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Research Article

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Comparative Study on Effect of Vestibular Stimulation and Tactile Stimulation along with Kinaesthetic Stimulation on Neuromuscular Development of Premature Infants

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Abstract: Our aim is to compare the effects of vestibular stimulation and tactile stimulation along with kinaesthetic stimulation on neuromuscular development of premature infants. Premature birth is the most common cause of infants' death considered as one of the risk factors for developmental disabilities, which can lead to long-term complications in the nervous system of infants. Since up to now, only few, many studies conducted under preterm infants our study is an attempt to find the effects on vestibular stimulation and tactile stimulation along with kinaesthetic stimulation on neuromuscular development of premature infants. Twenty infants were selected and divided into 2 groups based on inclusion criteria – infants born between 30 to 36 weeks, no history of cardiorespiratory problems, surgery, 5 min Apgar score less than 5. Infants born after 36 weeks, with a history of cardiorespiratory, neurological problem, congenital malformation are excluded. Group-A treated with vestibular stimulation and kinaesthetic stimulation for a period of 4 weeks (5 sessions/week)for 12 min. Group-B receives tactile stimulation and kinaesthetic stimulation for a period of 4 weeks (5sessions/week) for 12 min. New Ballard score is used as outcome measure for both pretest and posttest. Result of the study shows that both vestibular stimulation with kinaesthetic stimulation and tactile stimulation with kinaesthetic stimulation shows higher significant improvement. However vestibular stimulation with kinaesthetic stimulation shows more significance and effective in improving neuromuscular development of premature infants. The study concludes that vestibular stimulation and kinaesthetic stimulation is more effective than tactile stimulation and kinaesthetic stimulation in improving neuromuscular development of premature infants.

Keywords: Premature infants, vestibular stimulation, tactile stimulation, kinaesthetic stimulation, new Ballard score.

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1. INTRODUCTION

According to WHO, the infants born earlier than 37 wk from the first day of last menstruation were considered premature infants and its prevalence was estimated as 5%-7% globally[1]. Premature birth is the most common cause of infants' death considered as one of the risk factors for developmental disabilities, which can lead to long-term complications in the nervous system of infants. Following preterm birth, natural developmental processes are impaired, especially when the infant is born so early, which requires intensive care[2]. They are in danger for organic process issues. The causes of organic process issues are first, their premature birth may be due to pre-existing problems, second, birth in such premature pregnancy can cause damage to vital organs like heart and lungs, and third, this damage can occur during the neonatal period following treatment measures[3,4]. In addition, exhaustion caused by compliance or stress can also lead to injury or damage to development. Moreover, the very stimulatory environment of the hospital and lack of social interaction experiences with mother and great interaction with others can add to the above risks. Many reasons are conceivable that by itself or in interaction with other causes can lead to the cause of the problems related to the growth and development of premature infants. Often it is unclear how much premature infants are affected by these cases [5]. Although the brain of the infants born at 25 to 40 wk, is still immature but is rapidly evolving [6]. Impairment of brain growth and development in the early stages can affect some basic structures formed during this course of brain development, but there still needs to further evolve. All neuro-motor capacities should evolve to be prepared for functions that are more complex after infant's discharge from the hospital [7]. Developmental care is a broad classification of interventions designed concerning improving developmental outcomes in premature infants admitted to the neonatal intensive care unit [8]. Multi-sensory stimulation is relatively a new intervention closely related to principles of evolutionary care [9]. Since 1960, different researchers have proposed different types of multi-sensory stimulation for premature infants admitted in the hospital with aim to simulate the intrauterine environment at the first weeks of life in order to maintain and facilitate the development of premature infants[10]. Different stimulation programs included auditory touch-motor or situational stimulation or visual stimulation[11]. Sensory stimulation, either single or multi-sensory stimulation, had positive outcomes and results in the process of evolutionary domains[12]. Now, there is contradictory evidence forthe effect of multi-sensory stimulation from neuromuscular aspect in premature infants and short-term effects of multi-sensory stimulation (auditory, tactile, kinaesthetic, vestibular and visual stimulation). The following multisensory stimuli were provided; Tactile Stimulation—Gentle stroking massage for 3 min in a sequence of chest, upper limbs and lower limbs in supine position; from the neonate for 3 min; Vestibular Stimulation—Gentle horizontal and vertical rocking for 3 min. Kinaesthetic stimulation-Gentle passive movements to the upper limb and lower limb[13] NEW Ballard Scaleother wise known as Dubowitz assessment tool is a commonly used neurological assessment. It assigns a score to various criteria (Posture, Square window, Arm recoil, Popliteal angle, Scarf sign, Heel to ear) of a pre term infant according neuromuscular development and motor activity the sum of all of them extrapolated to neuromuscular development. Four criteria are scored from 0 through 4, and one criterion is scored from 0 through 5 in the original Ballard Score. According to the performance and activity the scores were then ranged from 0 to 25.

2. MATERIALS AND METHODS

In this experimental study , 33 subjects were tested and out of them Twenty infants were selected from ACS medical college and hospital after obtaining signed consent form from their parents and neonatologist and divided into 2 groups based on selection criteria. About 8 infants did not fit into the inclusion criteria. 5 infants parents did not want to participate in the study. Infants born between 30 to 36 weeks, no history of cardiorespiratory problems, surgery, 5 min Apgar score less than 5 were included in the study. Infants born after 36 weeks, with a history of cardiorespiratory, neurological problem, congenital malformation were excluded. After getting the ethical clearance from Institutional Review Board 057/PHYSIO/IRB/2018-2019 Group-A treated with vestibular stimulation as vertical rocking and horizontal rocking and kinaesthetic stimulation as joints are passively moved by the therapist for a period of 4 weeks (5 sessions/week)for 12 min. Group-B treated with tactile stimulation as gentle stroking over the limbs and kinaesthetic stimulationas joints are passively moved by the therapist for a period of 4 weeks (5sessions/week) for 12 min. New Ballard score is used as outcome measure for both pretest and posttest.

2.1 Ethical Concern

The procedures were followed according to the recommendations of Helsinki Declaration of 1964 (as revised in 2008). This study was registered under Faculty of Physiotherapy, Dr.MGR educational and Research institute with [0057/PHYSIO/IRB/2018]. The study was carried out during January 2018 to May 2019since the study was on the premature infants the procedure was completely explained to the parents and the written informed consent was obtained for the study.

3. STATISTICAL ANALYSIS

The collected data were tabulated and analyzed using both descriptive and inferential statistics. All the parameters were assessed using the statistical package for social science (SPSS) version 24. Paired t-test was adopted to find the statistical difference within the groups & Independent t-test (Student t-Test) was adopted to find the statistical difference between the groups. The data were presented as mean, standard deviation (SD), probability value (p) less than 0.0001 was considered as statistically significant

4. RESULT

On comparing the Mean values of Group A andGroup B on New Ballard score (NBS) Score, it shows significant increase in the post test Mean values but (Group A) shows (35.5) which has the Higher Mean value is more effective than (Group B) (29.7) at $P \leq 0.001$. Hence Null Hypothesis is rejected. On comparing the Mean values of Group A & Group B on New Ballard score (NBS) Score, it shows significant increase in the post test Mean values but (Group A) shows (35.5) which has the Higher Mean value is more effective than (Group B) (29.7) at $P \leq 0.001$. Hence Null

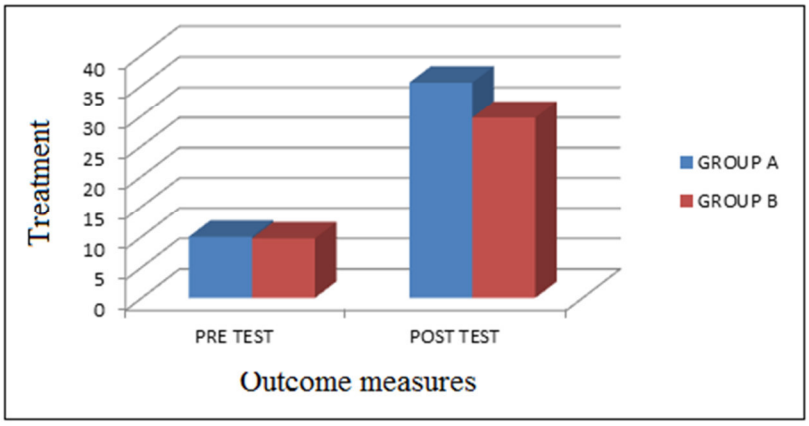
Hypothesis is rejected. However vestibular stimulation with kinesthetic stimulation shows more significance and effectiveness in improving neuromuscular development of premature infants.

Table 1. Comparison of new ballard score between group A & group B in pre test and post test

#NBS	#Group – A		#Group - B		T - Test	Df	Significance
	Mean	S.D	Mean	S.D			
PRE TEST	10	6.324	9.8	5.678	0.176	9	0.863
POST TEST	35.68	7.881	29.7	5.986	3.561	9	0.0005***

Independent t – test (paired t – test) within the groups

The above table I reveals the Mean, Standard Deviation (S.D), t-test, degree of freedom and p-value of the NBS between (Group A) & (Group B) in pre test and post test. This table shows that there is no significant difference in pre test values of the NBS between Group A & Group B (*P > 0.05). It shows that statistically highly significant difference in post test values of the NBS between Group A & Group B (***- P ≤ 0.001).



SD- pre test -5.678post test- 5.986

Graph 1. Comparison of new ballard score between group A & group B

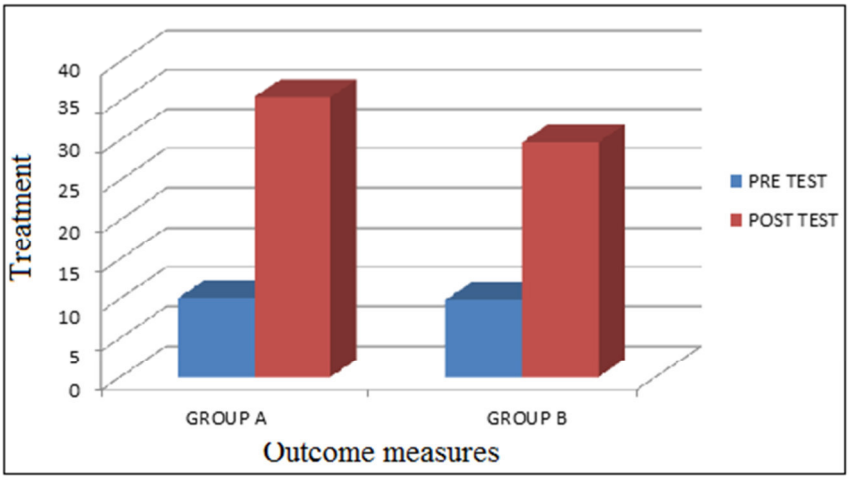
The x axis of the Graph-1shows pre test and post test to the treatment. The Y axis of the graph shows outcome scores they scored before and after the treatment. Y AXIS 1unit= 5 Scores in New ballard score.

Table 2. Comparison of new ballard score within group A and group B in pre test and post test values

#DASS	PRE TEST		POST TEST		t - TEST	SIGNIFICANCE
	MEAN	S.D	MEAN	S.D		
GROUP- A	10	6.324	35.5	7.881	0.176	0.000***
GROUP- B	9.5	5.678	29.7	5.986	4.014	0.000***

Student test is used for analysis between the groups

The above table reveals the Mean, Standard Deviation (S.D), t-test, and p-value of the NBSbetween (Group A) & (Group B) in pre test and post test. This table shows that statistically highly significant difference in post test values of the NBS between Group A & Group B (***- P ≤ 0.001). Both the Groups shows significant decrease in the post test Means but (Group-A) which has the higher Mean value is more effective than (Group-B). p≤0.001 is significant hence*** shows the group is showing significance. Hence the study is successful.



SD- pre test -7.881post test- 5.986

Graph 2. Comparison of new ballard score within group A and group B

The x axis of the Graph-2 shows pretest and posttest to the treatment. The Y axis of the graph shows outcome scores they scored before and after the treatment.

5. DISCUSSION

Due to the high cost of care for premature infants and their neurological and physiological problems, care after the birth of these infants has been considered by the researchers from the last few decades to improve the living environment of these infants and effective and essential changes are made in their development[14]. Due to the high price of look after premature infants and their neurologic and physiological issues, care once the birth of those infants has been thought of by the researchers from the previous few decades to enhance the living atmosphere of hose infants and effective and essential changes ar created in their development [15]. According to difference in total score of Ballard criteria and in the components of Ballard criteria including posture, are Recoil, popliteal angle, and heel to ear[16]. The results of present study showed that neuromuscular development improved in the infants of group A. Modi N et al showed that there was a positive association between infant neurologic development and massage with human/ social contact. Vohr BR et al concluded that Developmental outcomes of very low birth weight infants were evaluated and a report on sensorineural and neurofunctional status of infants showed that such infants had more neurological problems and developmental delay compared with other infants[18]. More recently, Taneja V et al multisensory intervention in the form of play improved mental, motor, and social development in a group of children (age range of 6 months–2.5 yr) living in an orphanage in India. Zeraati H et al concluded that Premature infants admitted in the neonatal intensive care unit undergone many invasive methods, and multi-sensory stimulation is an effective non pharmacological method in the development of premature infants, and multisensory stimulation program improves neuromuscular development in the intervention group, it is recommended to perform this program as a standard care to reduce stress and improve neuromuscular development of premature infants[19,20]. In the present study GROUP-A which underwent vestibular stimulation with kinaesthetic stimulation shows more significance and effective in improving neuromuscular development of premature infants for The GROUP– B Who underwent tactile stimulation and kinaesthetic stimulation also had improving neuromuscular development of premature infants. There are statistically significant improvements in the neuromuscular development for both of these groups. Table-1 both the group shows significant increase in the post test means but [group-a] which has the higher mean value difference when compared to [group-b]. Table-2 within New Ballard score. On comparing the mean values between the groups there is statistically highly significant difference between the pretest and posttest values within group-a and group-b (***- $P \leq 0.001$). There is statistically highly significant difference between the pretest and posttest values within group-a and group-b (***- $P \leq 0.001$). In between group analysis it was found that the group which underwent vestibular stimulation with kinaesthetic stimulation shows more significance and effectiveness in improving neuromuscular development of premature infants.

6. CONCLUSION

The study concludes that both vestibular stimulation and kinaesthetic stimulation and tactile stimulation and kinaesthetic stimulation in improving neuromuscular development of premature infants. But vestibular stimulation with kinaesthetic stimulation shows more significance and effectiveness than tactile stimulation and kinaesthetic stimulation in improving neuromuscular development of premature infants. It can be used as a simple and cost effective treatment program in improving neuromuscular development among premature infants. It is noninvasive and non-pharmatic treatment with no side effects and it may reduce the chances of getting maldevelopment, delayed developmental milestones and other neurological defects. And it can be carried easily at home by the caretaker or mother with care. Hence this palliative care is necessary after the labor if the infant is premature.

7. AUTHORS CONTRIBUTION STATEMENT

Kamatchikaviraja, Jaiganesh Conceived the Idea/Experimental Design of the Study. Kamatchikaviraja, Jaiganesh.G, G. Mohan Kumar, Kaviraja.N Performed Experiments/Data Collection. Kamatchikaviraja, Tharani.G, Yuvarani. G Data Analysis and Interpretation. Kamatchikaviraja, Tharani.G, Yuvarani. G Primary author (wrote most of the paper or drafted the paper). Kamatchikaviraja, V. Rajalaxmi Provided revision to scientific content of the manuscript.G. Mohan Kumar, Kaviraja.N Provided stylistic/grammatical revision to the manuscript. Final approval of the version to be published.

8. CONFLICT OF INTEREST

Conflict of Interest declared none.

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