EFFECTIVENESS OF NEURO-DEVELOPMENTAL TREATMENT PROTOCOL TO IMPROVE MOTOR CONTROL IN PRETERM INFANTS - AN EXPERIMENTAL STUDY

Dissertation submitted to

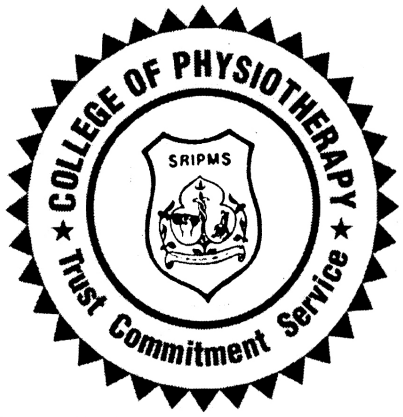
The Tamil Nadu Dr. M. G. R. Medical University

Chennai

In partial fulfillment of the requirements for the degree of

MASTER OF PHYSIOTHERAPY

(ADVANCED PHYSIOTHERAPY IN PEDIATRICS)



REG . NO. 2710110

APRIL - 2012

COLLEGE OF PHYSIOTHERAPY

SRI RAMAKRISHNA INSTITUTE OF PARAMEDICAL SCIENCES

COIMBATORE - 641 044.

CERTIFICATE

This is to certify that the dissertation work entitled **Effectiveness of Neuro-Developmental Treatment Protocol to Improve Motor Control in Preterm Infants – An Experimental Study** was carried out by the candidate bearing the **Register No. 27101110 (April 2012)** in College of Physiotherapy, SRIPMS, Coimbatore, affiliated to The Tamilnadu Dr. M.G.R Medical University, Chennai towards partial fulfillment of the **Master of Physiotherapy** (Advanced Physiotherapy in Pediatrics).

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Date :

CERTIFICATE

This is to certify that the dissertation work entitled **Effectiveness of Neuro-Developmental Treatment Protocol to Improve Motor Control in Preterm Infants - An Experimental Study** was carried out in College of Physiotherapy, SRIPMS, Coimbatore, affiliated to The Tamilnadu Dr. M.G.R Medical University, Chennai towards partial fulfillment of the **Master of Physiotherapy** (Advanced Physiotherapy in Pediatrics) under my direct supervision and guidance.

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This is to certify that the dissertation work entitled **Effectiveness of Neuro-Developmental Treatment Protocol to Improve Motor Control in Preterm Infants - An Experimental Study** Submitted By

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APRIL - 2012

To The Tamil Nadu Dr. M.G.R. Medical University, Chennai in Partial fulfillment of the requirement for the award of degree of **MASTER OF PHYSIOTHERAPY** was evaluated

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INTERNAL EXAMINER **EXTERNAL EXAMINER**

Place : Coimbatore
Date :

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CONTENTS

I. INTRODUCTION

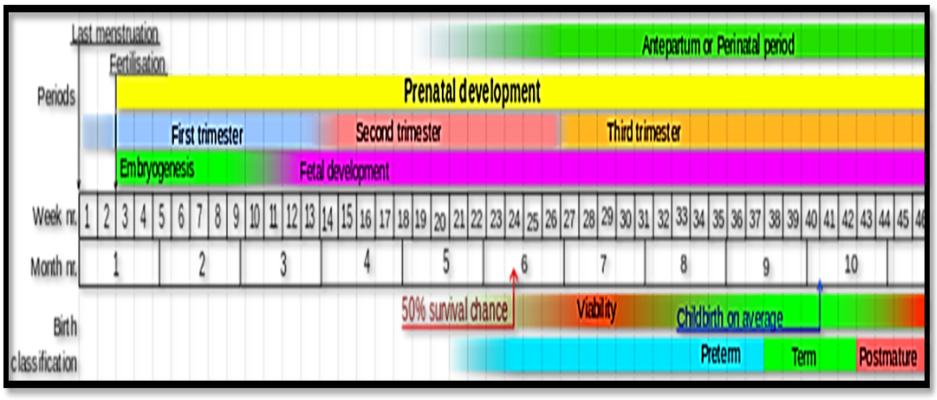
In humans, **preterm birth** is birth before full gestational period (37 weeks); a "premature" infant is one that has not yet reached the level of foetal development that generally allows a life outside the womb. Several organ systems mature between 34 and 37 weeks in the normal human fetus, and the fetus reaches adequate maturity by the end of this period.

Preterm birth is one of the major problems faced nowadays. Pre term infants have a lower chance of survival which is due to the motor, cognitive and sensory impairments.[1]

A report of 2007 from the Institute of Medicine emphasizes that preterm birth leads to many complex conditions which is caused due to multiple gene; environmental interactions and leads to birth before 37 weeks gestation. Neonatal complications lead to a higher rate of neurodevelopment instability.

There is an increased risk of cerebral palsy due to prematurity is well documented. Recent studies highlight the range and severity of cognitive, sensory, language, visual-perceptual, attention and learning deficits in very preterm children. The neuroimaging studies also help to identify perinatal risk factors. Hence neurodevelopmental follow-up

of neonatal intensive care unit trials offers the potential to really improve our understanding of how the preterm brain develops, is injured and recovers from injuries. A better knowledge / understanding of what influences the neurodevelopment outcomes is the main key for developing better treatment strategies.[2-4]



The chart above describes the growth of a fetus and its various complications due to different stages of delivery.

Common signs seen in prematurity include:

- Lanugo (body hair)
- Abnormal breathing patterns
- Clitoris enlarged
- Neonatal respiratory distress syndrome
- Pneumonia
- Decreased muscle tone and activity than full-term infants
- Difficulty in sucking and swallowing

- Low birth weight
- Genitals are small, soft and smooth.
- Soft and flexible ear cartilage
- Thin, smooth and shiny skin.

There is a significant overlap exist between preterm birth and prematurity. Usually the preterm babies are premature and term babies are fully matured. And this prematurity can be reduced to a small extent by using certain drugs that accelerate maturation of the fetus to a greater extent thus preventing preterm birth.

Some chronic medical conditions tend to complicate pregnancies and require medical attention to reduce the risk to mother and child. These include hypertension, diabetes, toxemia, thyroid dysfunction, kidney disorders, congenital heart conditions, and respiratory problems.

MOTOR PERFORMANCE IN PREMATURE INFANTS:

Usually the infant uses movement to communicate and interacts physically with objects or people by changing postures, entertaining movements in response to environmental demands and for self – comforting. Hence the infants usually exhibit normal active movement which is necessary for optimal perceptual development which lags in infants born prematurely.[6,7.]

Hence the children, born prematurely exhibit lower motor performance scores than infants born at term. Those infant's central nervous system defects have more chance of developing poor motor outcome[8]. The incidence of cerebral palsy is 25 to 30 times higher in infants with birth weight less than 1500g.[9]

The evolution of high- technology neonatal care units has been established for the emerging problem of high-risk infants. Neonatal care is being more important in these children.

Physical therapist has been incorporated as regular members in NICU. They help in eliciting reflexes, promote motor function, provide early stimulation.

The purpose of this study was to assess the efficacy of Neuro-Developmental treatment administered for infants born less than 35 weeks of gestational age which shows aberrant motor development.

NEURO-DEVELOPMENTAL THERAPY

Neurodevelopmental treatment (NDT) is widely used by clinicians when working with children diagnosed with neurological dysfunction, such as cerebral palsy, high-risk/low-birth weight infants or traumatic brain injury.

In **Neurodevelopmental Treatment (NDT)**, postural control is the basic foundation on which the babies begin to develop their skills. Patients undergoing this treatment which eventually learn how to control postures and movements and then progress to more difficult ones. Therapists will analyse certain postures and movements and look for any abnormalities during testing, such as common abnormal movement patterns that include obligatory synergy patterns. These patterns can be described as the process of learning an isolated movement of a particular limb, but triggering the use of other uninvolved muscles in order to achieve movement.

Preterm infants seem to benefit most from intervention that aims at mimicking the intrauterine environment, such as NIDCAP intervention. After term age, intervention by means of specific or general developmental programmes has a positive effect on motor development[10-14]

1.1 AIM OF THE STUDY

Earlier studies revealed that minimal stimulation would elicit good neurobehavioral responses in Neonatal intensive care unit (NICU). Some other studies indicate that positioning and special nursing care improves weight gain in pre term babies. The purpose of this study was to evaluate the efficacy of a Neuro-Developmental Treatment protocol designed to improve motor control in infants born prematurely and at high risk for developmental disability.

1.2 STATEMENT OF THE PROBLEM

Apart from normal nursing care and positioning in preterm infants, there is a delay in the motor development of the baby. Hence the study aims to find out the EFFECTIVENESS OF NEURO-DEVELOPMENTAL TREATMENT PROTOCOL TO IMPROVE MOTOR CONTROL IN PRETERM INFANTS.

1.3 OBJECTIVES OF THE STUDY

To find out the efficacy of a Neuro–Developmental Treatment program to improve motor control in pre-term infants.

1.4 HYPOTHESIS

Null hypothesis

'*There is no significant improvement of motor control with Neuro–Developmental Treatment program in pre-term infants*'.

II. REVIEW OF LITERATURE

- **Martha C. Piper, V. Ildiko Kunos, Diana M. Willis, Barbara L. Mazer states that** early physical therapy program investigated in this study was efficacious in altering the pattern of motor development in those high-risk infants participating in the trial.1986 by the American Academy of Paediatrics.
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- **Lekskulchai R, Cole J** suggest that the NDT intervention program is likely to have beneficial effects when offered to a similar population of preterm born infants. Aust J Physiother. 2001; 47(3):169-76.

- **Maria Ramsay, Kenneth M. Silver** suggest that physical therapy intervention provides more beneficence to improve tone in pre-term infants. American Academy of Paediatrics; November 21, 2009.
- **Als H, Lawhon G, Duffy FH, McAnulty GB, Gibes-Grossman R, Blickman JG.** Confirms that Very low-birth-weight preterm infants may benefit from individualized developmental care in the neonatal intensive care unit in terms of medical and neurodevelopmental outcome. JAMA. 1994 Sep 21; 272(11):853-8.
- **Cornill H Blauw-Hospers MSc, Mijna Hadders-Algra MD PhD** states that Preterm infants seem to benefit most from intervention that aims at mimicking the intrauterine environment, such as NIDCAP intervention. After term age, intervention by means of specific or general developmental programmes has a positive effect on motor development. . Developmental Medicine & Child Neurology13 FEB 2007.
- **Muriel Goodman, AlanD. Rothberg, JoyceE. Houston-Mcmillan** states that high-risk infants had higher mean neurodevelopmental scores throughout the study period and lower 1-year development quotients (DQ) than normals. In at-

risk groups did neurodevelopmental therapy alter the pattern of development or the outcome. Department of Physiotherapy and Paediatrics, University of the Witwatersrand, Johannesburg Hospital, United Kingdom., 24 September 2003.

- **Betty R. Vohr, MD, Linda L. Wright, MD, Anna M. Dusick, MD, Lisa Mele, MS, Joel Verter, PhD** states that early low birth weight infants are at significant risk of neurologic abnormalities, developmental delays, and functional delays , thus having poor motor control and Neurodevelopmental delay. 2000 American Academy of Pediatrics 141:1188-1193
- **Lucas A, Morley R, Cole TJ** states that there was adverse neurodevelopmental outcome of preterm neonatal motor control, thus decrease movements and may lead to delayed growth. BMJ. 1998; 297:1304-1308.
- **Bratzelon K.,** states that neonatal behavioural assessment scale is a valuable measure for assessing neonatal behaviour.1999;
- **Heidelise Als, PhD; Gretchen Lawhon, RN, PhD; Frank H. Duffy, MD** concludes that Very low-birth-weight preterm infants may benefit from individualized developmental care in the neonatal intensive care unit in terms of medical and neurodevelopmental outcome. JAMA. 2004;272:853-858;

- **Hawthorne, J. (2005)** states that the Neonatal Behavioural Assessment Scale to support parent-infant relationships Infant and is also used to measure the behavioural pattern of the infant. (6):213-18.
- **Richard A. Ehrenkranz, MDa, Anna M. Dusick, MD** states that analyses suggest that growth velocity during an ELBW infant's NICU hospitalization exerts a significant, and possibly independent, effect on neurodevelopmental and growth outcomes at 18 to 22 months' corrected age.2006 by the American Academy of Paediatrics.
- **Mandy B. Belfort, MD, MPHa, Sheryl L. Rifas-Shiman, MPHb, Thomas Sullivan, BMa, Comp Scc, Carmel T. Collins, RN, BSSc, PhD** studied on the Neurodevelopment of the preterm infant and after term states that in preterm infants there was an increased weight gain but not proportionate to length which was due to the developmental improvement in NICU stay. 2011 by the American Academy of Pediatrics
- **Dubowitz L, Dubowitz V.** states that the Supplemental Motor Test is a reliable measure for measuring the motor control of preterm infants. 2004.

- **Girolami GL.,** States that the Neuro-Developmental treatment therapy helps improving the motor control in patients. 2007 University of North California.
- **Paludetto LG, Watkins MP. ,** states that there is an early behavioural development in preterm infants. Dev Child Neuro 1999;26:347-353.

III. MATERIALS AND METHODOLOGY

3.1 PARTICIPANTS

Thirty preterm infants were randomly assigned to receive Neuro-Developmental Treatment protocol two times per day for 7 days**.**

3.2 MATERIALS

- Cotton rolls
- Towel
- Data collection and recording sheet.

3.3 METHODOLOGY

a. STUDY DESIGN

This is a study with two groups. One received routine nursing care with positioning and other received Neuro-Development Treatment protocol. The results were compared.

b. STUDY SETTING

The study was carried out in NICU, Sri Ramakrishna hospital, Coimbatore.

c. SAMPLING TECHNIQUE

Convenient random sampling.

d. **SAMPLE SIZE**

30 pre-term infants were assigned into two groups of 15 each.

e. **STUDY DURATION**

The study was conducted for a period of 7-20 days.

f. **SELECTION CRITERIA**

Inclusion criteria

- ❖ Gestational age below 35 weeks
- ❖ Birth weight less than 1800 gm
- ❖ NICU stay for minimum 7 days
- ❖ Should evidence at least 3 of the following medical complications
- ❖ 5-minute Apgar score of 5 or less
- ❖ Intraventricular haemorrhage documented by ultrasound
- ❖ Central nervous system depression
- ❖ Asphyxia
- ❖ Birth weight less than 1000 gm.
- ❖ Respiratory arrest
- ❖ Respiratory distress syndrome
- ❖ Need for mechanical ventilation
- ❖ Thermal instability

Exclusion Criteria

- ❖ Genetic anomalies
- ❖ Congenital malformations
- ❖ Human - immuno deficiency virus.
- ❖ Hepatitis B
- ❖ Birth weight above 2000 gms

h. **METHODS OF COLLECTION OF DATA**

Subjects who fulfil the selection criteria will be selected for the study and informed consent will be obtained from their parents or guardian. All the subjects will be randomly divided into Group A (Control group) and Group B (Experimental group).

Group A (Control group) subjects will receive routine treatment which includes medications, nursing care and positioning. The positioning includes prone, side lying, supine and supported sitting positions to facilitate movement and active postures.

Group B (Experimental group) subjects will receive the above mentioned routine treatment and additionally Neuro–Developmental Treatment program. The Neuro-Developmental treatment program was designed to influence the infant's ability to lift heads in prone, bring hands to mouth, hold the head in midline in supine position, and lift and hold the arms and lower extremities up against the force of gravity.

At no time during the study did treatment need to be discontinued because of tachycardia, bradycardia, increased or decreased respiratory rates, excessive crying or apnea.

All the subjects will be treated in study setting with two 15 minutes session per day for 7 continuous days and the outcome will be assessed by using Neonatal Behavioural Assessment Scale & Supplemental Motor Test to know the effectiveness before and after 7 days of study.

i. OUTCOME MEASURES

- Neonatal Behavioural Assessment Scale
- Supplemental motor test.

j. Treatment duration

Two treatment sessions of 12-15 minutes period per day for 7-20 days.

j. Statistical analysis

Independent t test was used for comparing both groups.

Equations independent t test and

$$t = \frac{\bar{x}_1 - \bar{x}_2}{S} \sqrt{\frac{n_1 n_2}{(n_1 + n_2)}}$$

$$S = \sqrt{\frac{\sum (x_1 - \bar{x}_1)^2 + \sum (x_2 - \bar{x}_2)^2}{n_1 + n_2 - 2}}$$

Where,

S = Combined Standard deviation.

X_1 = Difference between pretest and posttest in Group A

$\bar{x}_1$ = Mean difference of the Group A.

X_2 = Difference between pretest and posttest in Group B

$\bar{x}_2$ = Mean difference of the Group B.

n_1 = Number of patients in Group A

n_2 = Number of patients in Group B

IV. TREATMENT TECHNIQUES

PROCEDURE

The study consisted of 2 groups and the study was carried for 7-20 days with two 12-15 min session per day.

In group A (Control group) the subjects will receive routine treatment which includes medications, nursing care and positioning.

The positioning includes prone, side lying, supine and supported sitting positions to facilitate movement and active postures.

SIDE LYING

Helps to facilitate respiration

.

PRONE LYING

Improves tone and control, but should not be prolonged for a long period as there are chances for a prominent occiput.

Improves breathing.

SUPINE LYING

Helps in facilitating movements, eye contact, respiration.

Procedure

Group B (Experimental group) subjects will receive the above mentioned routine treatment and additionally Neuro–Developmental Treatment program.

This treatment is given in 4 positions. They are supine, prone, sitting.

SUPINE:

- Treatment occurs in therapist lap.
- Head in midline-for elongation of cervical spine;
- Arms, Shoulders on chest with Scapular depression and Elbow flexion
- Elongation of thoracic and lumbar spine;
- Pelvis slightly off support surface.
- Hips, knees flexed over abdomen.

Activities

1. Compress the shoulders to activate neck flexors, anterior chest, shoulder and abdomen- increase strength and control in anterior neck muscles.
2. Compress horizontally through shoulders to activate anterior chest and shoulder muscles; assist infant to bring hands to mouth.
3. Compression upward from lifted pelvis with legs flexed over abdomen to activate abdominal anterior neck and chest muscles – increase strength of abdominal muscles.

4. Weight shifting from side to side using small increments of movement and allowing the infant to maintain his head and arms without help.

Goals

1. Stabilizing the trunk for free head movement.
2. Tucking in the body in for attaining positions of comfort.
3. Moving into side lying from supine
4. Stabilizing the head in midline.
5. Bringing hands together for reaching.

PRONE POSITION

The infant will be treated in therapist's lap or isolated.

With arms positioned in flexion on either side of the infant's chin. ;Pelvis tilted posteriorly with hips flexed and knees under abdomen.

Activities

1. Compress the shoulders to activate neck and upper back extensor muscles - increase strength and control in upper back extensor muscles.
2. Compress horizontally through shoulders to activate anterior shoulder and scapular muscles
3. Compression combined with elongation of one side and weight shifting over elongated side to facilitate turning of head.
4. Support under the abdomen to activate abdominal muscles.

Goals

1. Clearing phase for breathing in prone
2. Pushing up on forearms.
3. Bringing hands to mouth for comfortable positioning.
4. Rolling from prone to supine

Sitting

- Treatment occurs in therapist lap or bed.
- Head supported from behind for elongation of cervical spine.
- Back straight, pelvic alignment neutral.
- Infant should be lilted 10-15 degrees backward in space.
- Slight upward traction of the trunk to inhibit back rounding.

Activities

1. Compression downward the shoulders to activate anterior neck and chest and abdominal muscles - increase strength and control in neck muscles.
2. Compress horizontally through shoulders to activate anterior shoulder and chest muscles- bring hands to mouth.
3. Movement of supported head and trunk slightly back ward to activate neck and abdominal muscles.

4. Movement of supported head and trunk laterally with elongation of weight bearing side of trunk, partial turning movements.

Goals

1. Holding the head in upright position helps in controlling the arms for reaching and grasping.
2. Maintaining the shoulders relaxed, trunk extended and head controlled against gravity to improve strength and control for back muscles.
3. Stabilizing the head in variety of positions in space for looking

SIDE LYING

Infant treated in side lying or therapist's lap.

- Head flexed slightly forward with chin tuck.
- Arms forward to midline.
- Elongation of thoracic and lumbar spine.
- Pelvis neutral, hips, knees flexed towards abdomen.

Activities

1. Compress the shoulders and maintain chin tuck to activate neck flexors, anterior chest, shoulder and abdomen- increase strength and control in anterior neck muscles.

2. Rocking the infant slowly backward to activate anterior neck and abdominal muscles.
3. Compress horizontally through shoulders to activate anterior chest and shoulder muscles; assist infant to bring hands to mouth together in midline.
4. Slight lateral lifting of the pelvis to elongate the weight bearing of the side and facilitate rolling maintain the forward flexed position of head, neck, trunk and pelvis.

Goals

1. Maintaining comfortable position in side lying.
2. Bringing hands to mouth
3. Helps to roll over and push into sitting.

At no time during the study did treatment need to be discontinued because of tachycardia, bradycardia, increased or decreased respiratory rates, excessive crying or apnea.

V. DATA ANALYSIS

Thirty pre term babies were assigned for treatment. They were divided into two groups each group contain fifteen babies.

One group received routine nursing care and positioning and; The other group received Neuro-Developmental Treatment protocol.

The outcomes were measured by two scales and they are :

- Supplemental motor test;
- Neonatal behavioral assessment scale.

GROUPS	GENDER	
	MALE	FEMALE
CONTROL	7	8
EXPERIMENTAL	6	9

SUPPLEMENTAL MOTOR TEST
GROUP A

S.NO	PRE TEST	POST TEST	(X_1)	$\left(X_1-\overline{X_1}\right)$	$\left(X_1-\overline{X_1}\right)^2$
1	45	57	12	2.6	6.76
2	40	56	16	1.4	1.96
3	41	60	19	4.4	19.36
4	43	60	17	2.4	5.76
5	40	60	20	5.4	29.16
6	35	54	19	4.4	19.36
7	44	56	12	2.6	6.76
8	50	60	10	4.6	21.16
9	40	60	20	5.4	29.16
10	42	54	12	2.6	6.76
11	43	58	15	0.4	0.16
12	40	51	11	3.6	12.96
13	36	46	10	4.6	21.16
14	43	54	11	3.6	12.96
15	45	60	15	0.4	12.18

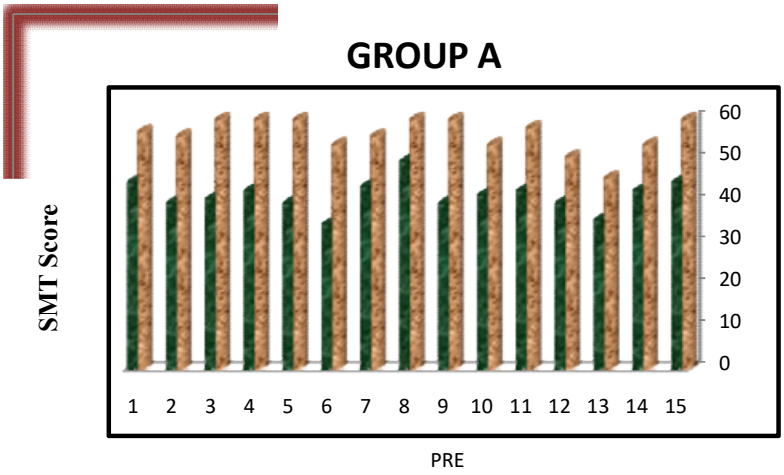
X_1 = 219
Mean = 14.6

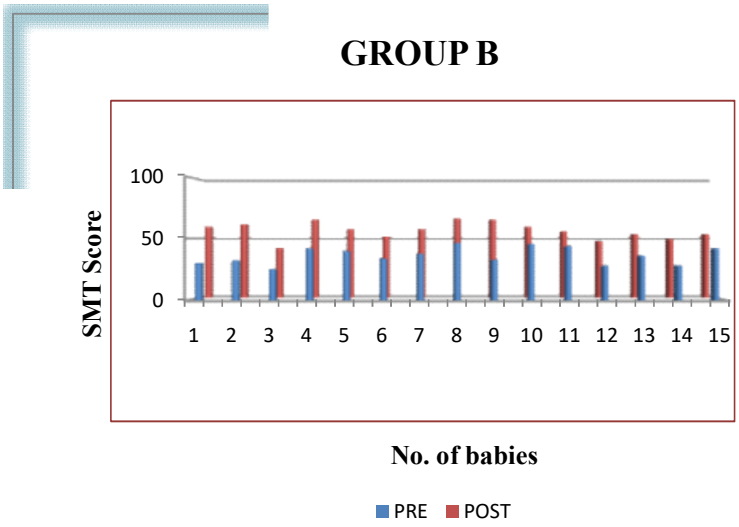
SUPPLEMENTAL MOTOR TEST
GROUP B

S.NO	PRE TEST	POST TEST	(X_2)	$\left(X_2 - \overline{X_2}\right)$	$\left(X_2 - \overline{X_2}\right)^2$
1	30	60	30	9.5	90.25
2	32	62	30	9.5	90.25
3	25	42	17	3.5	12.25
4	42	66	24	3.5	12.25
5	40	58	18	2.5	6.25
6	34	52	18	2.5	6.25
7	38	58	20	0.5	0.25
8	47	67	20	0.5	0.25
9	33	66	33	12.5	156.25
10	46	60	14	6.5	42.25
11	44	56	12	8.5	72.25
12	28	48	20	0.5	0.25
13	36	54	18	2.5	6.25
14	28	50	22	1.5	2.25
15	42	54	12	8.5	72.25

X_2 = 308
Mean = 20.5
S = 5.26
t = 3.06

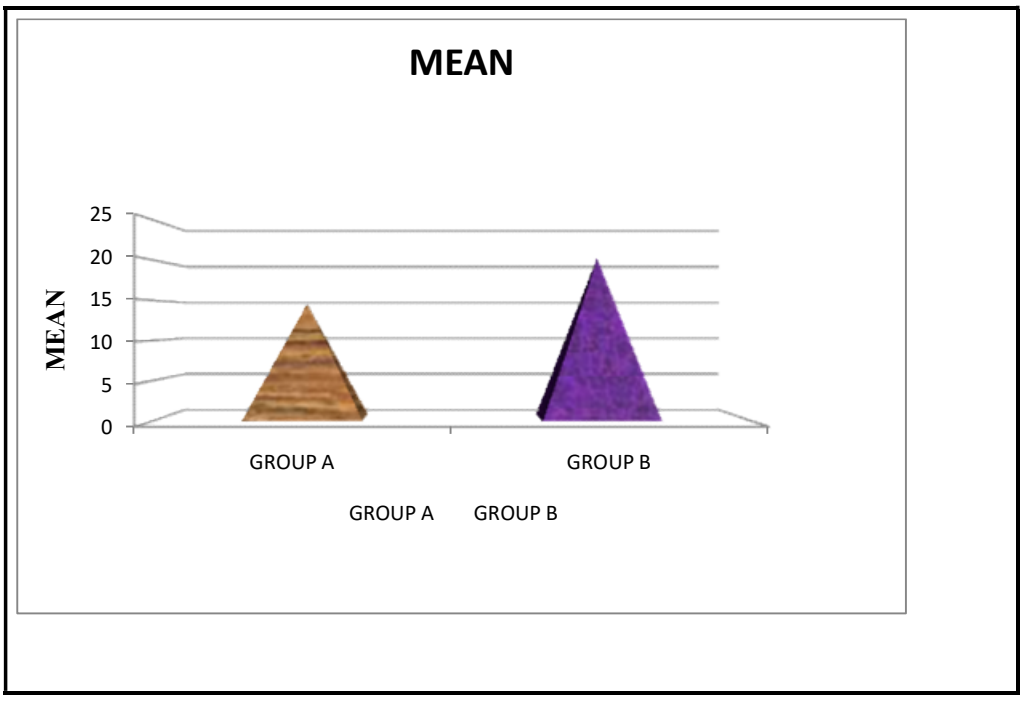
SUPPLEMENTAL MOTOR TEST





SUPPLEMENTAL MOTOR ASSESSMENT SCALE

Parameter	groups	Mean	Statistical analysis	Calculated 't' value	Table value
SMT	Group A	14.6	5.26	3.06	2.76
	Group B	20.5			



NEONATAL BEHAVIOR ASSESSMENT SCALE

GROUP A

S.NO	PRE TEST	POST TEST	X_1	$(X_1-\overline{X_1})$	$(X_1-\overline{X_1})^2$
1	64	70	6	0	0
2	55	67	12	6	36
3	73	80	7	1	1
4	61	67	6	0	0
5	59	66	7	1	1
6	65	71	6	0	0
7	60	64	4	2	4
8	62	67	5	1	1
9	66	69	3	3	9
10	41	47	6	0	0
11	64	70	6	0	0
12	55	60	5	1	1
13	61	66	5	1	1
14	59	63	4	2	4
15	60	68	8	2	4

$X_1 = 90$

$\overline{X_1} = 6$

NEONATAL BEHAVIOR ASSESSMENT SCALE

GROUP B

S.NO	PRE TEST	POST TEST	X_2	$\left(X_2 - \overline{X_2}\right)$	$\left(X_2 - \overline{X_2}\right)^2$
1	63	75	12	3.94	15.52
2	59	64	5	3.06	9.36
3	60	65	5	3.06	9.36
4	59	67	8	0.06	9.36
5	43	51	8	0.06	9.36
6	61	71	10	1.94	3.76
7	56	62	6	2.06	4.24
8	46	52	6	2.06	4.24
9	40	55	15	6.94	48.16
10	39	47	8	0.06	9.36
11	36	45	9	0.09	0.008
12	43	54	11	2.94	8.64
13	61	66	5	3.06	9.36
14	55	61	6	2.06	4.24
15	51	58	7	1.06	1.12

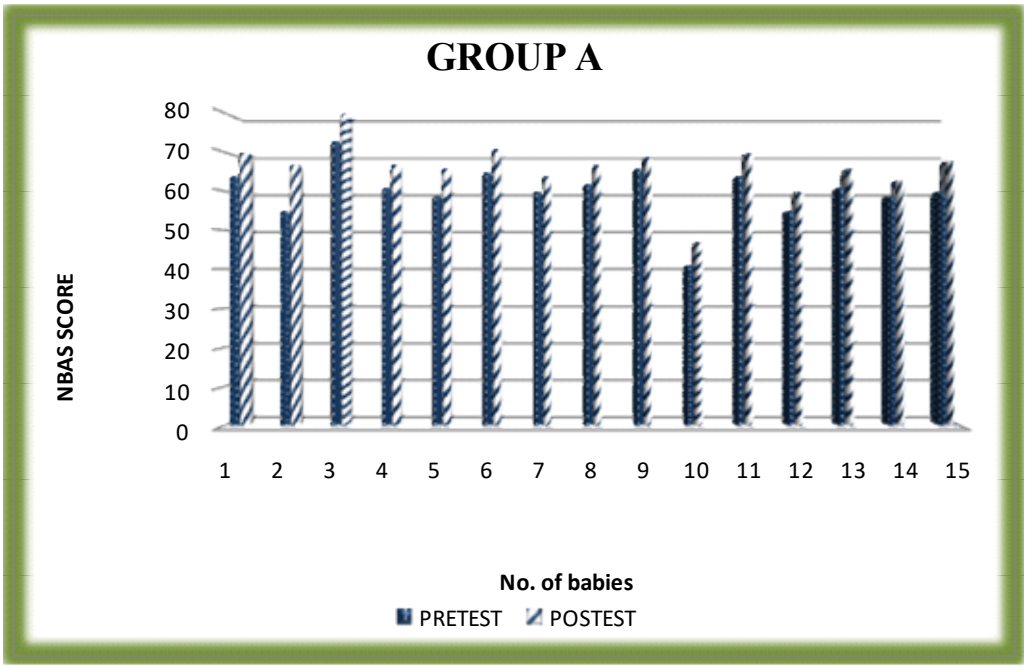
X_2 = 133

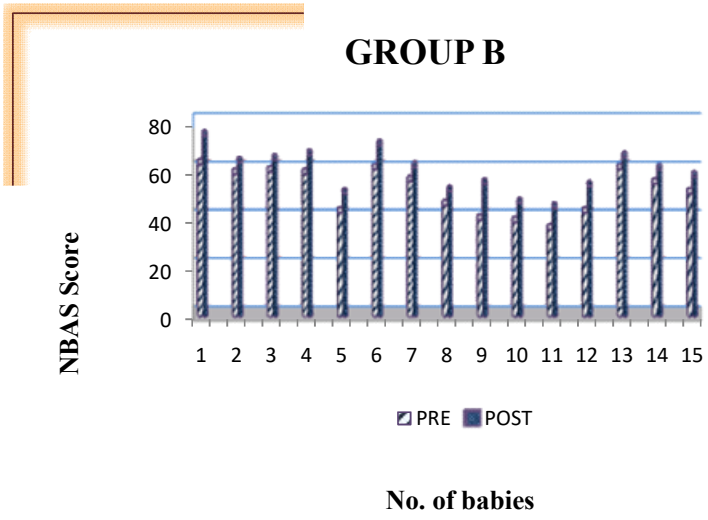
$\overline{X_2}$ =8.83

S = 2.72

t = 2.84

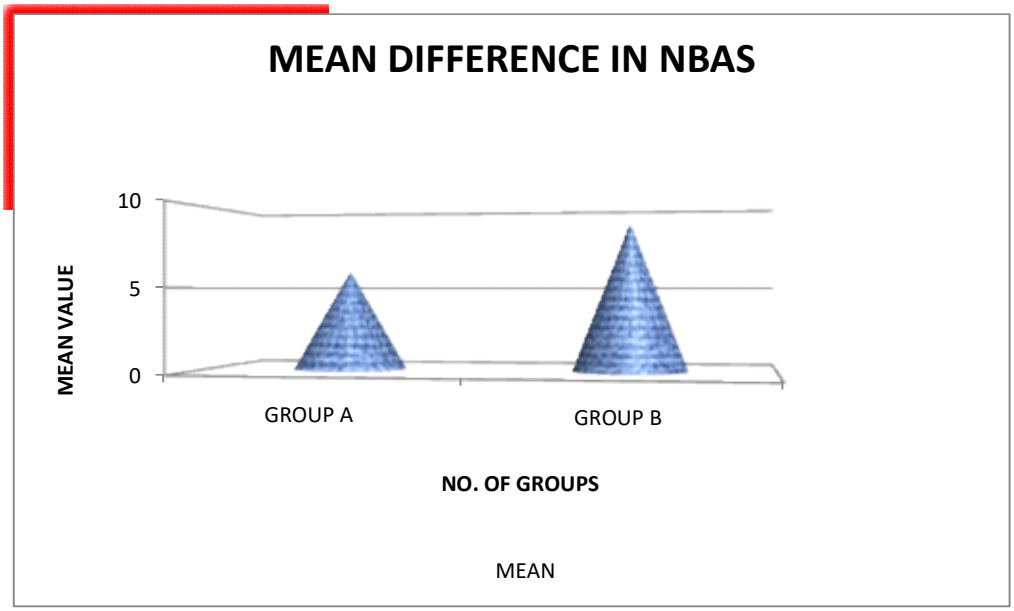
NEONATAL BEHAVIORAL ASSESSMENT SCALE





NEONATAL BEHAVIOURAL ASSESSMENT SCALE

Parameter	Groups	Mean	Statistical analysis	Calculated 't' value	Table value
NBAS	Group A	6	2.72	2.84	2.76
	Group B	8.83			



RESULTS

In this study, the pretest and posttest values were obtained by using NBAS and SMT scales. For comparison of the groups independent t test was used.

Both scales showed a significant value than the tabulated value.

't' value for SMT : 3.06 and

't' value for NBAS: 2.84.

The tabulated value for these scales at 28 degrees of freedom at 5% Level significance is 2.763.

Hence there was a significant change seen in SMT scale for motor control and mild increase in NBAS scale for behaviour.

VI. DISCUSSION

The treatment group which was given Neuro-Developmental Treatment gained more motor control than the other group.

Thirty pre term babies were assigned for treatment. They divided into two groups each group contain fifteen babies.

One group received routine nursing care and positioning and the other group received Neuro-Developmental Treatment protocol.

The outcomes were measured by two methods they were SMT and NBAS. Treatment duration was 7 days.

Parameter	Groups	Mean	Calculated 't' value	Table value
SMT	Group A	14.6	3.06	2.763
	Group B	20.5		

Parameter	Groups	Mean	Calculated 't' value	Table value
NBAS	Group A	6	2.84	2.763
	Group B	8.83		

Pre term infants within the treatment group so they have contributed to the greater weight gain, potentially via less energy expenditure.

According the statistical analysis, the independent t tests for treatment was high than the other group.

In SMT, independent t value was 3.06 which were greater than NBAS 2.84.

When comparing both the scales there was a significant increase in SMT (motor development) scale than NBAS (behavior) with this treatment protocol.

The calculated t value was 3.04 in SMT ; 2.84 in NBAS and the tabulated t value was 2.763 .

Hence we reject the null hypothesis and accept the alternate hypothesis.

There is significant change in motor control in preterm infants with Neuro-Developmental treatment.'

LIMITATIONS AND RECOMMENDATIONS

Though preterm infants face many challenges and leads to many complications, not all fields have been into research. In our study also we have some limitations and suggestions are provided for it.

LIMITATION

- The study was time bound only.
- It has been done in small number of subjects.
- It includes only pre term babies with 28-34 weeks of gestational age.

RECOMMENDATIONS FOR FURTHER STUDY

- Further studies can be conduct for a larger sample size.
- Same type of studies can also be used with term babies.
- Along with the Neuro-Developmental therapy other techniques like voijta and early stimulation therapy can be added for further studies.

VII CONCLUSION

According on the statistical analysis and review of literature, it has been clearly concluded that *Neuro-Developmental Treatment protocol* is found to improve the motor control in pre-term infants.

Hence the alternate hypothesis is accepted and there is

"There is a significant improvement of motor control with Neuro–Developmental Treatment program in pre-term infants".

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APPENDICES

APPENDIX I

NEONATAL ASSESSMENT CHART

- Name
- Age
- Gender
- Date of birth
- Address
- Ip/op no
- Head circumference
- Birth weight
- Chief complaints
- History
    - Prenatal
    - Natal
    - Post natal
    - Family history

ON OBSERVATION

- Supine
- Prone
- Sitting
- Standing

MILESTONES

- Social smile (2 months)
- Head holding (4 months)
- Follow with eyes (5 months)
- Rolling over (6 months)
- Crawling (7months)
- Sitting (8 months)
- Standing(12 months)
- Walking (15 months)

REFLEX EVALUATION

Neonatal reflexes

1) Spinal reflexes

- Lower limb placing (B-6weeks)
- Upper limb placing (B-6 weeks)
- Automatic walking (B-6 weeks)
- Flexor with drawl (28 weeks-2 mnths)
- Crossed extensor thrust (28 wks-2mnths)
- Sucking (B-7 mnths)
- Rooting (B-4mnths)
- Swallowing (B-7mnths)

- Moro's (28wks-5 mnths)
- Starle (B-persists)
- Palmar grasp (B-6mnths)
- Plantar grasp(28 wks-10 mnths)

2) Automatic reactions

- Landau's reflex (6mnths-15 mnths)
- Gallant's trunk incurvation (B- 3 yrs)
- Parachute reaction

3) Brainstem reflexes or tonic reflexes

- ATNR (B- 6 mths)
- STNR (4mnths-12 mnths)
- TLR (B-6 mnths)
- Positive supporting reactions (B- 6 mnths)
- Negative supporting reactions

4) Midbrain reactions or postural reflexes

- Optical righting (2mnths- persists)
- Labyrinthine (2mnths-persists)
- Body righting on body (4mnths-5yrs)
- Body righting on head (B-5yrs)
- Dolls eye(B-2wks)

5) Cortical reactions

- Balance and equilibrium

a. In prone (6mnths-persists)

b. In supine (7mnths-persists)

c. In sitting (7mnths-persists)

d. In standing (12 mnths-persists)

ON EXAMINATION

❖ APGAR SCORE

A- Appearance

P- Pulse rate

G- Grimace

A- Attitude of limb

R- Respiratory rate

Total score- 10

❖ Higher functions

- Hearing
- Vision
- Speech

❖ Motor assessment

➢ Tone

Right	Left
Upper limb	Upper limb
Lower limb	Lower limb

➢ Range of motion

Right	Left
Upper limb	Upper limb
Lower limb	Lower limb

➢ Reflexes

- Deep tendon reflexes

Right	Left
Upper limb	Upper limb
Lower limb	Lower limb

- Superficial reflexes

➢ Voluntary control

➢ Deformities/ contractures/ tightness

- Limb length discrepancy
  - True length
  - Apparent length
- Hand functions

Bowel and bladder functions

Associated handicap

Remarks

Physical therapy- Aims and Management

APPENDIX II

SUPPLEMENTAL MOTOR TEST SCORE SHEET

I. Observed items

S.NO	ITEMS	S C O R E			
		0 (Absent)		2(Present)	
		Pre	Post	Pre	Post
1	Head in midline for 5 sec				
2	Head turn right to left				
3	Head turn left to right				
4	Hands together				
5	Left hand to mouth				
6	Right hand to mouth				
7	Right hand open				
8	Left hand open				
9	Pelvic tilting				
10	Hip flexion with neutral rotation/abduction				
11	Hip turn right to left (prone)				
12	Hip turn left to right (prone)				
13	Head lift for 5 sec(prone)				
14	Roll to right				
15	Roll to left				
	TOTAL				

Total score in observed items:

II. TESTED (ELICITED) ITEMS:

S.No	ITEMS	SCORE					
		0	1	2	3	4	
1.	Neonatal neck righting to right						
2.	Neonatal neck righting to left						
3.	Head in midline(hands held on chest)						
4.	Head in midline with visual stimulation						
5.	Maintain hands in midline						
6.	Anti- gravity hip and knee flexion						
7.	Extended neck in supported sitting						
8.	Flex neck in supported sitting						
9.	Head turn to prone to sound on right						
10.	Head turn to prone to sound on left						
11.	Head lift in prone						
12.	Arm flexion from extended position from prone						
	TOTAL						

Total score in elicited items:

TOTAL SUPPLEMENTAL MOTOR TEST SCORE:

SCORING CRITERIA

0- ABSENT

1- DIMINISHED

2- NORMAL

3- EXAGGERATED

4- ABNORMAL

APPENDIX III
NEONATAL BEHAVIORAL ASSESSMENT SCALE
SCORE SHEET

S.NO	Habituation	9	8	7	6	5	4	3	2	1
1	Response dec. to light									
2	Response dec. to rattle									
3	Response dec. to bell									
4	Res. dec. to foot probe									
	Total									

S.NO	Social-Interactive	9	8	7	6	5	4	3	2	1
1	Animate visual									
2	Anim. visual and auditory									
3	Inanimate visual									
4	Inanimate visual and auditory									
5	Inanimate auditory									
6	Animate auditory									
7	Alertness									
	Total									

S.NO	Motor system	9	8	7	6	5	4	3	2	1
1	General tone									
2	Motor maturity									
3	Pull-to-sit									
4	Defensive									
5	Activity level									
	Total									

S.NO	State organisation	9	8	7	6	5	4	3	2	1
1	Excitement level									
2	Rapidity of build-up									
3	Irritability									
4	Liability of states									
	Total									

S.NO	Autonomic system	9	8	7	6	5	4	3	2	1
1	Tremulousness									
2	Startles									
3	Liability of skin colour									
4	Smiles									
	Total									

S.NO	Supplementary Items	9	8	7	6	5	4	3	2	1
1	Quality of alertness									
2	Cost of attention									
3	Examiner facilitation									
4	General irritability									
5	Robustness and endurance									
6	State regulation									
	Total									

SCORING CRITERIA:

9 – Shutdown of body movements; some diminution in blinks and respiratory changes after 1-2 presentations of the stimuli.

8 – Shutdown of body movements; some diminution in blinks and respiratory changes after 3-4 presentations of the stimuli.

7 – Shutdown of body movements; some diminution in blinks and respiratory changes after 5-6 presentation of the stimuli.

6 – Shutdown of body movements; some diminution in blinks and respiratory changes after 7-8 presentations of the stimuli.

5 – Shutdown of body movements; some diminution in blinks and respiratory changes after 9-10 presentations of the stimuli

4 – No complete shutdown observed 10 trials. Body movements are present but there is a decrease in the level of responsiveness. Body movements are delayed.

3 – No complete shutdown observed over 10 trials. Diminution in responses , but responses are present till the last trial.

2 – No shutdown observed with gradual increase in responses. Startles may be present after final trial.

1 – No shutdown observed and an item have to be discontinued as the baby moves into a state of physiological stress, eg. apnea, startles, tremors.

NEONATAL REFLEXES

S.NO	Reflexes	1	2	3
1	Plantar			
2	Babinski			
3	Ankle clonus			
4	Rooting			
5	Sucking			
6	Glabella			
7	Passive resist. – legs			
8	Passive resist. – arms			
9	Palmar (hand-grasp)			
10	Placing			
11	Standing			
12	Walking			
13	Crawling			
14	Incurvation			
15	Tonic dev. – head and eyes			
16	Nystagmus			
17	TNR			
18	Moro			
	TOTAL			

SCORING:

i. Diminished

ii. Normal

iii. Exaggerated.

APPENDIX IV

APGAR SCORE

A- Appearance

P- Pulse rate

G- Grimace

A- Attitude of limb

R- Respiratory rate

Total score- 10

SIGN	SCORE		
	0	**1**	**2**
Color	Pale / blue	Extremities - blue	Pink completely
Heart rate	Absent	<100/min	>100/min
Reflexes	No response	Grimace	Cough/sneeze
Muscle tone	Flaccid	Mild flexion	Complete flexion
Respiration	Absent	Weak	Good cry