



DEVELOPMENT AND EFFICACY OF SEMI STRUCTURED SENSORY ENRICHMENT INTERVENTION IN PREMATURE INDIAN INFANTS

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ABSTRACT

This study aimed to find out the efficacy of developed semi structured sensory enrichment intervention over premature Indian infants an early first year of life for their sensory development . A pre-/post-test design was used on fifty premature infants from a low socioeconomic setting in specialized NICU setup into one group after being matched by corrected age and inclusion criteria by convenient sampling . Before and after the intervention, the preterm infants sensory processing functions were evaluated using the Infant/ Toddler Sensory Profile (ITSP). The preterm infants underwent an eight weeks of sensory enrichment intervention. Semi- structure sensory enrichment intervention had a positive effect on the sensory processing and development of premature Indian infants, especially in terms of Sensory development. The feasibility of the identification of sensory processing issues in the early years of life should be highlighted, as it favors early referral for intervention. The purpose of this early sensory enrichment intervention may help NICU graduate infants later in their life in terms of physical & mental development age appropriately . Awareness about their family members & health care professionals how early stimulation important for infants. Semi- structure sensory enrichment intervention at an early age enhances the over all developmental progress of premature infants.

KEYWORDS: Sensory Enrichment intervention, Preterm infants, Sensory processing



INTRODUCTION

Prematurity consider to be less than 37 weeks of gestational age [case smith]. According to world health organization suggested below 28 weeks extremely preterm, 28 to 32 weeks infants under very preterm and 32 to 37 weeks comes under moderate to late preterm Infants. They are classified as preterm(<37weeks), Term(37-41weeks) & Postterm (42weeks or more). with decreasing gestational age at birth associated with increased risk of mortality and disability and greater intensity of care[13]

Infants who are born preterm may have perinatal medical problems specific to prematurity. An estimated 15 million babies are born too early every year. That is more than 1 in 10 babies[10]. Approximately 1 million children die each year due to complications of preterm birth Infants born prematurely have an increased risk for immediate medical complications, as well as social-emotional, cognitive, motor, neurological language, attention, behavior difficulties and sensory processing problems later in life[10,12]. Preterm infant Born before 37 or 38 weeks [case smith].

Preterm infants who are born at 23 weeks of gestation are more likely to present sensory processing alterations than those who are born at 33 weeks[2]. This suggests that the risk found for Sensory Processing Disorder in preterm infants increases according to the degree of neurobiological immaturity at birth[6].

However, more than one-third of the cohort displayed visual-auditory, taste-smell, movement, and tactile sensitivity, which suggests a low neurological threshold in these sensory domains[12].

Infants who are born preterm may have perinatal medical problems specific to prematurity and thus, spend a long period of hospitalization in Neonatal Intensive Care Units (NICU). Incomplete sensory development due to preterm birth and excessive sensory stimuli and painful invasive procedures, which the infants are exposed to in the NICU and affect the central nervous system (CNS) organization, may cause alternations in the sensory processing functions[H CElik] [8]. Routine evaluation for sensory processing differences of children born preterm is necessary.

SENSORY PROCESSING DISORDER (SPD)

Sensory processing disorder (SPD) is the term used to refer to difficulties in processing and using sensory information for the regulation of physiological, motor, affective, and/or attention responses that interfere in the organization of behavior and in the participation in activities of daily living [6].

Sensory processing concerns the way the central nervous system manages the information received from sensory organs, that is, the visual, auditory, tactile, gustatory, olfactory, proprioceptive, and vestibular stimuli. Its prevalence is estimated from 5 to 16% in apparently normal population and 30 to 80% among the population with specific diagnoses.

Although the etiology of SPD remains unknown, genetic, family, and environmental factors have been reported in the literature. In this context, preterm infants (born before 37 weeks of gestation) are considered at risk for SPD [6].

This risk is a consequence of both the interruption of neurobiological intrauterine development and the sensory experiences of the Neonatal Intensive Care Unit (NICU) environment, which can alter the development and functioning of the sensory systems.

Although there is evidence of sensory processing disorders in children who were born preterm, there are still relatively few studies on the association of sensory processing with prematurity, hindering the general view of the prevalence and persistence of the symptoms of SPD in this population[6].

The clinical manifestations of SPD are varied and include crying and excessive agitation, difficulty in self-consoling, sleep problems and acceptance of food, exacerbation of parental separation anxiety, persistent and exaggerated shyness with strangers, intolerance to change, lack of interest and indifference in social interaction. Functional problems commonly associated with SPD in early childhood include decreased social skills and participation in games, reduced frequency, duration, and complexity of adaptive responses; impaired self-confidence and/or self-esteem; and poor motor skills. Problems in balance, gross and fine motor coordination, and motor planning, as well as delayed language acquisition, tactile hypersensitivity, These problems may persist in adulthood, resulting in social and emotional difficulties[6].

NEED OF SENSORY ENRICHMENT INTERVENTION

Sensory Enrichment Therapy uses pleasant sensory stimulation to improve the overall development of child's brain. It can be divide it into four subcategories visual enrichment, auditory (sound) enrichment, Tactile (touch) enrichment & Olfactory enrichment (smell & taste)

Sensory processing disorder is evident early in the lifespan and if it may be due to specific exposures or injuries. Although sensory development begins early in utero and continues over time, the early sensory



development of the preterm infant occurs primarily in an external environment with sensory stimuli the infant is not yet prepared to integrate[9].

The early neonatal intensive care unit (NICU) environment could play a role in the development of sensory processing disorder in preterm infants.

The NICU environment has external stimuli that an infant would not typically experience in utero . Without the protective environment of the womb, preterm infants are exposed to intense auditory, tactile, visual, and nociceptive stimuli in the [10] .

These sensory exposures occur during a critical period of brain development , which can interfere with motor, neurological, and sensory development [10]

RATIONALE

Already most of studies proved that sensory processing disorder occurred in premature infant for the sensory integration intervention given to premature infant population all over the world But to the best of my knowledge providing individually sensory enrichment intervention from early months in their life after medically stable condition not conducted .Most of research found after 2 years of life[5] .

Study needed to prevent increasing rate of sensory difficulties & disability in premature infant for their later in life . In this study work done on premature infant , due to their prematurity they developed sensory processing difficulties if proper and early sensory enrichment intervention provide from NICU itself would be help full for premature infant sensory & motor development

In this study attempt has been made to develop and find out the efficacy of semi structure sensory enrichment intervention in early months of premature infant during NICU stay and post discharge intervention should be continue .

SIGNIFICANCE OF STUDY

The study was undertaken to find out the efficacy of sensory enrichment intervention in premature Indian infant their early first year of life to enhance their sensory development age appropriately. Which was indirectly affect baby overall developments including motor ,cognition , communication.

Benefiting the study are the various sectors as follows:

The Society

In future study will provide direct awareness and importance of early detection of issues which will be helpful to prevent further rate of difficulties & disabilities . However early detection & intervention

important . As well as understood the Importance of early intervention services .

The parents

Prevent entire family unit as a child may be unable to fully participate in certain activities. This may places additional stress related to planning and preparation on parents and may even lead to strained family dynamics, if the child is unable to participate in activities .

An Occupational Therapist

Provide specific explanation of prenatal fetal development & sensory enrichment intervention preterm baby week wise . when to start week wise particular sense stimulation & intervention.

Other Medical & Rehabilitation Professional Team

Understand the NICU Environment , Meaning of under stimulation & over stimulation of sensory system . Importance of Saving of life along with quality of life . providing proper concept of team efforts & intra referral among all professionals to achieve global development of preterm baby .

Aim : To find out the efficacy of developed semi structure sensory enrichment intervention over premature infant an early first year of life for their sensory development .

Objectives : a) to develop the semi structure sensory enrichment intervention for premature Indian infant. b) to find out the efficacy of developed semi structure sensory enrichment intervention.

METHODS

Research Design : A pre-/post-test design was used within the group for assessment and intervention purpose .

Sample

Ten premature infants met the criteria for inclusion (medically stable, birth weight 800gm to 2500 gm, gestational age 28 to 34 weeks, corrected age Birth to 12 months , Low socioeconomical status) Kuppuswamy socioeconomical scale were used. In exclusion (no previous occupational therapy or Sensory intervention, no additional congenital anomaly , systemic disease and neurological abnormalities, no Skin infection , Refractory seizure , Sepsis, Iono tropic support , Problem identify of hearing & visual report) participated in the study. Sampling was convenient selected who full fill criteria for study .

**RESEARCH PROCESS: ASSESSMENT AND INTERVENTION****PHASE -I**

Expert must be NICU specialized & having good academic and clinical handling. Expert professionals should include (Pediatrician, Neonatologist, Occupational Therapist, Physiotherapist, Developmental Therapist, Early interventionist, Neonatal Specialized Nursing staff). Before formal documentation explained purpose of study to them & its outcome in details convey, individually through professional meeting. Then Proper permission was taken by concern expert for development of semi structure Sensory enrichment(SE) intervention in different sensory components. After that framing of SE intervention tentatively on the basis of literature review & clinical practice by researcher. Framed the intervention of different sensory components with the help of supporting articles and linkert scale was used to select treatment items in each component. Sensory components which including ,Tactile, Proprioceptive ,vestibular ,Visual , Auditory ,olfactory .

Framed SE intervention was given /send by in hand & Mail to the expert for their expert opinion and regular feedback were taken by expertise. After getting expert feedback & approval of SE intervention

then researcher ready to use SE intervention for their further study to see the efficacy of developed semi structure sensory enrichment intervention .

PHASE -II

Medical and background information was obtained from hospital files and parent interviews. Using the different measuring instruments and conducted the pre- and post-test procedures and recorded the data. One standardised measuring instruments were used in this study: the Infant/Toddler Sensory Profile (ITSP), Base line data was taken at 1st day & the same day intervention started. In Intervention phase After obtaining base line data all the subjects were given the intervention for eight weeks, three days a week, one session of 45 minute duration. simultaneously same intervention suggested to perform in home based environment to continuity of the intervention.

PHASE -III

Post intervention evaluation was done same as base line data were taken, at last day of intervention.

NOTE: For treatment following corrected age
0 – 3 Months

SENSES	SENSORY PROTOCOLS
T A C T I L E	TACTILE
	Through Holding
	Diapering
	Technical intervention(Warm touch)
	Passive movement or stimulation
	Positioning
	Self touch (hand to mouth ,face,head ,ear ,nose and eyes, grasp)
	Human touch
	Skin-to-skin care (kangaroo Mother care)
	Incubator humidity Non nutritive sucking with a pacifier
P R O P R I O C E	PROPRIOCEPTIVE
	Infant positioning: supine ,prone, side-lying
	Put sidelying position with blanket rolls against the sides of the incubators or bassinet.(infant should be positioned supine while sleeping; and in prone / side-lying while alert and awake)
	Infants are positioned in flexion with their hands near the mouth before being wrapped in a blanket
	Weight bearing and swaddling



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P T I V E	Allowing free, unrestricted movement
	Passive movement and free movements prior to a diaper change,
	VESTIBULAR
V E S T I B U L A R	Gentle rocking various planes and positions while being swaddled (Slow ,even ,rhythmical input most frequently in an anterior posterior plane
	Distressed movement transition treated – therapist lap ,seated in a rocking chair , gymnastic ball , swings padded with blanket rolls)
	Transferring one lap to another
	Holding positions
	Cloth Hammock at home/ blanket roll in NICU
A U D I T O R Y	AUDITORY
	Voice & rattle positioned at the side of infants head outside his or her visual field
	Verbalization
	Maternal voice recordings, and music direct auditory exposures
	Maternal heartbeat
	Infant Earplugs
	Speaking softly and in low tones
	Soft shoes
Not using incubator top as a table surface	
V I S U A L V I S U A L	VISUAL
	Encouraging visual attention through human interaction
	Environment with low background lighting is most conducive to optimal visual focusing and tracking
	Taping ping pong balls to tongue depressors with wool are hung in the incubators or taped to the side of the bassinet .
	Shielding the infant’s face
	Draping the isolette with thick cover
	During photo therapy shielding the eyes
Dim Light	
O L F A C T O R Y	OLFACTORY
	Scent cloth
	Close contact with parents
	Facilitate early, frequent, and prolonged skin-to-skin care
	Provide the mother's scent when possible via breast pad, soft cloth



3 – 6 Months

SENSES	SENSORY PROTOCOL
<p style="text-align: center;">T A C T I L E</p>	<p style="text-align: center;">TACTILE</p>
	<p>Hand to hand activity , hand to knee activity , hand to foot activity (supine position with the pelvis flexed full term)</p>
	<p>Distal proximal massage of the extremities (massage therapy involves gentle touch, stroking or rubbing the infant with hand using light/moderate pressure)</p>
	<p>Reduce increased tone in the shoulder girdle – traction while handling the upper extremity</p>
	<p>weight bearing with compression through the shoulders in the prone position</p>
	<p>Non nutritive sucking with a pacifier</p>
	<p>Human touch</p>
	<p>Passive movement or stimulation</p>
	<p>Positioning</p>
	<p>Self touch (hand to mouth ,face,head ,ear ,nose and eyes, grasp) Diapering</p>
<p style="text-align: center;">P R O P R I O C E P T I V E</p>	<p style="text-align: center;">PROPRIOCEPTIVE</p>
	<p>Weight bearing and swaddling</p>
	<p>Weight bearing experiences , traction , and joint compression</p>
	<p>Allowing free, unrestricted movement Passive movement and free movements prior to a diaper change</p>
<p style="text-align: center;">V E S T I B U L A R</p>	<p style="text-align: center;">VESTIBULAR</p>
	<p>Gentle rocking various planes and positions while being swaddled (Slow ,even ,rhythmical input most frequently in an anterior posterior plane</p>
	<p>High tone infants – fast arrhythmical input</p>
	<p>Distressed movement transition treated – therapist lap ,seated in a rocking chair , gymnastic ball , swings padded with blanket rolls)</p>
	<p>Transferring one lap to another Change the different different positions Cloth Hammock at home/ blanket roll in NICU</p>



A U D I T O R Y	AUDITORY
	Voice & rattle positioned at the side of infants head outside his or her visual field
	Verbalization
	Talked in a high pitched voice reciprocal manner , toys with soft , low sounds (soothing music)
	Maternal voice recordings, and music direct auditory exposures
	Quiet conversations (Reading ,Singing, Speaking t, Playing soft music)
	VISUAL
V I S U A L	Encouraging visual attention through human interaction Appropriate toys provide for stimulation , visual fixation , tracking , skein of red wool , a red ball , a black & white target , a mirror , the therapist's faces
	Red & black magic markers are used to draw dots and bull's eyes forms on the ping pong balls
	OLFACTORY
O L F A C T O R Y	Scent cloth
	Close contact with parents
	Facilitate early, frequent, and prolonged skin-to-skin care
	Provide the mother's scent when possible via breast pad, soft cloth

6– 9 Months

SENSES	SENSORY PROTOCOLS
T A C T I L E	TACTILE
	Soft, gentle touch in all caregiving interactions
	Passive movement or stimulation
	Positioning
	Self touch (hand to mouth ,face,head ,ear ,nose and eyes, grasp)
	Hand to hand activity , hand to knee activity , hand to foot activity (sitting position)
	Distal proximal massage of the extremities (massage therapy involves gentle touch, stroking or rubbing the infant with hand using light/moderate pressure)
	Weight bearing with compression through the shoulders in the prone position



P R O P R I O C E P T I V E	PROPRIOCEPTIVE
	Weight bearing experiences , traction , and joint compression
	Holding ,pushing /pulling activities
V E S T I B U L A R	VESTIBULAR
	Change the different- different positions (slow to sudden)
	Swings exposure in different planes
	Cloth Hammock at home/ blanket roll in NICU
A U D I T O R Y	AUDITORY
	Talked in a high pitched voice reciprocal manner , toys with soft , low sounds (soothing music)
	Quiet conversation (Reading ,Singing, Speaking t, Playing soft music)
V I S U A L	VISUAL
	Appropriate toys provide for stimulation , visual fixation , tracking , skein of red wool , a red ball , a black & white target , a mirror , the therapist's faces
	Red & black magic markers are used to draw dots and bull's eyes forms on the ping pong balls
	Torch activity in dark room , laser light , tracking with head static & eye movement
O L F A C T O R Y	OLFACTORY
	Close contact with parents
	Provide Opportunities to different- different fregmance smell



9 – 12 Months

SENSES	SENSORY PROTOCOLS
	TACTILE
T A C T I L E	Passive movement or stimulation
	Distal proximal massage of the extremities (massage therapy involves gentle touch, stroking or rubbing the infant with hand using light/moderate pressure)
	Weight bearing with compression through the shoulders in the prone position
	Soft, gentle touch in all caregiving interactions
P R O P R I O C E P T I V E	PROPRIOCEPTIVE
	Weight bearing experiences , traction , and joint compression Climbing ,Actively exploring floor activities , uneven mattress provide for explore
V E S T I B U L A R	VESTIBULAR
	Change the different- different positions (slow to sudden)
	Swings exposure in different planes
	Cloth Hammock at home/ blanket roll in NICU
A U D I T O R Y	AUDITORY
	Talked in a high pitched voice reciprocal manner, toys with soft , low sounds (soothing music) Quiet conversations (Reading ,Singing, Speaking t, Playing soft music)



V I S U A L	VISUAL
	Red & black magic markers are used to draw dots and bull's eyes forms on the ping pong balls
	Torch activity in dark room , laser light , tracking with head static & eye movement
O L F A C T O R Y	OLFACTORY
	Close contact with parents
	Provide Opportunities to different- different fragrance smell

DATA ANALYSIS

In within the group biostatistician using Non parametric , Wilcoxon Signed Ranks Test . Data analysis used SPSS20 software Version . Relative difference in percentage formula was used .

RESULT

Demographic Data

There were no statistically significant differences . All ten participants lived in low socioeconomic settings by using kuppus-wamy socioeconomic scale to find out socioeconomic status (

Wilcoxon Signed Ranks Test

SES) of an urban family .In the study number of males participated six & female participated four ,Age group were 0- 12 months . Premature infants birth weight between 800 gm to 2500 gm were included .premature infants weeks consider between 28 weeks to 34 weeks who fall under very preterm (28 weeks to 32 weeks) & moderate to late preterm (32 weeks to 37 weeks) .

Since the scale given data Linkert scale so we are using Non- Parametric Test ,Wilcoxon Signed Ranks Test shown in Table 1 & 2.

Ranks (Table 1)

Post –pre	N	MEAN RANK	SUM OF RANK
Negative Rank	4(a)	5.38	21.50
Positive Ranks	6(b)	5.58	33.50
Ties	0 (c)		
Total	10		

- a. Post < Pre
- b. Post > Pre
- c. Post = Pre

Test statistics (a) (Table 2)

	Post – Pre
Z	-.614(b)
Asymp.sig.(2-tailed)	.539

- a . Wilcoxon Signed Ranks Test
- b. Based on negative Rank



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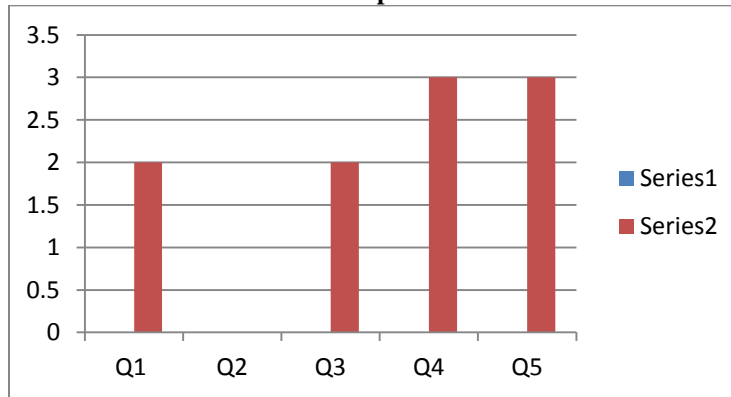
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Here ITSP Scale showing score sensitive towards typical performance some quadrants towards typical shown more score and some quadrants shown less score were comes under typical performance . At pre-test, infants an experienced difficulties & number of infants facing difficulties in each quadrant in terms

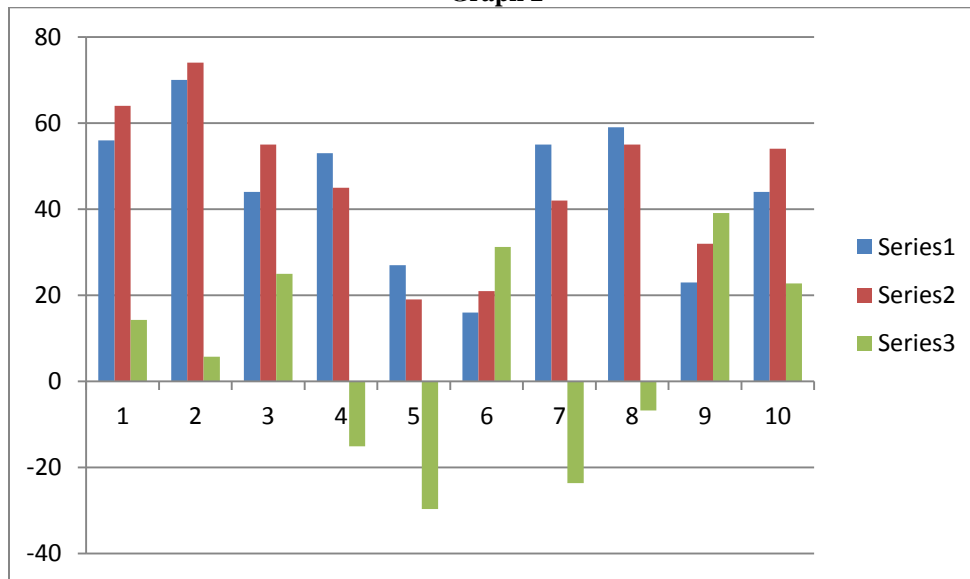
of low registration (Q1), two infants involved , Sensory sensitivity (Q2) ,no issues found in infants, Sensory seeking (Q3) two infants , Sensory Avoiding (Q4) three infants and low thresholds (Q5) three infants (Graph 1). Each quadrant shows pre and post relative difference (Graph 2)

Graph 1



No. Of Cases in Each Quadrant

Graph 2



Relative Difference In Percentage (Pre & Post)

No statistically significant difference was found within the pre-test & post test score results , But notified relative difference towards atypical to typical performance of Premature infants in each quadrants of ITSP Scale scoring .overall noticed that atypical to typical performance score marked .

CONCLUSION

This study adds to the growing body of evidence suggesting that children born preterm are at increased risk for atypical sensory processing. In addition, this study shows that length of NICU stay are associated with altered sensory processing patterns which indicated that a short period of weekly sensory enrichment intervention sessions had a noticeable positive effect on premature infants, sensory processing



in terms of registration, modulation and discrimination, contributing to their ability to develop supportive skills for optimal development. Early Semi structure sensory enrichment intervention contributes to enhanced sensory development. [6,9,12]

LIMITATION OF THE STUDY

- Less sample size
- Less intervention and Follow up weeks
- Only one scale used
- Compare between two groups (control & experimental group)

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