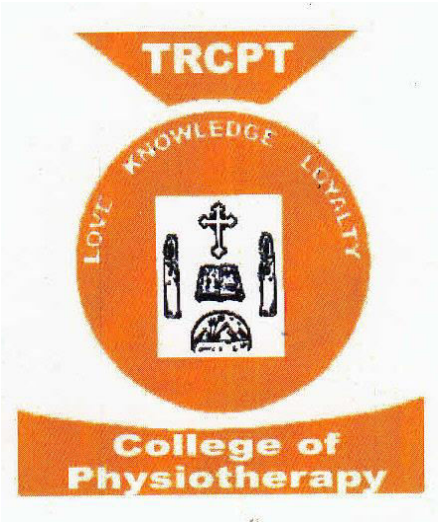
A STUDY TO COMPARE THE EFFECTIVENESS OF VESTIBULAR STIMULATION VS NEURODEVELOPMENT THERAPY IN IMPROVING BALANCE FOR CHILDREN WITH DOWN SYNDROME



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MPT-NEUROLOGY

Dissertation Submitted To

THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY, CHENNAI

TOWARDS PARTIAL FULFILLMENT AS REQUIREMENT FOR THE DEGREE

MASTER OF PHYSIOTHERAPY

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CERTIFICATE

This is to certify that the research work entitled **"A STUDY TO COMPARE THE EFFECTIVENESS OF VESTIBULAR STIMULATION VS NEURODEVELOPMENT THERAPY IN IMPROVING BALANCE FOR CHILDREN WITH DOWN SYNDROME"** was carried out by the candidate with the **(REG NO: 271620141)** Master of physiotherapy student at Thanthai Roever Collage of Physiotherapy, Perambalur, submitted to Tamil Nadu Dr. M.G.R. Medical University, Chennai towards the partial fulfillment as a requirement for the Degree Master of Physiotherapy **(MPT-NEUROLOGY).**

Prof. C.V. John Franklin, MPT. MIAP.
Principal
Thanthai Roever College of Physiotherapy
Perambalur -621212

CERTIFICATE

This is to certify that the research work entitled **"A STUDY TO COMPARE THE EFFECTIVENESS OF VESTIBULAR STIMULATION VS NEURODEVELOPMENT THERAPY IN IMPROVING BALANCE FOR CHILDREN WITH DOWN SYNDROME"** was carried out by the candidate with the **(REG NO: 271620141)** Thanthai Roever College of Physiotherapy Perambalur under the guidance of me towards the partial fulfillment as a requirement for the degree Master of Physiotherapy Submitted to The Tamil Nadu Dr. MGR Medical University Chennai. **(MPT-NEUROLOGY).**

GUIDE

Prof. K. Krishnaraja, MPT., MIAP.,

Vice-Principal

Thanthai Roever College of Physiotherapy

Perambalur -621212

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INTRODUCTION

Down syndrome was named after JOHN LANGDON DOWN the first physician to identify the syndrome. Down syndrome is the most common Chromosomal abnormality among live birth. Down syndrome is the most frequent genetic cause of mild to moderate mental retardation and associated medical problem and occurs in 1 out of 800 live births in all races and economic groups.

Down syndrome is characterized by a variety of dimorphic features, congenital malformation and other health problems and medical condition. Not all of them are present in each affected individual.

In children with Down syndrome there have been a number of observed and measured motor characteristics such as hypotoncity, joint hypo mobility, decrease in deep tendon reflex, maintenance of primitive reflex and a delay in appearance of reaction timing and equilibrium reaction that may have contributed to delay development.

The chromosomal basis of Down syndrome

Human body cell contains 23 pairs of chromosome, half of which are inherited from each parent. Only the human reproductive cells, the sperm cells in males and the Ovum in females, have 23 individual chromosomes not pairs. These chromosome pairs as the xx pair present in females, and the xy pairs, present in males, and number them 1 through 22.

When the reproductive cells, the sperm and ovum combine at fertilization, the fertilized egg that results contains 23 chromosome pairs. A fertilized egg that will develop into a female contains chromosome pairs 1 through 22, and the xx pair. A fertilized egg that will develop into a male contains chromosome pairs 1 through 22, and the xy pair. When the fertilized egg contains extra material from chromosome number 21, this results in Down syndrome.

Incidence of Down syndrome

Down syndrome rises with increasing maternal age.

For parents of a child with Down syndrome due to translocation trisomy 21, there may be an increased likelihood of Down syndrome in future pregnancies. This is because one of the two parents may be balanced carriers of the translocation.

Occurrence of Down syndrome

Occurrence of Down syndrome is due to a random event that occurred during formation of the reproductive cells, the ovum or sperm. The probability that another child with Down syndrome will be born in a subsequent pregnancy is about 1 percent, regardless of maternal age.

AIM & NEED OF STUDY

AIM OF STUDY

Aim of the study is to compare the effectiveness of Vestibular stimulation Vs Neurodevelopmental therapy in improving balance for children with Down syndrome.

NEED FOR STUDY

In clinical setting Neurodevelopmental therapy is being usually given to improve balance for children with Down syndrome. Vestibular stimulation has shown promising result and it is a approach that can be used to improve balance in children with Down syndrome by normalization of extensor muscle tone and also by the development of equilibrium reaction.

This study has been conducted in an attempt to compare the effectiveness of vestibular stimulation with Neurodevelopmental therapy to improve balance for children with Down syndrome.

OPERATIONAL DEFINITION

Down syndrome

A congenital disorder characterized by varying degree of mental retardation and multiple developmental defects. It is most commonly caused by the presence of extra chromosome 21. It is also called as Trisomy 21 or mongolism.

Neurodevelopmental therapy

Neurodevelopmental therapy is a interdisciplinary problem solving approach and management for impairment of motor including tone pattern of movement, sensory perceptual, cognitive function resulting from CNS.

Vestibular stimulation

Vestibular stimulation is a specific form of physical therapy designed to habituate symptoms and promote adaptation to substitution for various aspects of deficits related to a variety of balance disorder.

Pediatric balance scale

A modified version of the berg balance scale for school age children was developed as a balance measure for children with mild to moderate motor impairment.

REVIEW OF LITERATURE

1. Dyer et al 1990 uyanik et al 2001

Down syndrome generally have deficit in eye hand co-ordination, equilibrium, speed, reaction timing, visual motor control.

2. Gilman et al 1981

Hypotonus in Down syndrome has been defined as a lack of descending excitation to the spinal cord motor neuron pool.

3. Hulya Kalyan et al, Mini uyanik et al

Balance deficit in downs syndrome are not associated with hypotonic but result from defect in higher level postural mechanism.

4. Alex Menderron et al

He stated that complication such as hypothyroidism, coeliac disease and obesity occur more frequently with Down's syndrome.

5. Mine uyanik et al

In children with down syndrome, dysfunction of stereognoics and decease in motor skill are also related to hypotonic.

6. Wollacott and Shumway Cook et al 1986

Hypotoncity disrupts the feedback mechanism which enables the perception of the position of the body in space and plays a role in the voluntary control of muscle and as a result body posture and quality of movement are affected.

Suggested that in establishing more effective balance in Down syndrome children should be on enhancing motor co-ordination by improving spatiotemporal coupling between muscle groups and on improving the organizational process for adapting postural adjustment by changing task condition.

8. Shumway Cook and Wollacott et al 1985

Balance difficulties in down syndrome appear to result from deficit integration of visual, vestibular and somatosensory input.

9. Aqyres et al 1979, Kelly et al 1989

Different head position and movements are necessary for the stimulation of vestibular receptors but particularity the horizontal position is more important.

10. Magrun et al 1981

He stated that vestibular dysfunction is observed in many developmental disorders as motor dis-co-ordination and learning disabilities.

11. Ottenbacher and Petersen et al 1983

Suggested that vestibular system is particularly important in the development of motor skill, balance, forming coordinated eye movement and visual attention skill.

12. Cohen and Keshner et al 1989

Vestibular system is important in the development achievement of normal motor development and co-ordination.

13. Kenneth Ottenbacher et al

In his study on 'Developmental implication of clinically applied vestibular stimulation' concluded that vestibular stimulation has positive effect on arousal level, motor development, reflex integration.

14. Shumway Cook et al 1992

He stated that children with vestibular dysfunction treated with equipment such as swings, hammocks stimulate the vestibular system.

15. Joan synder Lydic et al

In his study on 'Effects of vestibular stimulation on motor performance of infants with Down syndrome' concluded that down syndrome infants are capable of making significant changes in motor ability.

16. Fisher and Bundy et al 1989

In assessment of determining the indication of the vestibular stimulation intervention. It is necessary that most of the following finding have positive outcome : Shortening of post rotary nystagmus duration, inefficiency in pivot prone (prone extension) position, hypotonscity in extensor muscle ,weakness in equilibrium, disease in (co-ordination) joint stability, feeling of gravitational insecurity.

17. Medisiror l Bittas Rs et al

Vestibular stimulation seems to be safe and efficacious therapeutic option in children with peripheral vestibular disturbance.

18. Jan Stephen Tecklen et al

Vestibular stimulation activities can be chosen to improve balance that stimulate experience of movement. Examples of equipments used in the movement activities include hammock swing, scooter board.

19. Wang Wyju YH et al

Vestibular stimulation given to Down syndrome children produced a marked change in balance and qualitative and quantitative jumping performance.

20. Abdulaziz et al

Significant difference was recorded in balance for children with Down syndrome. It may be attributed to the enhancing effect of vestibular stimulation. It is thus concluded that vestibular stimulation can be added to the treatment programme of down syndrome children.

21. Darrahj et al

Neurodevelopmental therapy had shown to be an efficacious in improving muscle tone balance and postural control in children with Down syndrome.

22. Charlene Butler et al

Neurodevelopmental approach focuses on sensory motor component of muscle tone, reflexes balance, abnormal movement pattern, postural control (i.e.) components though most likely to be impaired as a result of CNS damage. .

23. Janet Santepieto et al, Anne Spalding et al

Using Swiss ball exercises is a great way to improve posture, balance, and body awareness and also to build overall strength and endurance.

24. Dilip R.Patel et al

The aim of Neurodevelopmental therapy approach is to facilitate normal motor development and function and to inhibit abnormal tone, reflexes and movement pattern

Reliability of Pediatric balance scale

1. Fronjoine et al, Mary Rose HR et al, Joan S et al

Pediatric balance scale has been demonstrated to have good test-retest and interrates relaiability when used with school aged children with mild to moderate motor impairment.

2. Myung sook et al, Nometal, hyun Lee et al, Jungah et al

Pediatric Balance Scale could be a useful clinical measurement to assess balance skills for children with developmental delay.

Down syndrome

A common chromosome disorder due to an extra chromosome number 21. Down syndrome is a common birth defect. The chromosome abnormality affects both the physical and intellectual development of the individual.

Classification

1. Trisomy 21

Trisomy 21 affects about 95% of the people with Down syndrome. It is genetically inherited. Abnormal cell division occurs in the egg (95% of trisomy 21 cases) or sperm (95% of trisomy 21 cases) before or after conception. As the embryo develops the extra chromosome is copied in every cell of the body.

Older women are at higher risk than younger women of having a baby with trisomy 21.

2. Translocation

Translocation affects about 4% of the people with Down syndrome. Although the total number of chromosome is normal (46) a part of chromosome 21 breaks off attaches to another chromosome and produces signs and features of Down syndrome. Genetic concealing may help to determine the origin of the translocation.

3. Mosaicism

About 3 out 100 people with Down syndrome have a type called Mosaicism. Mosaicism result from abnormal cell division in only some cell after fertilization

while others divide normally. The cell that divide abnormally produce 47 chromosome with the extra genetic material from chromosome 21. As the embryo grows both normal and abnormal cell continually replicate. Even though half of the cell may be normal symptoms usually are nearly same as those that occurs with other type of Down syndrome.

Signs and symptoms

Down syndrome is characterized by a variety of dysmorphic features and other health conditions

Dysmorphic features

Head & Neck:

- Brachycephaly
- Upslanting palpebral fissures
- Epicanthic folds

- Brushfield spots

- Flat nasal bridge
- Folded or dysplastic ears
- Simian Crease

- Small stature
- Open mouth
- Protruding and furrowed tongue
- Narrow palate
- Abnormal teeth
- Short neck
- Excessive skin at the nape of neck

Extremities

- Short broad hands
- Hypoplastic mid phalanx of fifth finger
- Incurved fifth finger
- Space between the first & second toe
- Hyperflexibility of joints
- Hypotonia

Health Conditions

- Congenital heart disease
- Hearing problem
- Intestinal problem such as blocked small bowel
- Celiac disease
- Eye problem such as cataract, myopia, strabismus
- Thyroid dysfunction
- Skeletal problems
- Dementia similar to Alzhimer’s

Prenatal screening for Down syndrome

- ✓ Serum alpha feto protein (MSAFD)
- ✓ Chorionic gonadotrophin (HCG)
- ✓ Unconjugaged estriol (UE3)

Diagnostic test for Down syndrome

- ✓ Amniocenterrs
- ✓ Chorionic villus sampling (CVS)
- ✓ Percertaneous umbilical blood sampling (PUBS)

Diagnosis of Down syndrome

This involves a blood test called a Chromosome Karyotype. This involves 'growing' the cells from the baby's blood for about two weeks followed by microscopic visualization of the chromosome to determine if extra material from chromosome 21 is present.

Need for Physical Therapy for Down syndrome
Patricia Winder et al

Early physical therapy intervention assist children with Down syndrome in developing optimal movement pattern which build the foundation for motor performance to become an area of strength.

Cannoly and Micheal et al 1986

The occurrence of balance and co-ordination problem in Down syndrome children support the view that physical therapy may be useful not only during preschool period but also during all adolescent life.

Need for Vestibular stimulation:

The receptors in the vestibular system respond both to movement and gravity. The vestibular system is a system that affects balance, eye-movement, and posture and muscle tone.

Weeks et al 1979, Magrun et al 1981, Sandler and Molain et al 1987 Arendt et al 1991, Dava et al 1992 Uyanik et al 2003

The following can be beneficial as therapeutic effects of vestibular stimulation.

1. Regulation of functional balance
2. Developing gross motor function
3. Increasing perception motor skill
4. Developing intellectual function
5. Increasing co-ordinated eye-movement and visual attention skills

Need for Neurodevelopmental Therapy

The neurodevelopmental therapy approach focuses on the normalization of hyper or hypotonic muscle the specific handing intervention of equilibrium reaction and the child movement and its facilitation.

Bobath 1980 et al Marris et al 1981

Neurodevelopmental therapy is a popular theory methods within the intervention approaches of infants and children with neuron motor dysfunction.

MATERIALS AND METHODOLOGY

Study design

Pretest & posttest experimental study design

Sample Size

20 Children who fit into the inclusive criteria were taken. 10 patients were allotted for each group.

Sampling technique

Purposive sampling technique.

Study setting

- Retna Global hospital, Trichy
- Spastic Society, Trichy
- Thanthai Roever College of Physiotherapy OP Department, Perambalur

Criteria for selection

Inclusive Criteria

- Age : 5 to 10 Yrs.
- Sex : Both Male & Female
- Children diagnosed with Down syndrome through chromosome Karyo type

Exclusive Criteria

- Congenital heart disease
- Hearing problem
- Dementia similar to Alzheimer's
- Eye problem such as Cataract
- Celiac disease

Duration of study

4 months

Hypothesis

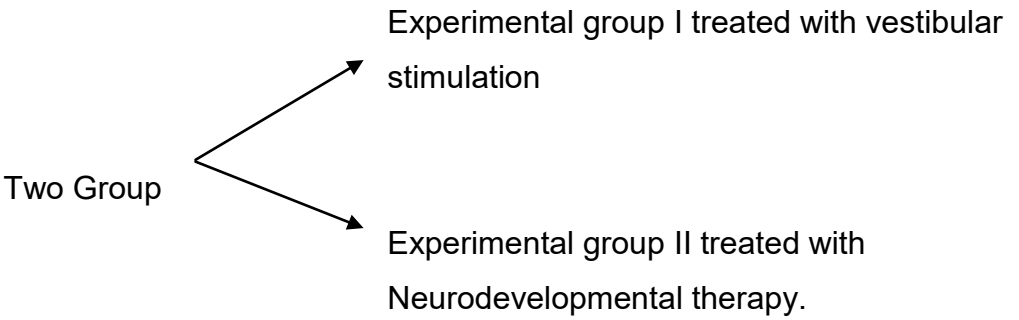
a) Null Hypothesis

- There is no significant effect of vestibular stimulation in improving balance for children with Down syndrome.
- There is no significant effect of Neurodevelopmental therapy in improving balance for children with Down syndrome.
- There is no significant difference in the effectiveness of vestibular stimulation Vs Neurodevelopmental therapy in improving balance for children with Down syndrome.

b) Alternate hypothesis

- ❖ There is significant effect of vestibular stimulation in improving balance for children with Down syndrome.
- ❖ There is significant effect of Neurodevelopmental therapy in improving balance for children with Down syndrome.
- ❖ There is significant difference in the effectiveness of vestibular stimulation Vs Neurodevelopmental therapy in improving balance for children with Down syndrome.

Study Method



Measurement Tool

Pediatric Balance Scale

Technique of Study

Experimental Group I

To find out the effect of vestibular stimulation in improving balance for children with Down syndrome.

Vestibular Stimulation

a. Bouncing & jumping activities
   - Jump on a mini trampoline
   - Jump on the bed
   - Jump off a step into a pile of pillows or bean bag chairs.
   - Bounce on a bouncy horse with up and down and back and forth motion.

b. Linear swing activities
   - Hammock swing – on stomach while doing an activities (knock over cones, throw bean bags, catch a ball, pick up toys etc)
   - Hammock swing – moving back and forth or side to side.

- Hammock swing – with rotation and changing direction quickly

c. By moving the support surface, the centre of gravity is changed as active or passive.

d. By pushing – pulling activities displacement of the centre of gravity is created. There are activities which enable active equilibrium on steep surface such as stairs, ramps and unfamiliar surface

e. By using equipment such as balance boards, barrel

f. Slide – various heights and directions and landing on various surface.

Duration of treatment - 45min

Repetition - 10 Rep/exercise

No.of section - 2 session / day

No. of day/week - 5 days / week

Exercise on trampoline

Experimental Group II

To find out the effect of Neurodevelopmental therapy in improving balance for children with Down syndrome.

Neurodevelopmental therapy

a. Swiss ball exercise
   - Trunk extension in Swiss ball
   - Trunk Rotation in Swiss ball
   - Prone to sitting, supine to sitting.
   - Forward weight shift into extended upper extremities with lower extremities maintained in dissociated position.

b. Mat activities:
   - Side sitting to kneeling
   - Kneeling to half kneeling
   - Proximal weight bearing with single leg dissociation and one hand searching activity.

c. Standing
   - Sitting to half kneeling
   - Single leg standing
   - Dissociated quadripod in proximal weight bearing

   Duration of treatment - 45min
   Repetition - 10 Rep/exercise
   No.of section - 2 session / day
   No. of day/week - 5 days / week

Exercise on Swiss ball

STATISTICAL ANALYSIS

(i) Changes within group I and group II are analysed using paired 't' test

$$\text{paired } t = \frac{\bar{d}\sqrt{n}}{s}$$

$$S = \sqrt{\frac{\sum d^2 - (\bar{d}^2)n}{n-1}}$$

$\bar{d}$ = mean of deviation

n = total number of subjects

s = standard deviation

Σd^2 = Sum of squared deviation

Level of significance 5%

ii) Difference in outcome between group I and group II are analysed using independent 't' test

$$\text{independent t} = \frac{\bar{X} - \bar{X}_2}{S} \quad \frac{\sqrt{n_1 + n_2}}{n_1}$$

$$S = \sqrt{\frac{\sum (X_1 - \bar{X}_1)^2 + \sum (X_2 - \bar{X}_2)^2}{n_1 + n_2 - 2}}$$

$\bar{x}_1$ = mean of group I

$\bar{x}_2$ = mean of group II

n_1 = number of samples in group I

n_2 = number of samples in group II

S = standard deviation

Level of significance 5%

DATA PRESENTATION

A. Experimental Group I

- 10 Down syndrome children were treated with Vestibular stimulation

S.No.	PRE TEST	POST TEST
1	8	25
2	4	24
3	9	29
4	5	25
5	9	27
6	10	31
7	9	28
8	8	26
9	11	33
10	10	30

B. Experimental Group II

- 10 Down syndrome children were treated with Neurodevelopmental therapy

S.No.	PRE TEST	POST TEST
1	8	18
2	9	20
3	7	17
4	8	19
5	7	16
6	8	20
7	7	15
8	9	19
9	5	12
10	4	10

DATA ANALYSIS

Demographic Data

		Group II	Group II
Age	5 – 8	4	7
	8 – 10	6	3
Sex	M	5	6
	F	5	4

Tabulation: Paired‘t’ test

A. Experimental Group I (Vestibular stimulation)

	Pre test	Post test
Mean	8.3	27.8
‘t’ value	41.489	

Level of significance : p<0.05 and significant

B. Experimental Group II (Neurodevelopmental therapy)

	Pre test	Post test
Mean	6.8	16.6
‘t’ value	15.932	

Level of significance: p<0.05 and significant

Unpaired ‘t’ test

A. Post test between Experimental Group I and Group II

	Group I	Group II
Mean	27.8	16.6
‘t’ value	5.125	

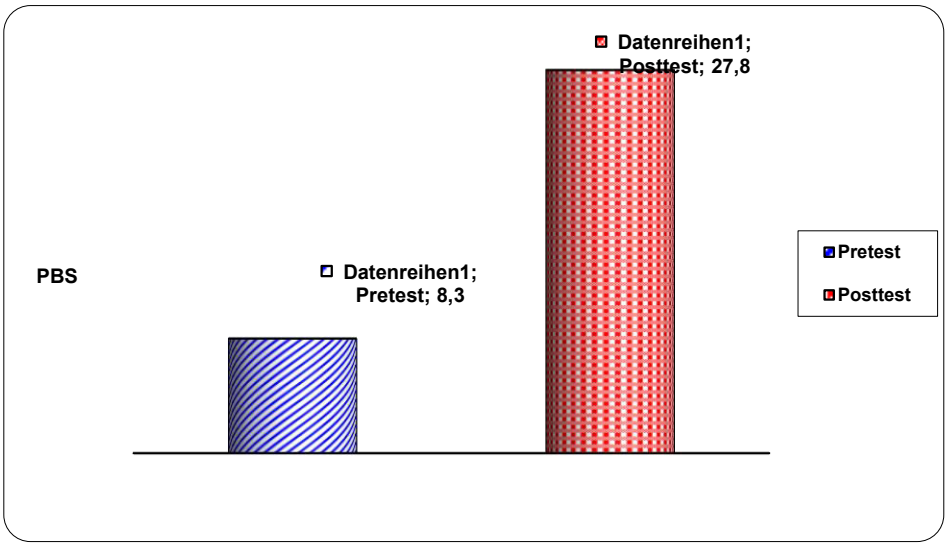
Level of significance: p<0.05 and significant

GRAPHICAL PRESENTATION

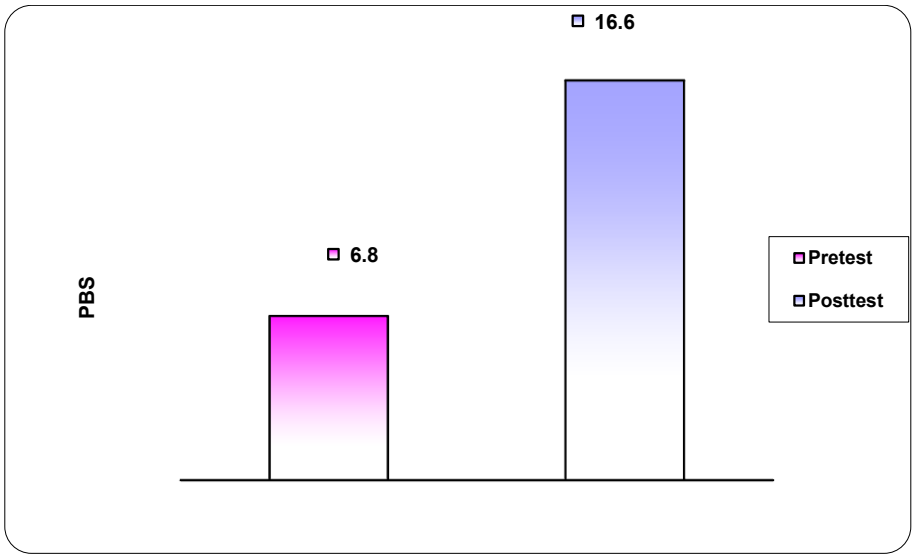
Pediatric balance scale

Paired‘t’ test

A. Experimental Group I (Vestibular stimulation)

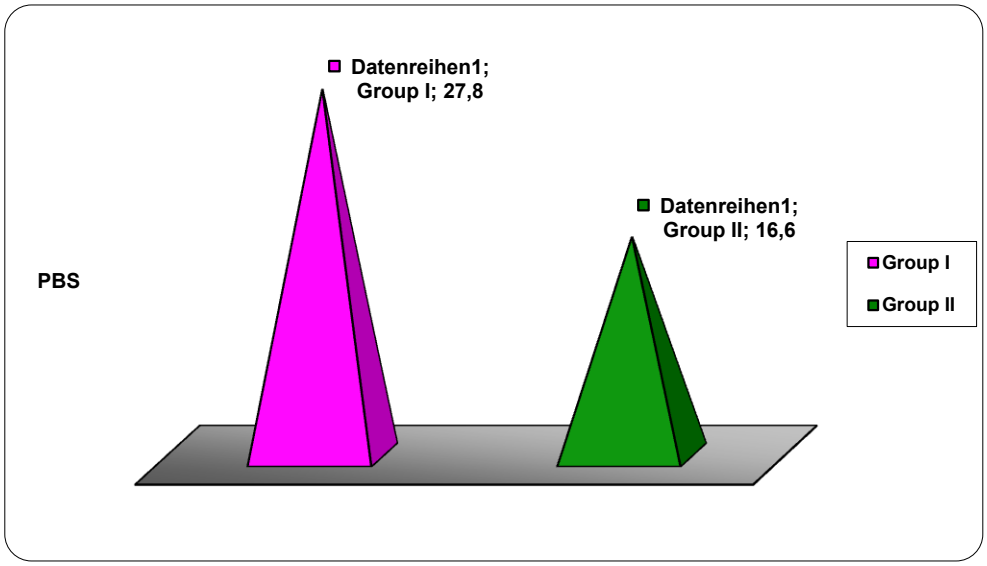


B. Experimental Group II (Neurodevelopmental therapy)



Independent ‘t’ test

Post test of experimental group I & group II



RESULT

Paired‘t’ test

Pediatric balance scale

Experimental Group I (Vestibular Stimulation)

For 9 degree of freedom at 5% level of significance the calculated ’t’ value is 41.489 which is greater than the table ‘t’ value 2.262. Hence alternate hypothesis is accepted.

Experimental Group II (Neurodevelopmental therapy)

For 9 degree of freedom at 5% level of significance the calculated‘t’ value is 15.932 which is greater than the table ‘t’ value 2.262. It shows there is significant difference between data. Hence alternate hypothesis is accepted.

Unpaired ‘t’ test

Pediatric balance scale

Post test value (Experimental Group I & II)

When the post test value of experimental Group I and experimental Group II were analyzed by unpaired ‘t’ test. The calculated ‘t’ value is 5.125. The table ‘t’ value at 5% level of 18 degree of freedom is 2.101 which is less than the calculated ‘t’ value. So there is significant difference between two groups and hence alternate hypothesis is accepted.

DISCUSSION

Down syndrome is the most common chromosomal abnormality among live birth. In children with Down syndrome there have been a number of observed and measured motor characteristic such as delay in equilibrium reaction, hypotonicity, joint hypomobility, a delay in appearance of reaction timing.

The study was conducted to compare the effectiveness of Neurodevelopmental therapy and Vestibular stimulation to improve balance in children with Down syndrome.

The study comprised of two experimental group of 20 samples. They were included according to the inclusive and exclusive criteria. The samples were selected using purposive sampling design. The samples were divided into two experimental groups where experimental group I received vestibular stimulation and experimental group II received neurodevelopmental therapy. Pre and post test scores were noted according to the study design. Balance were assessed using pediatric balance scale.

The statistical analysis was done using paired‘t’ test and independent‘t’ test. The results obtained after analysis showed there is significant improvement in group I treated with vestibular stimulation compared to group II treated with neurodevelopmental therapy and found that there is no significant difference between two groups.

The improvement is due to vestibular stimulation.

Reasons:-

- ❖ It is important in the achievement of normal motor development and co-ordination
- ❖ It is particularly important in the development of motor skills, the integration of postural reflex, forming co-ordinated eye movement.
- ❖ Vestibular stimulation a beneficial in regulation of functional balance.
- ❖ Vestibular stimulation helps in bringing out positive outcomes in the following.
- ❖ Shortening of post rotary nystagmus duration
- ❖ Inefficiency in pivot prone extension
- ❖ Hypotonicity in extensor muscle
- ❖ Weakness in equilibrium and support reaction
- ❖ Decrease in joint stability
- ❖ Feeling of gravitation insecurity

SUMMARY AND CONCLUSION

A balance disorder is a disturbance that causes an individual to feel unsteady or have a sensation of movement. An organ in our inner ear is an important part of our vestibular system.

The Vestibular system in the brain does more than just allow us to stand upright, maintain balance and move through space. It co-ordinates information from the vestibular organ in the inner ear eyes, muscle, joints finger tips, palm of the hand , gravity receptors on the skin and adjust to heart rate, Blood pressure, muscle tone, limb position, arousal and balance.

Dysfunction in the vestibular system can cause abnormalities in muscle tone, difficulty defecating, need for self-stimulation etc. Exercises that activate wide range of inputs to the vestibular system have been found to be effective in reducing vestibular problem.

Physical therapy intervention like vestibular stimulation and neurodevelopmental therapy were given to selected patient 10 patient in each group.

Pretest, posttest scores are noted and analysis was done using paired ‘t’ test and independent ‘t’ test statistical analysis shows that there is significant improvement in balance with both technique and vestibular stimulation is found to be more effective than neurodevelopmental therapy.

From this it can be concluded that vestibular stimulation can be incorporated to treat children with Down syndrome to improve balance. Further undergoing earlier management leads to better prognosis

LIMITATION AND SUGGESTION

- ⇨ This study has been carried out on small sample size. Studies can be done with larger samples.
- ⇨ The study was done in a short term and long period study should be performed to validate the finding.
- ⇨ Further studies on comparing Neurodevelopmental therapy Vs vestibular stimulation in improving motor performance can be done.
- ⇨ Further studies on comparing vestibular stimulation and sensory integration can be used to improve balance in Down syndrome children.
- ⇨ Assessment of balance can also be done using computerized bio - photogrammetry.
- ⇨ Studies on Neurodevelopmental therapy, sensory integration and vestibular stimulation given in combination has been proved to effective can also be done.
- ⇨ Studies in improving gait for children with Down syndrome through vestibular stimulation can also be done.
- ⇨ Balance activities given through sensory integration can be assessed with ‘pediatric clinical test of sensory interaction for Balance.

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APPENDIX

APPENDIX-I

Pediatric Neurological Evaluation Chart

NAME :

AGE :

SEX :

GUARDIAN'S OCCUPATION :

ADDRESS :

DATE OF ASSESMENT :

CHIEF COMPLAINTS :

HISTORY

Past Medical history :

Present medical history :

Associated Medical Problem :

VITAL SIGNS

Temperature :

Blood pressure :

Pulse rate :

Respiratory rate :

MILESTONE ASSESSMENT
NEONATAL REFLEX

ON OBSERVATION

Built :

Posture :

Deformity :

External appliance :

Tropic changes :

ON EXAMINATION

Mental Status

a. Level of Consciousness : (Glasgow Coma Scale)

b. Memory

1. Immediate recall : Present/ Absent

2. Short Term : Present/Absent

3. Long Term : Present/Absent

C. Orientation

(To Time, Place and Person) :

d. Ability to follow

1. Instruction :

(One, two, three level commands)

2. Higher cortical function

Calculation ability :

Abstract reasoning :

Attention span :

Learning deficits :

3. Communication

Aphasic : Expressive/Receptive/Global

Non Aphasic :

4. Sensation

Superficial

Pain :

Touch :

Temperature :

Pressure :

Proprioceptive :

Cortical sensation :

Hearing :

Vision

Acuity :

Peripheral vision :

Depth perception :

Hemianopsia :

5. Perception

Agnosia :

Apraxia :

Spatial relation :

Body image :

6. Joint mobility

Range of motion :

Joint play :

Soft issue compliance :

Fixed contracture :

7. Motor control

a. Tone :

b. Reflexes :

Superficial reflex : Babinski/Abdominal

Deep tendon reflex :

Primitive reflexes :

Tonic reflexes :

C.Voluntary movement patterns

Synergy dominance:

Selective movement control :

d. Coordination :

e. Balance :

f. Gait :

g. Hand function :

8. Bladder & Bowel function

APPENDIX II

PEDIATRIC BALANCE SCALE

Name: _____ Date: _____

Location: _____Examiner: _____

Item Description

1. Sitting to standing
2. Standing to sitting
3. Transfers
4. Standing unsupported
5. Standing with eyes closed
6. Standing with feet together
7. Standing with one foot in front
8. Standing on one foot
9. Placing alternate foot on stool
10. Reaching forward with outstretched arm

Total Test Score = 40

General Instructions

1. Demonstrate each task and give instructions as written. A child may receive a practice trial on each item. If the child is enable to complete the task based on their ability to understand the directions, a second practice trial may be given. Verbal and visual directions may be clarified through the use of physical prompts.

2. Each item should be scored utilizing the 0 to 4 scale. Multiple trials are allowed on many of the items. The child's performance should be scored based upon the lowest criteria, which describes the child's best performance. If on the first trial a child receives the maximal score of 4 additional trials need not be administered. Several items require the child to maintain a given position for a specific time. Progressively more points are deducted if the time or distance requirements are not met if the subject's performance warrants supervision; or if the subject touches an external support or receives assistance from the examiner. Subjects should understand that they must maintain their balance while attempting the tasks. The choice, of which leg stand on or how far to reach, is left to the subject. Poor judgement will adversely influence the performance and the scoring. In addition to scoring items 1, 5, 6, 7, 8, 9, 10 and 13 the examiner may choose to record the exact time in seconds.

1. Sitting to Standing

Special instruction : Items #1 and #2 may be tested simultaneously if, in the determination of the examiner, it will facilitate the best performance of the child.

Instructions : Child is asked to "Hold arms up and stand up". The child is allowed to select the position of his/her arms.

Equipments : A bench of appropriate height to allow the child's feet to rest supported on the floor with the hips and knees maintained in 90 degrees of flexion.

Best of Three Trials

( ) 4 able to stand without using hands and stabilize independently

( ) 3 able to stand independently using hands
( ) 2 able to stand using hands after several tries
( ) 1 needs minimal assist to stand or to stabilize
( ) 0 needs moderate or maximal assist to stand

2. Standing to Sitting

Special Instruction : Items #1 and #2 may be tested simultaneously if, in the determination of the examiner, it will facilitate the best performance of the child.

Instructions: Child is asked to sit down slowly, without use of hands. The child is allowed to select the position of his/her arms.

Equipment : A bench of appropriate height to allow the child's feet to rest supported on the floor with the hips and knees maintained in 90 degrees of flexion.

Best of Three Trials

( ) 4 sits safely with minimal use of hands
( ) 3 controls descent by using hands
( ) 2 uses back of legs against chair to control descent
( ) 1 sits independently, but has uncontrolled descent
( ) 0 needs assistance to sit

3. Transfers

Instructions : Arrange chair(s) for a stand pivot transfer, touching at a forty-five degree angle. Ask the child to transfer one way toward a seat with armrests and one way toward a seat without armrests.

Equipment : Two chairs, or one chair and one bench. One seating surface must have armrests. One chair/bench should be of standard adult size and the other

should be of an appropriate height to allow the child to conformably sit with feet supported on the floor and ninety degrees of hip and knee flexion.

Best of Three Trials

( ) 4 able to transfer safely with minor use of hands
( ) 3 able to transfer safely; definite need of hands
( ) 2 able to transfer with verbal cueing and/or supervision (spotting)
( ) 1 needs one person to assist
( ) 0 needs two people to assist or supervise close guard) to be safe

4. Standing Unsupported

Instructions : The child is asked to stand for 30 seconds without holding on or moving his/her feet. A taped line or footprints may be placed on the floor to help the child maintain a stationary foot position. The child may be engaged in non-stressful conversation to maintain attention span for thirty seconds. Weight shifting and equilibrium responses in feet are acceptable, movement of the foot in space (off the support surface) indicates end of the timed trial.

Equipment : a stop watch or watch with a second hand
a twelve inch long masking tape line or two footprints placed shoulder width apart

Best of Three Trials

( ) 4 able to stand safely 30 seconds
( ) 3 able to stand 30 seconds with supervision (spotting)
( ) 2 able to stand 15 seconds unsupported
( ) 1 needs several tries to stand 10 seconds unsupported
( ) 0 unable to stand 10 seconds unassisted

_____ **Time in seconds**

Special Instructions : If a subject is able to stand 30 seconds unsupported, score full points for sitting unsupported. Proceed to item #6

5. Standing Unsupported With Eyes Closed

Instructions : The child is asked to stand will with feet shoulder width apart and close his/her eyes for ten seconds. Direction : "When I say close your eyes, I want you stand still, close your eyes, and keep them closed until I say open". If necessary, a blindfold may be used. Weight shifting and equilibrium responses in the feet are acceptable, movement of the foot in space (off the support surface) indicates end of timed trial. A taped line or footprints may e placed on the floor to help the child maintain a stationary foot position.

Equipment : a stop watch or watch with a second hand
a twelve-inch long masking tape line or two footprints placed shoulder width apart
blindfold

Best of Three Trials

( ) 4 able to stand 10 seconds safely
( ) 3 able to stand 10 seconds with supervision (spotting)
( ) 2 able to stand 3 seconds
( ) 1 unable to keep eyes closed 3 seconds but stays steady
( ) 0 needs help to keep from failing

_____ Time in seconds

6. Standing Unsupported With Feet Together

Instructions : The child is asked to place his/her feet together and stand still without holding on. The child may be engaged in non-stressful conversation to maintain attention span for thirty seconds. Weight shifting and equilibrium responses in feet are acceptable; movement of the foot in space (off the support

surface) indicates end of timed trial. A taped line or footprints may be placed on the floor to help the child maintain stationary foot position.

Equipment : a stop watch or watch with a second hand
a twelve inch long masking tape line or two footprints placed together

Best of Three Trials

( ) 4 able to place feet together independently and stand 30 seconds safely
( ) 3 able to place feet together independently and stand for 30 seconds with supervision (spotting)
( ) 2 able to place feet together independently but unable to hold for 30 seconds
( ) 1 needs help to attain position but able to stand 30 seconds with feet together
( ) 0 needs help to attain position and /or unable to hold for 30 seconds

_____ Time in seconds

7. Standing Unsupported One Foot in Front

Instructions : The child is asked to stand with one foot in front of the other, heel to toe. If the child cannot place feet in a tandem position (directly in front), they should be asked to step forward far enough to allow the heel of one foot to be placed ahead of the toes of the stationary foot. A tapped line and/or footprints may be placed on the floor to help the child maintain a stationary foot position. In addition to a visual demonstration, a single physical prompt (assistance with placement) may be given. The child may be engaged in non-stressful conversation to maintain his/her attention span for 30 seconds. Weight shifting and/or equilibrium reactions in the feet are acceptable. Timed trials should be stopped if either foot moves in space (leaves the support surface) and/or upper extremities support is utilized.

Equipment : a stop watch or watch with a second hand
a twelve inch long masking tape line or two footprints placed heel to toe

Best of Three Trials

( ) 4 able to place feet tandem independently and hold 30 seconds

( ) 3 able to place foot ahead of other independently and hold 30 seconds

Note : The length of the step must exceed the length of the stationary foot and the width of the stance should approximate the subject's normal stride width

( ) 2 able to take small step independently and hold 30 seconds, or required assistance to place foot in front, but can stand for 30 seconds

( ) 1 needs help to step, but can hold 15 seconds

( ) 0 loses balance while stepping of standing

_____ Time in seconds

8. Standing On One Leg

Instructions : The child is asked to stand on one leg for as long as he/she is able to without holding on. If necessary the child can be instructed to maintain his/her arms (hands) on his/her hips (waist). A taped line of footprints may be placed on the floor to help the child maintain a stationary foot position. Weight shifting and/or equilibrium reactions in the feet are acceptable. Timed trials should be stopped if the weight-bearing foot moves in space (leaves the support surface), the up limb touches the opposite leg or the support surface and/or upper extremities are utilized for support.

Equipment : a stop watch or watch with a second hand
a twelve inch long masking tape line or two footprints placed heel to toe

3 Trials Average Score

( ) 4 able to lift leg independently and hold 10 seconds
( ) 3 able to lift leg independently and hold 5 to 9 seconds
( ) 2 able to lift leg independently and hold 3 to 4 seconds
( ) 1 tries to lift leg unable to hold 3 second but remains standing
( ) 0 unable to try or needs assist to prevent fail

_____ Time in seconds

9. Placing Alternate Foot on Step Stool While Standing Unsupported

Instructions: The child is asked to place each foot alternately on the step stool and to continue until each foot has touched the step/stool four times

Equipment: a step/stool of four inches in height
a stop watch or watch with a second hand

( ) 4 stands independently and safely and completes 8 steps in 20 seconds
( ) 3 able to stand independently and complete 8 steps in 20 seconds
( ) 2 able to complete 4 steps without assistance, but requires close supervision (spotting)
( ) 1 able to complete 2 steps, needs minimal assistance
( ) 0 needs assistance to maintain balance or keep from falling, unable to try

_____ Time in seconds

10. Reaching Forward With Outstretched Arm While Standing

General Instruction And Set Up : A yardstick affixed to a wall via Velcro strips will be used as the measuring tool. A taped line and/or footprints are used to maintain a stationary foot position. The child will be asked to reach as far forward without falling, and without stepping over the line. The MCP joint of the child's fisted hand will e used as the anatomical reference point for measurements.

Assistance may be given to initially position the child's arm at 90 degrees. Support may not be provided during the reaching process. If 90 degrees of shoulder flexion cannot be obtained, then this item should be omitted.

Instructions: The child is asked to lift his/her arm up like this. "Stretch out your fingers, make a fist, and reach forward as far as you can without moving your feet".

3 Trials Average Results

Equipment:

a yardstick or ruler

a taped line or footprints

a level

( ) 4 can reach forward confidently > 10 seconds

( ) 3 can reach forward > 5 inches safely

( ) 2 can reach forward > 2 inches safely

( ) 1 reaches forward but needs supervision (spotting)

( ) 0 loses balance while trying requires external support

_____ Total Test Score

Maximum Score = 56