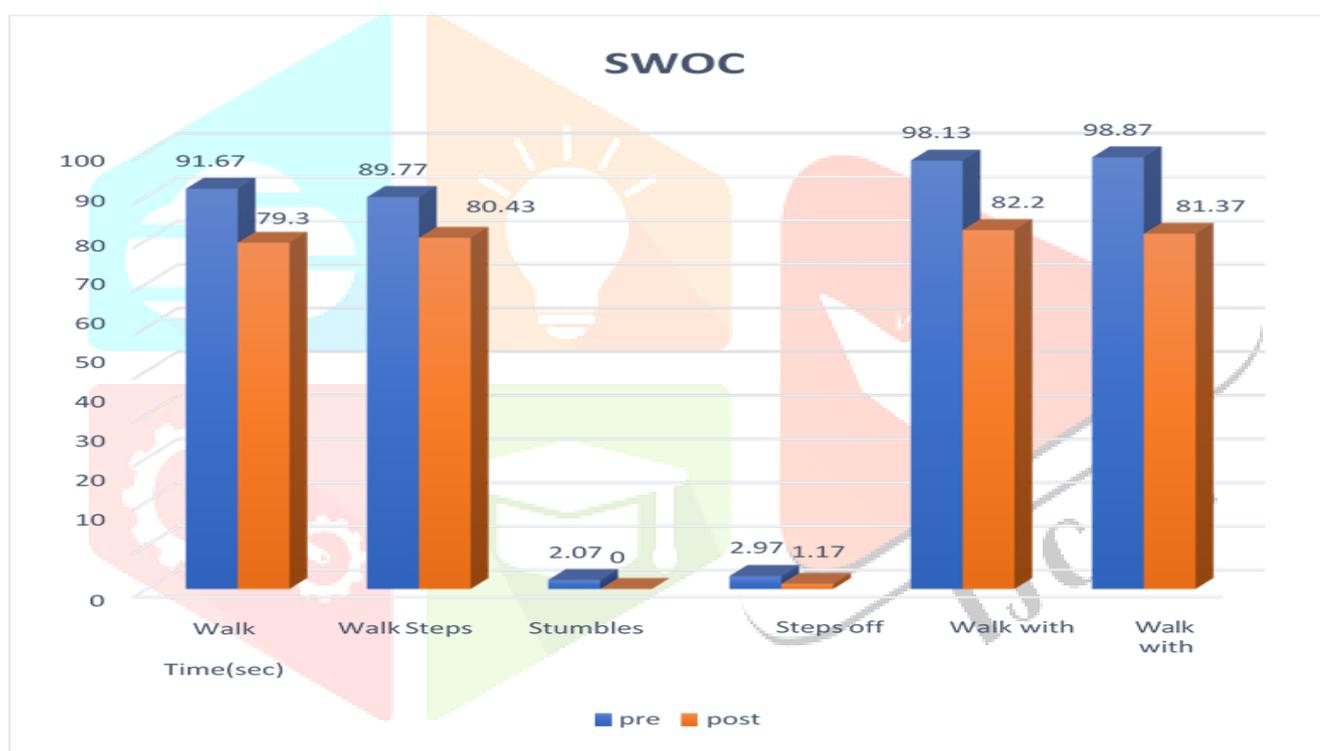


Table 5 and Graph 5 shows the mean score of pre SWOC components and mean score of post SWOC components of Down syndrome children.

DISUCSSION:

The main purpose of the study is to determine the effects of Standardized Walking Obstacle Course in children with Down Syndrome. Result of the study showed that the obstacle walking course as a treatment was effective to improve balance, speed, functional skills and even motor and sensory impairments.

Ki-Tae Park, Hyun-Joo Kim, PhD et al (2015) stated that the effect open circuit training program using obstacle on the walking and balance abilities of stroke patients. 12 stroke patients then were included in this study who at least have stroke before 6 months and who can able to walk independently for 40 meters and can cross over the obstacles. Treatment protocol continued for 3 days/week, for 4 weeks and 30 minutes per session, so total 12 session were done. They concluded that circuit training program using obstacles had a positive effect on the gait and balance abilities of the stroke patients by using BBS and TUG.²³

Standardized walking obstacle course was performed by keeping different obstacles in whole 12.2 meters pathway. The obstacles like crutch, shag rug, visually stimulating colourful mat and bolster. So, the fact is that this sort of training shows improvement in vestibular, motor and somato-sensory systems. In this study children were given to walk on a pathway having obstacle in between. After completing the treatment PBS, TUG and SWOC were

measured for balance, speed, motor and sensory impairments and for their cognitive behaviour.

The result of pre intervention mean score of SWOC: walk time= 91.67, walk steps= 89.77, stumbles= 2.07, steps off= 2.97, walk with tray= 98.13 and walk with glasses= 98.87 and post SWOC: walk time=79.30, walk steps= 80.43, stumbles= 0.00, steps off= 1.17, walk with tray= 82.20 and walk with glasses= 81.37. So, in this study SWOC score shows the good progress of the children after completing the treatment of obstacle walking. Roosha Parikh, Priya Kulkarni et al. (2013) studied on the performance of children with mental retardation with and without Down's Syndrome on SWOC. 30 participants aged between 6 to 14 years were included in this study and were divided into 2 groups. So, in this study authors concluded that overall activity of functional ambulation is decreased in children with Down's Syndrome as compared to those with mental retardation in time in seconds, number of steps, stumbles and steps off the path.¹⁶

So, in this study Standardized walking obstacle course was used as a procedure for obstacle training in children with Down's Syndrome for 3 days/week for 4 weeks. The result shows the clear effect in pre and post of the training in children with down syndrome with their decrease in time, steps, stumbles, and steps off the obstacle course. Sharon L. Held, PT, DPT, MS, PCS, Karen M. Kott, PhD, PT, and Brenda L. Young, PhD et al. (2006), did some calculations to find out how reliable and valid the new functional measurement tool for children named as Standardized Walking Obstacle Course (SWOC) was and concluded that SWOC was reliable within and between raters and concurrent validity with the TUG for use with children to establish their functional ambulation capability. The SWOC could be any easy way available in any setting for any individual who can follow the instructions and walk without any assistive device.¹⁵

CONCLUSION:

This study showed there is a significant difference in efficacy of Standardized walking obstacle course training in children with Down Syndrome in their balance, walking time, developing motor impairments and cognitive skills. So, this study concluded that SWOC training was found effective in Down Syndrome children.

LIMITATIONS AND FUTURE RECOMMENDATIONS

LIMITATIONS:

Long term follow up was not taken, Control group was not taken

FUTURE RECOMMENDATIONS:

This study can also be done in specifically for motor and sensory impairment children, This exercise protocol can also be used for many other pediatric conditions who are having motor impairments and delayed milestone

REFERENCES:

1. Prevalence of Down Syndrome in Western India: A Cytogenetic Study Gadhia Pankaj, Kathiriya Avani and Vaniawala Salil, Published 5th November 2014.
2. Physical therapy in Down syndrome: systematic review and meta-analysis L. Ruiz- González, D. Lucena-Antón, A. Salazar, R. Martín-Valero & J. A. Moral- Muñoz, VOLUME 63 PART 8 pp 1041–1067 AUGUST 2019
3. Pediatric Neurologic Physical Therapy Second Edition Edited by Suzann K. Campbell, Ph.D., P.T., f.A.P.T.A. I. Professor Department of Physical Therapy College of Associated Health Professions University of Illinois at Chicago Chicago, Illinois chapter 6 page no: 131.
4. Down Syndrome Screening in India: Are We There Yet? K. Manikandan Suresh Seshadri Received: 31 July 2017 / Accepted: 5 August 2017 / Published online: 17 August 2017, Federation of Obstetric & Gynecological Societies of India 2017
5. Sacks, B, and Buckley, S. in 2003: What do we know about the movement abilities of children with Down Syndrome?
6. Suzann K. Campbell, Pediatric Neurologic Physical Therapy, 2nd edition, Susan

- R. Harris, Alice M. Shea 6th chapter Down Syndrome.
7. Textbook of Pathology for homeopathy AK Mandal Shramana Choudhary volume1 chapter: 12 recent diagnostic tests.
 8. Text book of Pediatrics P.M. Dani Waldoe Nelson U. KO KO volume 3 chapter: 33 genetic and childhood disease.
 9. Pediatric Physical Therapy 4th edition Jan S. Tecklin.
 10. Chromosomal Abnormalities: Genetic Disease Burden in India Article in International Journal of Human Genetics · March 2010, Kaur Anupam, Jai Rup Singh.
 11. Adapted physical activity quarterly, 1991,8,179209 Motor Development in Children with Down Syndrome: A Review of the Literature.
 12. Ulrich D. A., Ulrich B. D., Angulo-Kinzler R. M. & Yun J. (2001) Treadmill training of infants with Down syndrome: evidence-based developmental outcomes. *Pediatrics*108, e84.
 13. Rahman S. A. A. & Shaheen A. A. M. (2010) Efficacy of weight bearing exercises on balance in children with Down syndrome. *Egyptian Journal of Neurology, Psychiatry and Neurosurgery* 47, 37–42.
 14. Jankowicz-Szymanska A., Mikolajczyk E. & Wojtanowski W. (2012) The effect of physical training on static balance in young people with intellectual disability. *Research in Developmental Disabilities* 33, 675–81.
 15. Sharon L. held, Karen M. Kott, and Brenda L. 2006, Standardized Walking Obstacle Course (SWOC): Reliability and validity of a new functional measurement tool for children.
 16. Performance of Children with Mental Retardation with and without Down's Syndrome on Standardized Walking Obstacle Course Roosha Parikh, Priya Kulkarni, Sherin Abraham, Keerthi Rao, Subhash Khatri (Pravara Institute of Medical Sciences, College of Physiotherapy, Loni, India) *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)* e-ISSN: 2279-0853, p-ISSN: 2279- 0861. Volume 6, Issue 1 (Mar.- Apr. 2013), PP 20-24
 17. K.Kott, Physical therapy education, Suny Upstate Medical University, Syracuse, NY, S. Held, M. Franjoine, Physical therapy, in 2004: Performance on the Standardized Walking Obstacle Course (SWOC) for matched pairs of children with cerebral palsy and typical development.
 18. Timed "Up & Go" test in children and adolescents Teste Timed "Up & Go" Renata D'Agostini Nicolini-Panisson, Márcio Vinícius F. Donadio, *Rev Paul Pediatric* 2013;31(3):377-83.15/1/2013
 19. Podsiadlo D, Richardsons in 2001, Time UP and Go Test reliability and validity
 20. Son H, et al. (2019) Effect of turning direction on Timed Up and Go test results in stroke patients. *Eur J Phys. Rehabil Med.* (pp 35-39) Pusan, South Korea.
 21. Thakkar Priya Janak 23 June 2011, A study analyzing the effectiveness of pediatric balance scale as an outcome measure for balance in children suffering from Down's Syndrome.
 22. Pediatric Balance Scale: A modified version of the Berg Balance Scale for the school-age child with mild to moderate motor impairment, Mary Rose Franjoine, Joan S. Gunther and Mary Jean Taylor, 2003.
 23. Effect of the circuit training program using obstacles on the walking and balance abilities of stroke patients Ki-Tae Park, Ms, Hyun-Joo Kim, PhD December 2015.