



IMPACT OF VESTIBULAR STIMULATIONS USING VESTIBULATOR ON THE CHILDREN WITH DEVELOPMENTAL DISORDERS.

¹*Dr. Anis Choudhery Ph. D. and ²Aaliya Baig

¹Department of Zoology, G.M.Momin Women's College, Bhiwandi, District Thane, 421302, Maharashtra, India.

²Transpact (TEL)-SINE-IIT Bombay, CSR Building 3rd Floor, IIT Campus, Mumbai 78, Maharashtra, India.

*Corresponding Author: Dr. Anis Choudhery Ph. D.

Department of Zoology, G.M.Momin Women's College, Bhiwandi, District Thane, 421302, Maharashtra, India.

Article Received on 06/04/2020

Article Revised on 27/04/2020

Article Accepted on 17/05/2020

ABSTRACT

Background: The vestibular system is one of the basic sensory systems¹. It provides a foundation for the development of all other sensory systems such as touch, vision, sound and proprioception. The vestibular system is neurologically interconnected with many other systems in the brain. It is connected with limbic system, which is crucial for the development of further physical, emotional and psychosocial regulation and wellbeing. The vestibular processing system is also interconnected to the cerebellum, combining visual information to enable reflexive eye movements. It controls equilibrium and balance, controls body movement, and facilitates the development of muscle tone. It also is one of the influencing factors in auditory language processing. The objective of this case study is to understand the impact of one aspect of sensorimotor techniques of therapeutic intervention i.e. the Vestibular stimulations Using Vestibulator on the Emotional/Mental Wellbeingsleep, social behavior, mental wellness, confidence, and pain of children with developmental disorders. **Methods:** A clinical study was conducted at the POSAT Foundation, Mumbai to study the effects of vestibular stimulation using the Vestibulator on the muscle tone and reflex responses of the children suffering from cerebral palsy between December 2017 to July 2018. Other children were also undergoing regular treatment using the Vestibulator. For the present study, we selected 13 children suffering from developmental disorders below 10 years, having regular therapy using the Vestibulator. A detailed interview with parents was conducted on the rate of improvement for Sleep, pain, confidence, Social behaviors, and mental wellness of their child. **Results:** The study reveals that there are lots of improvements in the children suffering from developmental disabilities. A 100% improvement in the sleep of the children with Attention Deficit Hyperactivity Disorder, 80% in Cerebral Palsy children, and no sign of improvement in a partial blind child was seen. There was no sign of pain reduction seen in any of the children, except the Children suffering from Down's syndrome and Cerebral Palsy. A100% confidence improvement was seen in all children. Social behavior was found to improve in children having more than 30 sessions. **Conclusions:** Vestibular Stimulations can be used as a therapeutic modality to facilitate mental /emotional wellbeing, social behavior, confidence, sleep and pain in the children with developmental disorders .And that Vestibular stimulation is one of the best tool for sensory integration therapy. This therapy can also be recommended for adult, especially for those suffering from Vertigo^[2], Parkinson's diseases^[3],

- 1- Ornitz, E.M., Atwell, C.W., Kaplan, A.R., & Westlake, J.R. (1985): Brain-stem dysfunction in autism: Results of vestibular stimulation. Archives of General Psychiatry, 42: 1018-1025.
- 2- Sadegh Jafarzadeh, et.al Effect of Early Vestibular Rehabilitation on Vertigo and Unsteadiness in Patients with Acute and Sub-Acute Head Trauma Iran J Otorhinolaryngol, 2018 Mar; 30(97): 85–90.
- 3- S.B. Pinheiro et.al Vestibular rehabilitation in patients with Parkinson's disease, Phyiotherapy May 2015 Volume 101, Supplement 1, Pages e1214–e1215.

KEYWORDS: Vestibular Stimulation, Sensory Integration, Developmental Disorders.

BACKGROUND

According to UN Enable, around 10% of the world's population, 650 million people, live with disabilities. In India, 1.67% of the 0-19 population has a disability. 35.29% of all people living with disabilities are children. Other estimates say that India has 12 million children living with disabilities. Only 1% of children with

disabilities have access to school and one-third of most disabilities are preventable.^[1]

Disability in childhood can have a lifelong impact on a person's physical, mental and emotional health, as well as their social situation. Children with a disability may have special needs, particularly regarding health and

education, and may need to negotiate significant social and environmental barriers in order to fully participate in everyday life. In India 80% of children with disabilities will not survive past age forty.^[2]

The World Health Organization estimates that 15-20% of children, worldwide, have disabilities; 85% of which are in developing countries.^[1] As per 2011 Census of India, there are 7,862,921 children with disability in the below 19 year age group, including 1,410,158 visual impairment, 1,594,249 hearing impairment, 683,702 speech disorder, 1,045,656 movement disorder, 595,089 intellectual disability, 678,441 multiple disability, and 1,719,845 other disabilities.^[3]

Developmental disabilities are a group of conditions due to an impairment in physical, learning, language, or behavior areas. These conditions begin during the developmental period, may impact day-to-day functioning, and usually last throughout a person's lifetime. Developmental disabilities begin anytime during the developmental period and usually last throughout a person's lifetime. Most developmental disabilities begin before a baby is born, but some can happen after birth because of injury, infection, or other factors.

Most developmental disabilities are thought to be caused by a complex mix of factors. These factors include genetics; parental health and behaviors (such as smoking and drinking) during pregnancy; complications during birth; infections the mother might have during pregnancy or the baby might have very early in life; and exposure of the mother or child to high levels of environmental toxins, such as lead.^[4]

Developmental disabilities occur among all racial, ethnic, and socioeconomic groups. Some of the developmental disabilities are attention deficit hyperactivity disorder, autism spectrum disorder, cerebral palsy, hearing loss, intellectual disability, learning disability, vision impairment, global developmental delay and other developmental delays.^[5]

Children with developmental disabilities have a dysfunctional sensory system – referred to as sensory integration disorders. Sensory integration focuses primarily on three basic senses—tactile, vestibular, and proprioceptive. Their interconnections start forming before birth and continue to develop as the person matures and interacts with his/her environment. The three senses are not only interconnected but are also connected with other systems in the brain. Sensory integration is also referred to as the ability to receive, process, and make sense of multiple sensory inputs at the same time. Knickerbocker (1980) believes that this behavior represents an excessive need for vestibular stimulation as well as a means of facilitating sensory integration.^[6]

Sensory integration is a dynamic process that

synthesizes, organizes and processes incoming sensory information from the body and the environment in order to create purposeful and goal-directed responses. Good sensory integration leads to the development of good body scheme, self-image, integration of primitive reflexes, balance, postural stability, ability to motor plan, coordination of two sides of the body, and eye-hand coordination.

The vestibular system is the primary organizer of sensory information and contributes to physical and emotional security. Many case studies have shown that improving the integration of the vestibular system using swings resulted in the improvement of the subject's postural control, movement, exploration, and emotional well-being.^[7,8]

METHODS

For this study, researchers conducted a detailed interview with the parents of children with developmental disabilities. Parent-reported data on 13 children aged less than 10 years with developmental disabilities, namely Attention Deficit Hyperactivity Disorder (ADHD), autism spectrum disorder (ASD), cerebral palsy (CP), Down's Syndrome (DS), learning disability (LD), vision impairment (VI), and global developmental (GDD) has been included in this study. Vestibular stimulation was provided by using the Vestibulator. The Children received a course of 30 to 38 sessions with the schedule of two sessions per week on the Vestibulator.

Assessment of children

We obtained an adequate medical history of each child including their behavior disorders, pattern and magnitude of behavior over the year. extenuating or aggravating factors, functional impairment, we try to gather the information on the individual's level of functioning including cognitive, adaptive, social- functioning, levels of receptive understanding and expressive language, writing skill, behavior during therapy, at school and at home. We also tried to map their sleep habits, pain, mental wellness, anger, anxiety, nervousness and confidence level. Every child was treated separately while in analysis with help of therapists and parent.

The Children were evaluated by the therapist post the scheduled course of treatment and the results were analyzed. A Unit scale was created to quantify the results. The results were averaged if the number of children is more than one for a particular disability.

Inclusion Criteria for the subjects for the study was as follows.

1. The Child should be less than 10 years old and expressive.
2. Minimum session on Vestibulator should be 30 and maximum session should be 38.
3. Therapy should regularly taken.
4. Voluntary consent of the Parents for the interview and to publish the results.

About the Apparatus

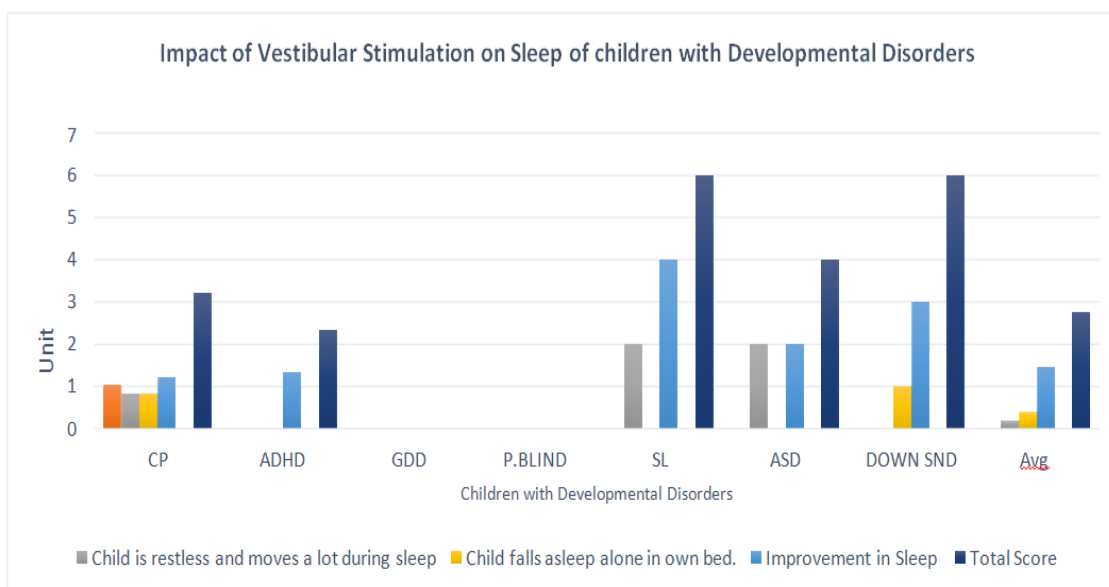
The equipment used to provide the vestibular stimulations to the subjects was the Vestibulator. Vestibulator provides a wide range of ergonomically designed therapy modules to achieve maximum Vestibular Stimulation for vestibular, neuro-developmental and sensory integration therapy. It Provides stimulations in all the three planes of motions

viz vertical stimulations, sliding stimulations, tilts-lateral, antero-lateral & linear, rotations at intermittent angles as well as 360 degrees in cyclic or only clock wise & anti clock wise directions. The therapy sessions on Vestibulator becomes very specific as it can provide desired degree of motion with desired speed, amplitude in desired positions decided by the therapist for a particular patient.

Observation 01

Chart -01: Impact of Vestibular Stimulation on Sleep of children with Developmental Disorders.

Disorders	CP	ADHD	GDD	P.BLIND	SL	ASD	DOWN SND	Avg
Child is restless and moves a lot during sleep	0.8	0	0	0	2	2	0	0.16
Child falls asleep alone in own bed.	0.8	0	0	0	0	0	1	0.38
Improvement in Sleep (Range 1 to 10)	1.2	1.33	0	0	4	2	3	1.461
Total Score	3.2	2.33	0	0	6	4	6	2.76



Graph -01: Impact of Vestibular Stimulation on Sleep of children with Developmental Disorders.

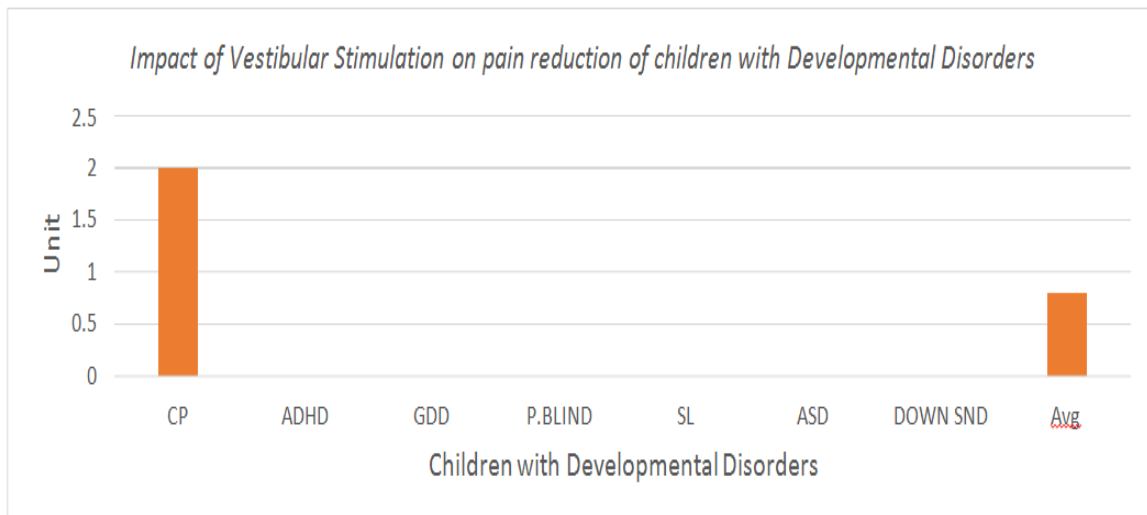
It is observed that, except GDD and partial blind child rest other children responded very well to vestibular stimulation. Children with learning disability showed the maximum improvement in sleep followed by children with Down's syndrome then Autistics(Hyperactive). ADHD and CP children also exhibited positive developments in sleeping behavior. Very less improvements was seen in restlessness during sleep of these children but quite good improvement was seen in children with CP and Down syndrome in terms of going to sleeping alone.

The sleep problems of children with developmental disorders deserve particular attention and not least because of their prevalence and severity. The additional stress that they place upon care-givers/parents, the contribution that sleep disturbance might be making to daytime difficulties with their behavior and cognition, and the caregiver's/parents' ability to cope with them and, fortunately, the improvements in child and parent functioning that can follow successful treatment.^[9]

Observation 02

Disorders	CP	AHDH	GDD	P.BLIND	SL	ASD	DOWN SND	Avg
Pain reduction In lower back, hips, and legs.	2	0	0	0	0	0	0	0.79

Chart -02 : Impact of Vestibular Stimulation on pain reduction of children with Developmental Disorders



Graph 02: Impact of Vestibular Stimulation on pain reduction of children with Developmental Disorders.

Of the many conditions that can be associated with cerebral palsy, one of the most common is pain. Pain can take many different forms, affect different parts of the body, and vary in severity with the individual to individual.

“pain constituted a significant problem in children and adolescents with CP.”^[10]

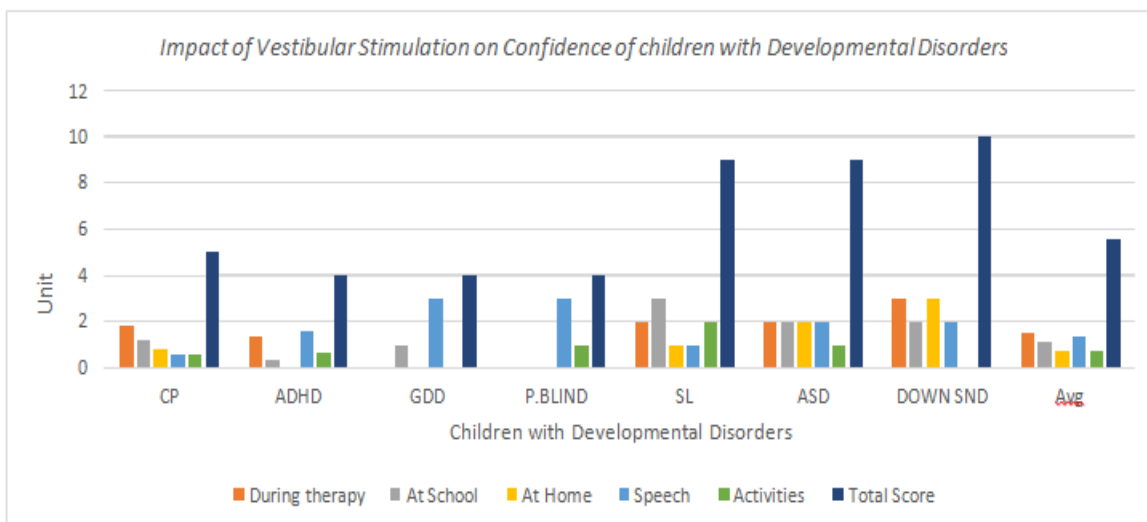
According to a study published by the U.S. National Institutes of Health, which included a study of 2,777 children with cerebral palsy born between 2001-2012,

Pain is not a problem with other development disorders, so there was no question asked with other children, but just to see the impact on pain in case of children with CP. It was found that children in limited sessions of 30-35 experienced a substantial pain reduction.

Observation 03

Chart 03: Impact of Vestibular Stimulation on Confidence of children with Developmental Disorders.

Disorder Confidence Gained	CP	AHDH	GDD	P.BLIND	SL	AUTISTIC -HYPER	DOWN SND	Avg
During therapy	1.8	1.33	0	0	2	2	3	1.5
At School	1.2	0.33	1	0	3	2	2	1.15
At Home	0.8	0	0	0	1	2	3	0.7
Speech	0.6	1.6	3	3	1	2	2	1.38
Activities	0.6	0.66	0	1	2	1	0	0.69
Total	5.0	3.92	4.0	4.0	9.0	9.0	10	5.42



Graph 03: Impact of Vestibular Stimulation on Confidence of children with Developmental Disorders.

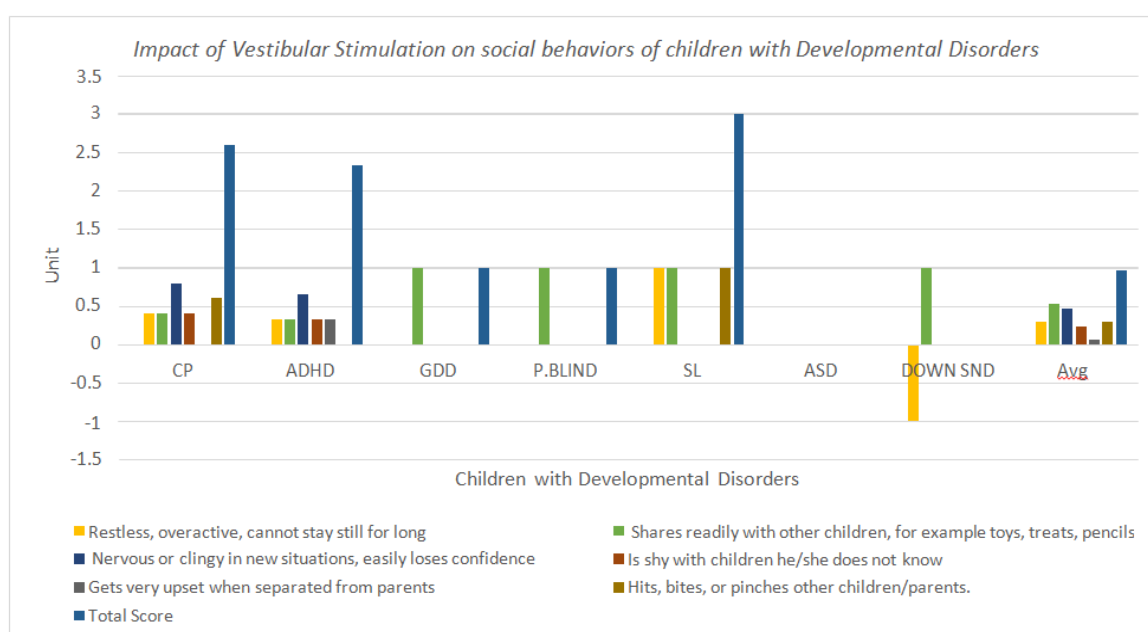
It is observed that all the children gained significantly confidence in speaking. Children with down syndrome gained maximum improvement and it is almost double then average of all children. while children with ADHD

showed the minimum improvement but then too it is substantially high in comparison to the number of sessions. Overall confidence level enhanced after vestibular stimulation therapy.

Observation 04

Chart 04: Impact of Vestibular Stimulation on social behaviors of children with Developmental Disorders.

Disorders	CP	AHDH	GDD	P.BLIN D	SL	AUTISTIC -HYPER	DOWN SND	Avg
Social Behaviour								
Restless, overactive, cannot stay still for long	0.4	0.33	0	0	1	0	-1	0.3
Shares readily with other children, for example toys, treats, pencils	0.4	0.33	1	1	1	0	1	0.53
Nervous or clingy in new situations, easily loses confidence	0.8	0.66	0	0	0	0	0	0.46
Is shy with children he/she does not know	0.4	0.33	0	0	0	0	0	0.23
Gets very upset when separated from parents	0	0.33	0	0	0	0	0	0.07
Hits, bites, or pinches other children/parents.	0.6	0	0	0	1	0	0	0.3
Total Score	2.6	2.33	1	1	3	0	0	0.96



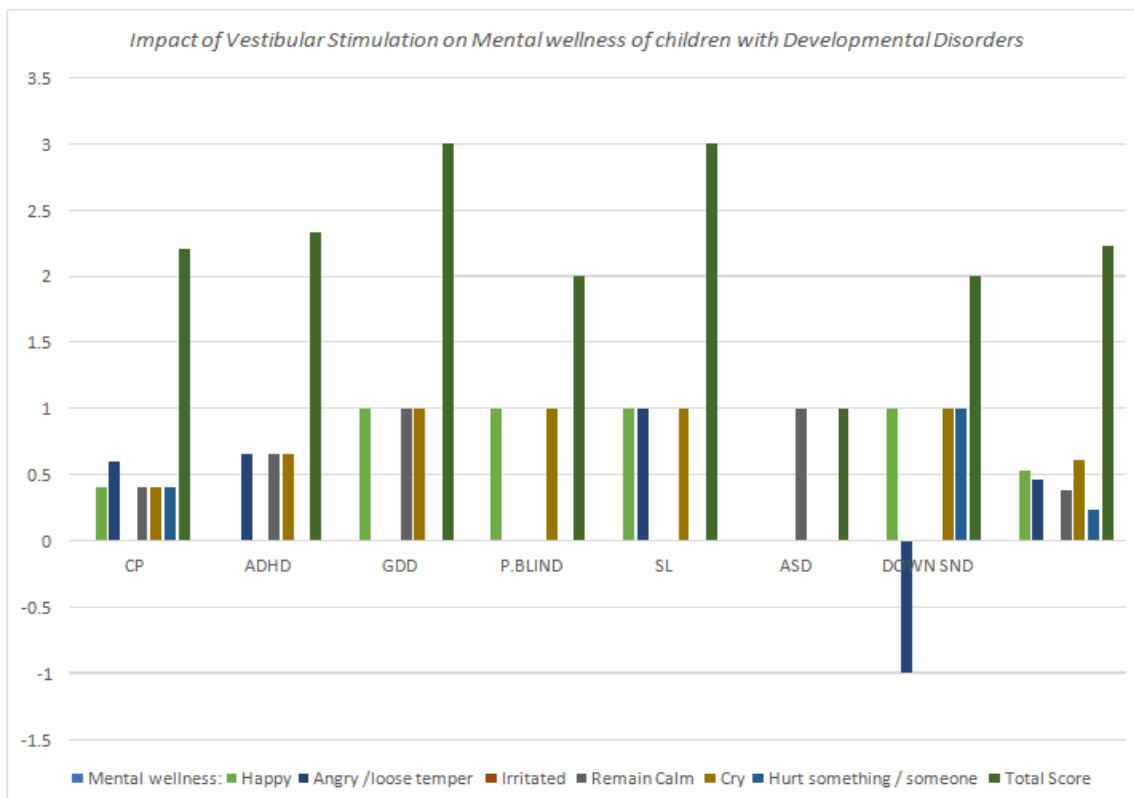
Graph 04: Impact of Vestibular Stimulation on social behaviors of children with Developmental Disorders.

Our observation was very positive in all cases except in case of Down's syndrome. Children with Down syndrome showed restlessness after therapy and we expect good results after more therapies. All the children showed good improvement in their sharing habits. A lot of improvement was seen in terms the reduction of their bad habits like biting, pinching, and hitting other children. Children with learning disability also improved a lot in social behaviors.

Observation 05

Chart 05: Impact of Vestibular Stimulation on Mental wellness of children with Developmental Disorders.

Disorders Mental wellness:	CP	AHDH	GDD	P.BLIND	SL	AUTISTIC -HYPER	DOWN SND	
Happy	0.4	0.332.33	1	1	1	0	1	0.53
Angry /loose temper	0.6	0.66	0	0	1	0	-1	0.46
Irritated	0	0	0	0	0	0	0	0
Remain Calm	0.4	0.66	1	0	0	1	0	0.38
Cry	0.4	0.66	1	1	1	0	1	0.61
Hurt something / someone	0.4	0	0	0	0	0	1	0.23
Total Score	2.2	2.33	3	2	3	1	2	2.23



Graph 05: Impact of Vestibular Stimulation on Mental wellness of children with Developmental Disorders.

Our observation was remarkably positive in terms emotional well being or mental wellness of these children. We witnessed a negative observation in the partial blind child who demonstrated an increased anger behavior.

Rest others demonstrated increased happiness quotient and reduction in anger. Irritation levels were also found to be improved and lowered down in most of the children, in fact all the children.

RESULTS AND CONCLUSIONS

Although this study had several limitations such as small sample size, short duration, and lack of established reliability measurements. Based on the positive results obtained it can be concluded at one aspect of sensorimotor techniques of therapeutic intervention i.e. the Vestibular stimulations have a positive impact on the Emotional/Mental Wellbeing of the children with

developmental disorders. Also it appears to support the hypothesis that Vestibular stimulations do have positive impact on the social behaviour and confidence level of Children .The results indicate positive impact of Vestibular Stimulations on the sleep and Pain of the children with developmental disorders.

REFERENCES

1. World Health Organization. World Report on Disability 2011. Available from: http://www.unicef.org/protection/World_report_on_disability_eng.pdf. Accessed December 17, 2014.
2. Bhagat Singh, ResearchGate October 2014 Status of Intellectual Disability in India: A Review.
3. Ministry of Home Affairs, Government of India. Census of India, 2011. Available from: <http://censusindia.gov.in/2011-common/censusdataonline.html>. Accessed December 17, 2014.

4. Developmental Disabilities: Delivery of Medical Care for Children and Adults. I. Leslie Rubin and Allen C. Crocker. Philadelphia, Pa, Lea & Febiger, 1989.
5. Zablotzky B, Black LI, Maenner MJ, Schieve LA, Danielson ML, Bitsko RH, Blumberg SJ, Kogan MD, Boyle CA. Prevalence and Trends of Developmental Disabilities among Children in the US: 2009–2017. *Pediatrics*, 2019; 144(4): e20190811.
6. Knickerbocker, B.M. (1980): A holistic approach to the treatment of learning disorders. Thorofare, NJ: Charles B. Slack.
7. Besnard S., Lopez C., Brandt T., Denise P., Smith P. F. (2015). Editorial: the vestibular system in cognitive and memory processes in mammals. *Front. Integr. Neurosci*, 9: 55. 10.3389/fnint.2015.00055 [PMC free article] [PubMed] [CrossRef] [Google Scholar]
8. An S. J. (2015). The effects of vestibular stimulation on a child with hypotonic cerebral palsy. *J. Phys. Ther. Sci*, 27: 1279 –1282. 10.1589/jpts.27.1279 [PMC free article] [PubMed] [CrossRef] [Google Scholar]
9. Wiggs L, France K. Behavioural treatments for sleep problems in children and adolescents with physical illness, psychological problems or intellectual disabilities. *Sleep Med Rev*, 2000; 4: 299-314 [PubMed] [Google Scholar]
10. Pain in children and adolescents with cerebral palsy: A population-based registry study. (n.d.). PubMed Central, (PMC).Retrieved from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5071732/>.