Innovations

"Effect of Perioral Stimulation on Feeding Performance and Weight of the Preterm Infant in Neonatal Intensive Care Unit"

[1]Ms. Sonali Kumari, [2]Dr. Ajeet Kumar Saharan, [3]Dr. Shantanu Sharma, [4]Dr. Anuja Choudhary, [5]Dr. Dharmita Yogeshwar, [6]Dr. Drishti Sheokand

[1]MPT (2022-24) Nims College of Physiotherapy, Jaipur, Rajasthan, India

[2,3] Professor - Nims College of Physiotherapy and Occupational Therapy, Jaipur, Rajasthan, India

[4]Assoc. Prof. - Nims College of Physiotherapy and Occupational Therapy, Jaipur, Rajasthan, India [5,6] Asst. Prof. - Nims College of Physiotherapy and Occupational Therapy, Jaipur, Rajasthan, India

Correspondence Author: **Dr. Ajeet Kumar Saharan**

Abstract

Background: Preterm Birth: *WHO defined "any birth that occurs before 37 full weeks of gestation, or <259 days after the start of last menstrual cycle". In the NICU, neonatal physiotherapists assist the newborn's posture and movements appropriate for their gestational age, as well as the functional and structural integrity of their body parts and systems, as defined by the International Classification of Functioning, Disability and Health (ICF).* ***Objective:*** *To determine the effectiveness of peri-oral stimulation on improving feeding qualityt and weight of preterm in NICU.* ***Methods:*** *It wasexperimental design study, prospective with random allocation of subjects. Infants were recruited from premature unit under department of neonatology at NIMS hospital in Jaipur, Rajasthan. All preterm Infants of less than 37weeks of gestation criteria were taken for the study. The infants were exclusively fed by either an orogastric or nasogastric tube, and were also getting oxygen through a high-flow nasal cannula owing to their premature birth. The mother's breast milk was employed as the feeding source. Pre-intervention assessment was taken on the first day before the intervention and post-assessment was taken after the 20th session of the intervention using outcome measures like,the evaluation of feeding performance included measuring the total amount of milk consumed per kilogram of body weight (ml/kg/feed) and the speed at which milk was transferred (ml/min)and weight was assessed by electronic weighing scale.* ***Result and Discussion:*** *The efficacy of perioral stimulation with conventional physiotherapy shown in table 8 (Group A) was compared to conventional physiotherapy alone (Group B) using paired t-tests. In Group A, the pre-intervention volume of feed was measured at 30 ± 7.984 and increased significantly to 32.88 ± 8.21, post-intervention ($t = -15.213$, $p < 0.00001$). Similarly, weight gain improved from 1.878 ± 0.335 to 2.239 ± 0.346 ($t = -11.451$, $p < 0.00001$). All changes observed in Group A were deemed statistically significant. In Group B, although there was*

an increase in the volume of feed from 29.71 ± 6.101 to 30.529 ± 6.06 (t = -6.424, p < 0.00001), the effect size was smaller compared to Group A. Weight gain also showed a smaller improvement from 1.957 ± 0.381 to 1.969 ± 0.39 (t = -2.308, p= 0.03471). This suggests that, while both interventions yielded positive outcomes, the addition of perioral stimulation to conventional physiotherapy significantly enhanced the results in terms of both feed volume and weight gain. ***Conclusion:*** *Perioral stimulation has a substantial impact on the weight and feeding performance of preterm neonates in the NICU.*

Keywords: *Preterm Infants, Feeding Problem; Neonatal Intensive Care Unit (NICU); Perioral Stimulation, Premature Infant Oral Motor Intervention (PIOMI), International Classification of Functioning, Disability and Health (ICF),Oral Motor Stimulation (OMS)*

Introduction

WHO defined Preterm birth as any "birth that occurs before 37 full weeks of gestation, or less than 259 days after the start of a woman's last menstrual cycle". In 2016, complications from preterm birth accounted for around 16% of all deaths in the world for children under the age of five, and 35% of newborn mortality. The most common problems that can happen after giving birth are respiratory, musculoskeletal and speech-hearing. Early gestation (34 weeks) has a much higher risk of mortality and morbidity, late preterm (34 – 37 weeks) is more common, and newborns late preterm have a much higher risk of unfavorable outcomes compared to those delivered at term[1]. The parents of a premature newborn experience trauma as well since they are unsure of their child's survival and how the premature delivery will affect their child's development.

Although babies born less than 22weeks gestation have survived, the official limit of viability nowadays is approx 23weeks. In clinical settings, subgroups of premature infants can be distinguished based on birth weight: extremely low birth weight infants (ELBWs), very low birth weight infants (VLBWs), low birth weight infants (LBWs), late preterm infants (infants 34–37 weeks), & infants with low birth weight (LBWs)[2]. The causes behind an extraordinary rise in premature births are the rising trend of artificially conceived pregnancies, aging mothers, substance abuse, medical illnesses, and domestic violence.[3] Stronger evidence consistently points to a negative outcome for alcohol consumers; women, who consume more than one drink daily, on average, are more likely to have prematurely delivery. Research points to aassociated between a low prenatal weight and a higher risk of premature delivery[4].Babies born before their due dates get protective and developmental care as part of their physiotherapy. These babies are at risk for bad brain outcomes during the postpartum period even though they don't have any risk factors for those outcomes.[5]Oral feeding problems are caused by morbidities related to premature birth in about 30–40% of cases. The underlying reasons of these issues include hypotonia, underdeveloped oro-motor control, and impaired coordination in the processes of sucking, swallowing, and breathing. Preterm infants may have difficulty sucking and rooting reflexes, inwardly pulled lower lips during nursing, biting behavior, hypertonic tongue, raised perioral muscle tone, and inability to feed themselves orally. Oromotor stimulation is a scientifically derived, step-by-step method of providing programmed stimulation to

the perioral and intraoral muscle tissues in order to strengthen them and support normal physiological feeding patterns. From 1993 onwards, research articles on oral motor treatment in preterm newborns were published by speech-language pathologists and occupational therapists. Dr. Brenda Knoll Lessen, a nurse, made the initial attempt to use oromotor therapy in the treatment of premature newborns in 2008.[7,8] A new intervention formed to enhance the capacity of premature infants for oral meals is known as Premature Infant Oral Motor Intervention (PIOMI).[9] For this population to grow and thrive, enteral milk feeding is essential. The primary factor that determines the length of hospital stay, physiologic stability, & weight gain in a newborn once it has recovered from the critical phase is its ability to feed orally. When a baby possesses the qualities necessary to consume >80% of the recommended ideal fluid intake orally over the course of a twenty-four-hour period, it is said to be able to feed itself.[10]

Oral stimulation is chosen since it is less expensive and safer.[11-12] As we can see that several studies have been done till now on oral stimulation which used both the aspects of Oral stimulation and intra-oral stimulation but till now, no studies have been done to find the effect of only peri-oral stimulation on preterm in ICU. So, the purpose of current research is to find the effect of peri-oral stimulation on feeding performance and weight of preterm infant in NICU. The Objectives of the study was to assess if preterm babies in the NICU benefit from peri-oral stimulation for better feeding performance and in enhancing weight gain of preterm infants in the NICU.

Material & Methodology

34 infants (male/female) were selected from NICU of NIMS Hospital, Jaipur via simple random sampling for the experimental study. Gestational age, Weight, Volume of feed were selected as variables. Infants were selected if they were on Orogastric or Nasogastric Feeds, gestational age less <37 week, no congenital anamolies, receives a minimum of 100 ml/kg of mother's milk as a gavage nutrition and is haemodynamically stable, respiratory support or high flow oxygen therapy. Infants were rejected if severe perinatal asphyxia, Grade 3/4 intraventricular haemorrhage, Intaventriculer hemorrhage, CHD and malformation.

Interventions: The Oral Motor Stimulation (OMS) technique involves facilitating muscular contraction via supported movement and building strength through resistance training. OMS included the application of stimulation around the mouth (peri-oral stimulation) and within the mouth (intra-oral stimulation). See the table1.

Table-1: Group – A: Peri-Oral Stimulation + Conventional Physiotherapy	
Exercises	**Dosages**
Superior Jaw-Light friction TMJ to upper lip.	1 min
Upper & Lower Lips-Periodic, curved force with the fingertip, mouth edge to lower lip.	1 min.
Mouth Orbicular Muscle-Superficial friction-surrounding the	30 sec.

mouth.	
Cheeks-Finger Kneading	1 min.
Chest Physiotherapy	2-3 min., 7 times twice a day
Limb Physiotherapy-PROM	7 times twice a day
Group – B: Conventional Physiotherapy	
Exercises	**Dosages**
Chest Physiotherapy	2-3 min., 7 times - twice a day
Limb Physiotherapy-PROM	7 times - twice a day

Data Collection

Method of Collection: Pre and post-test data was collected to measure the effectiveness of perioral stimulation. The assessment was conducted based on the total milk volume intake (ml/kg of body weight each feeding) and the speed of milk transfer (measured in ml/min.). The weight was measured using an electronic weighing scale.

Procedure: Stable subjects were randomly assigned in the experimental, prospective investigation. Because of their premature birth, infants were only given breast milk or oxygen via a high-flow nasal cannula, or both. Every two hours, the babies were given a bottle. A screen was erected around the newborn bed before perioral stimulation began and remained there during the intervention. Using a simple random sample method, the chosen newborns were split into 2 equal groups. Group-A received perioral stimulation in addition to leg physiotherapy and chest physiotherapy, while Group-B received just leg physiotherapy as a control. Twenty sessions were administered to both the groups over the course of two weeks, excluding weekends. Every oral feeding session that the on-duty nurse witnessed was documented, including the length and volume. The Volume intake (ml / kg / feed) and rate of milk transfer were used to evaluate feeding performance in the pre- and post-intervention assessments, respectively, which were administered on the first day before to and after the 20th session of the intervention.

Results

The frequency distribution of gestational age of subject of both the group. In Group A with regard to gestational age, majority of the subjects were 35 weeks old (35.29%), 4 subjects were 36 weeks old (23.53%), 3 subjects were 34-week-old (17.65 %), 3 subject were 33 weeks (17.65%) and only 1 subject was 32 weeks (5.88%). In group B with regard to gestational age, majority of the subjects were 35 weeks old (41%), 5 subjects were 36 weeks old (29.41), 4 subjects were 34 weeks old (23.53%) and only 1 subject was 33 weeks old (5.88%).

Poonam Bala, et. al 2015 did study on how oromotor stimulation can help babies born before they're due move from eating through a tube to full mouth feeding. The research included preterm babies of gestational age between 28-34 weeks. The results showed that it took babies in the intervention group, on average, fewer days to learn how to partially and fully feed themselves with a spoon than babies in the control group [5 (3–9.5) vs 10 (5–15) P=0.006; and 7 (5–14.5) v/s 12.5 (7–21); P=0.03].

María Álvarez-Cerezo, et. al2019 have explained that efficacy of an oral sensorimotor stimulation regimen in facilitating exclusive oral feeding for premature infants. 47 preterm newborns (between 25 - 30 weeks gestational age) were divided in 2 groups at random. While the CG (n = 23) got routine care, the EG (n = 24) babies underwent a 10-minute oral stimulation treatment. and their study's outcome was 8.3 days ahead of the CG, the EG attained complete oral eating (p ¼ 0.013). Additionally, 6.03 days before (p = 0.019) and 5.88 days prior (p = 0.040) saw EG attain the initial oral intake of 30% in the first five minutes. Additionally, EG was hospitalized for 6.9 fewer days than CG (p¼ 0.028).

Zaharoula Rigopoulou, et. al 2022 carried out research on the issues and procedures related to the oral feeding transition of preterm newborns age between 26 to 37 weeks. The frequency distribution of the volume of feed given to individuals in Group A and B in the pre-intervention phase. In group maximum 9 number of subjects had received feed between 21-30ml comprising (52.94%), 4 subjects had received feed between 31-40ml (23.53%), 2 subjects were received feed between 41-50 ml (11.76%), and 2 subjects were received feed less than 20ml (11.76%). In Group B, maximum number of subjects had received feed in between 21-30ml (47.06%), 6 subjects had received feed in between 31-40ml (35.29%), 2 subjects had received feed less than 20 ml (11.76%), and 1 subject had received feed in between 41-50ml (5.88%).

Pareshkumar A. et. al 2018 did a study to look at how mouth stimulation affected how well preemie babies could eat and how much weight they gained. The babies in the study were born before their due dates, within 30 and 34 weeks. The study found that the training group did better at eating, both in terms of total consumption and the rate of milk transmission. Group B who underwent only conventional physiotherapy, gestational age minimum recorded was 33 weeks, the maximum was 36 weeks, with a median of 35 (34-36) and mean of 34.94 ± 0.899. Regarding the volume of feed, both pre-post-interventions, the minimum recorded was 19 ml and 20 ml respectively, while the maximum was 44 ml pre-intervention and 45 ml post-intervention. With a median value of pre intervention 29 (27-32) and mean value 29.71± 6.101 and median value of post intervention 30(28-32) and mean value 30.529 ± 6.063. For weight gain, both pre-post-interventions, the minimum recorded was 1.45 kg and 1.45 kg respectively, while the maximum was 2.6kg pre-intervention and 2.7 kg post-intervention. The median weight gain pre-intervention was 1.957 ± 0.381and post-intervention was 1.88 (1.66-2.24), The mean weight gain pre-intervention was 1.957 ± 0.381 and post-intervention was 1.969 ± 0.39.

The efficacy of perioral stimulation with conventional physiotherapy is noted, Group A was compared to conventional physiotherapy alone Group B using paired t-tests. In Group A, the pre-intervention volume of feed was measured at 30 ± 7.984 and increased significantly to 32.88 ± 8.21, post-intervention ($t = -15.213$, $p < 0.00001$). Similarly, weight gain improved from 1.878 ± 0.335 to 2.239 ± 0.346 ($t = -11.451$, $p < 0.00001$). All changes observed in Group A were deemed statistically significant. In Group B, although there was an increase in the volume of feed from 29.71 ± 6.101 to 30.529 ± 6.06 ($t = -6.424$, $p < 0.00001$), the effect size was smaller compared to Group A. Weight gain also showed a smaller improvement from 1.957 ± 0.381 to 1.969 ± 0.39 ($t = -2.308$, $p= 0.03471$). This suggests that, while both interventions yielded positive outcomes, the addition of perioral stimulation to conventional physiotherapy significantly enhanced the results.

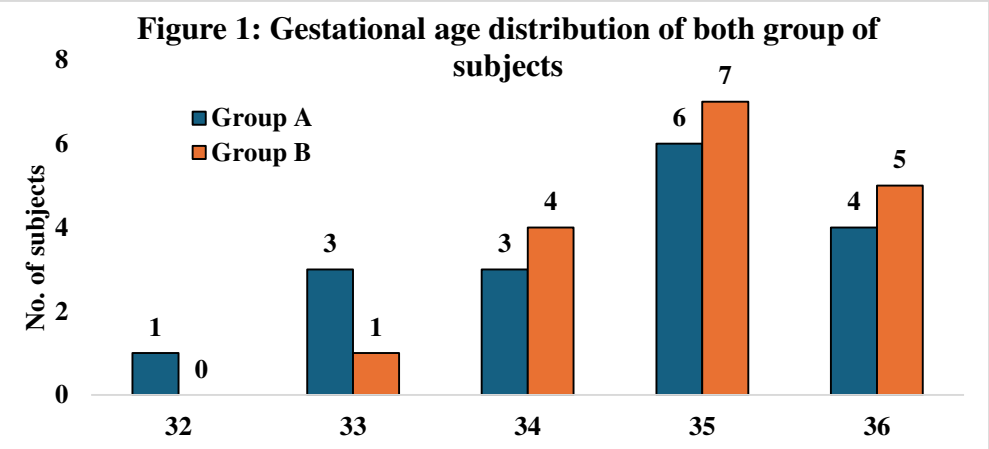

Table 2: Frequency distribution of volume of feed of subjects of both groups at post intervention				
Volume of Feed every 2 hourly(Post)	**Group A**		**Group B**	
	n = 17	**%**	**n = 17**	**%**
≤ 20 ml	1	5.88%	1	5.88%
21 – 30 ml	6	35.29%	8	47.06%
31 – 40 ml	8	47.06%	7	41.18%
41 – 50 ml	2	11.76%	1	5.88%

Table 3: Descriptive statistics of gestational age, volume of feed and weight gain of subjects of group A (perioral stimulation with conventional physiotherapy)					
Variables		**Minimum**	**Maximum**	**Median (IQR)**	**Mean ± SD**
Gestational Age		32	36	35 (34-35)	34.53 ± 1.231
Volume of Feed (ml)	**Pre**	18	47	29 (26-33)	30 ± 7.984
	Post	20	50	32 (28-37)	32.88 ± 8.21

Weight Gain (kg)	**Pre**	1.3	2.34	1.84 (1.64-2.1)	1.878 ± 0.335
	Post	1.6	2.9	2.3 (2-2.4)	2.239 ± 0.346

Table 4: Comparing efficacy of Group A (perioral stimulation with conventional physiotherapy) and Group B (conventional physiotherapy) by using paired 't' test

Variables		**Intervention**		**Paired 't' test**	**P - Value**	**Significance**
		Pre	**Post**			
Group A	**Volume of feed**	30 ± 7.984	32.88 ± 8.21	-15.213	0.00001	All are significant
	Weight gain	1.878 ± 0.335	2.239 ± 0.346	-11.451	0.00001	
Group B	**Volume of feed**	29.71 ± 6.101	30.529 ± 6.06	-6.424	0.00001	
	Weight gain	1.957 ± 0.381	1.969 ± 0.39	-2.308	0.03471	

Discussion

Research into the effects of perioral stimulation on neonatal intensive care unit (NICU) infants was the motivation for the current investigation. A notable outcome by estimating feed amount in milliliters and weight growth in kilograms using an electronic weight machine. Perioral stimulation was determined to be beneficial on preterm infants in the NICU at the conclusion of the 2-week intervention. While earlier research indicated that preterm newborns benefited from mouth stimulation, no studies have examined the impact of perioral stimulation on preterm infants' weight growth or feed volume. This study showed that the intervention led to better feeding performance, higher milk transfer rates on day 14, and overall weight gain, as well as a significantly higher volume of feed intake per kilogram of feed.

Oral Motor Stimulation, Feeding, and Sucking Success in Preterm Infants was studied on 29-34 week preterm by **Senay Aras Dogan et. al (2023)**. For premature babies, it's best to start oral feeding as soon as feasible. 39 infants were given oral motor stimulation, whereas 38 infants were just given, both groups received food 3 times daily for 14 days. There was little difference between the control and experimental groups and duration it took for both groups to go from oral to complete enteral feeding was comparable in this research. The results of this research show that preterm babie's health and sucking abilities are improved with oral motor stimulation.

Research on the effects of pre-feeding oral stimulation on the sucking ability of low-birth-weight babies in the neonatal intensive care unit was carried out by **Erni Wahyuni et al. (2023)**. The researchers in this study utilized a one-group pretest/posttest design. All newborns treated in the NICU were included in this study. Research found that babies' sucking abilities ranged from 0 to 6 before oral stimulation, with an average score of 2.67. After oral stimulation, babies' sucking abilities range

from an average of 3.73. Results from the statistical Wilcoxon t-test showed a p-value of 0.01. The study explained that sensory stimulation of these oral structures may improve oral structures in the sucking and swallowing processes.

Sensory motor stimulation improved oral feeding readiness in premature neonates, according to research by **Amna Nagaty et al. (2022)**. This research employed a single instrument and a deliberate sample of 140 premature newborns; the instrument included the following: personal information about the preterm baby, including gender, post-natal age, and the premature oral feeding readiness evaluation scale. When comparing the two groups on the third and fourth days of the intervention, there was a statistically significant improvement in the study group's behavioral state, tone, and global posture compared to the control group. The findings of this research demonstrated that preterm sensory oral stimulation prior to eating improves behavioral state.

The impact of oral motor stimulation exercises on the ability to feed premature infants was examined in research by **Funda Yavanoglu Atay et al. (2023)**. The development of the baby's oral motor skills and the interplay of the neurological, cardiorespiratory, and gastrointestinal systems are all intricate parts of the oral feeding process in premature newborns. This study was out to show how useful objective measures are for determining if a child is ready to start oral feeding on their own and how OMS exercises affected their sucking and swallowing abilities. This prospective cohort research was conducted at a single site and comprised babies hospitalized to our neonatal critical care unit who were born prematurely, at or before 34 weeks of gestation. A language and speech therapist certified in oral feeding skills (OFS) and non-nutritive sucking (NNS) scores administered all OMS program procedures daily, five days a week. Weekly evaluations of OFS staging and NNS score were conducted on all babies until discharge. The participants in this prospective cohort research were 50 newborns. The average weight at delivery was 1376.9±372 g, and the maternal gestational age was 30 weeks (with an interquartile range of 25-34). A substantial increase ($p<0.001$) was seen when comparing the OFS stages on days 5 and 10 of OMS. The study's findings provide credence to the idea that OMS exercises might help preterm babies prepare for the switch from gavage to oral nourishment by enhancing their eating abilities. The writers state that this enhancement is necessary because of the oro pharyngeal mechanism, which is activated by motor stimulation of the lips, jaws, tongue, and soft palate with the finger. So, to help preterm babies learn to feed themselves, doctors recommend early oral motor skills activities. Their research led them to the conclusion that oral motor skills (OMS) are beneficial when moving from gavage to oral feeding.

Conclusion

This study concluded that There is a significant effect of perioral stimulation on feeding performance and weight of preterm infants in neonatal intensive care unit.

Limitations: Small sample size.

Recommendations: Future research may have larger numbers of data.

Ethical Considerations:

Compliance with Ethical Guidelines: This study was approved by the Ethical Committee of NIMS University (Code: NIMS/PTOT/Feb/2024/ 83, dated 3.5.2024

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Authors' Contributions: All the authors have contributed in the study.

Conflict of interest: There is no conflict of interest.

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What is already known in this topic: Several studies have been done on Oral Stimulation (oral stimulation and intra-oral stimulation) to find the effect on feeding performance and weight of preterm infant in NICU.

What this article adds: This study has been done to find the effect of only Peri-Oral Stimulation on feeding performance and weight of preterm infant in NICU.

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