Effectiveness of Oral Stimulation Intervention on Premature Infants' Oral Feeding at Neonatal Intensive Care Unit

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Abstract

Background: The process of oral feeding for premature infant is challenging because of their poor oral motor abilities, immature oral-motor control, poor coordination of suck, swallow, and breathing. Consequently the majority of premature infants are unable to start bottle or breast feeding immediately after birth. **Aim:** evaluate the effectiveness of oral stimulation intervention on premature infants' oral feeding at neonatal intensive care unit. **Methods:** Quasi-experimental research design was utilized. **Setting:** This study was carried out in neonatal intensive care unit at Mansoura University Children Hospital. A purposive sample of premature infants which were randomly classified to the study & the control group (20 in each group). **Tools:** One tool was utilized to collect the data, ***part I*****:** Characteristics of premature infants. ***Part II:*** Feeding Readiness scale **and** ***Part III:*** Quality of Nippling Scale. **Results:** The present study showed that 60% of the study group was alert and had good tone and rooting, while 35% of the control group was drowsy, with some rooting and adequate tone. Also, 40% of the study group was Nipples with a strong coordinated suck during the feed, while 35% of the control group was Nipples with consistent suck but has difficulty coordinating swallow. **Conclusion:** Premature infants who received oral stimulation intervention exhibited an improvement in oral feeding compared to premature infants who did not receive it. **Recommendations:** Educational programs are recommended to improve neonatal nurses' knowledge and practices about oral stimulation intervention for premature infants.

Keywords*:* Oral feeding, Oral stimulation intervention, Premature infants.

Introduction

Most premature infants are incapable to accomplish independent oral feeding and are fed through tubes (Thabet, & Sayed, 2021). A quarter of all children suffer from feeding difficulties. Feeding difficulties are more common in preterm infants than in full-term infants. Oral feeding issues are estimated to affect 30-40% of premature infants (El-Shahat et al., 2018). On the other hand, issues with premature infant oral feeding can cause delays in hospital release, affect parent-infant attachement, and may result in long-term feeding abnormalities that due to growth failure. The social and financial burden of such outcomes are significant (Asadollahpour et al., 2015; El-Shahat et al., 2018).

Premature infants often struggle to integrate their suck, swallow, and breath reflexes before 34 weeks postpartum because of their neurological immaturity and other health issues (Sasmal, Shetty, & Saha, 2021). Because their gastrointestinal tract, respiratory, and central nervous systems are not developed enough to coordinate sucking, swallowing, and breathing, premature newborns must stay in neonatal intensive care units (NICUs) for days to many months to learn how to coordinate to suck, swallow, and breath to accomplish safe and successful oral feeding (Mahmoodi, Knoll, Keykha, Jalalodini & Ghaljaei, 2019).

Feeding behaviors are acquired before birth. As a result, neonates born at a later gestational age will have strong sucking abilities. Hypotonia, weakness, and lack of coordination in movements, poor awareness, irritability, unstructured motor activities, and physiological instability may occur in infants born before completed 37 weeks of gestation (John, Suraj, Padankatti, Sebastian, & Rajapandian, 2019; Mahmoodi et al., 2019; Sasmal et al., 2021).

Oral stimulation techniques are often employed in preterm baby rehabilitation programs. Providing stimulations prior starting of oral feeding can help the neural system maturity, enhance performance, and coordinate sucking, swallowing, and breathing functions (Ghomi et al., 2019; Gonzalez et al., 2021). Oral motor stimulation (OMS) comprises sensory-motor input to the cheeks, lips, gums, and tongue in premature infants to preserve rudimentary oral-motor abilities, develop oral muscle tone and movement for promoting normal oral motor growth, and improving oral feeding (Thakkar, Rohit, Ranjan Das, Thakkar, & Singh, 2018).

The accomplishment of independent oral feeding is essential of the requirements for premature infants' discharge. The quality of life for premature newborns and their families can be negatively impacted by their oral feeding issues, which can result in long-term feeding problems (Lyu et al., 2020). After addressing with the acute and chronic morbidities linked with preterm, independent oral feeding is the last issue to be taken into account. Infant oral feeding is a relatively unexplored field. Due to this, premature newborns' inability to readily feed through the mouth has drawn a lot of attention in recent years (Han, Shin, & Jeon, 2020). Thus, this study was conducted to evaluate the effectiveness of oral stimulation intervention on premature infants' oral feeding at NICU.

Aim of the Study

This study aimed to evaluate the effectiveness of oral stimulation intervention on premature infants' oral feeding at the neonatal intensive care unit.

Research question:

Premature infants who receive oral stimulation intervention may exhibit an improvement in oral feeding compared to premature infants who do not receive it.

Subjects & Methods

Research design:

Quasi-experimental research design was utilized to apply this study.

Setting:

This study was carried out at the neonatal intensive care unit at Mansoura University Children's Hospital.

Subjects:

A purposive sample of premature infants who obtained care at the earlier stated setting which were randomly classified into the study group and the control group. The first 20 premature infants who were admitted to the NICU were randomly distributed to the "control group," and the next 20 premature infants were randomly allocated to the "study group" after the control group infants were assigned. Inclusion criteria were gestational age of 30-36 weeks, birth weight of 1500–2500 g, free from any major health problems as congenital abnormalities, brain damage, or major medical conditions (such as necrotizing enterocolitis and serious infectious infections).

Tools for data collection:

Part I: Characteristics of premature infants that included gender, gestational age, birth weight, type of delevery, chronological age, and weight of the premature infant.

Part II: Feeding Readiness Scale: It was adopted from Crowe, Chang, & Wallace, (2016) and used to assess a premature infant's readiness for oral feeding. There were 5 scores utilized. Score one for readiness. Before nursing care, infants should be alert or at least drowsy. Infants should have a tone that is good for their age. When gently handled for everyday care, the newborn develops this drowsy or alert state, A score two for readiness indicates. This score also denotes that the newborn is rooting or takes the pacifier if offered. The infant's tone is appropriate for feeding. A newborn who may be momentarily attentive but did not exhibit signs of hunger, such as rooting, bringing their hand to their mouth, or or

taking the pacifier, receives a readiness score of three. The newborn receives 4 points if they are sleeping while receiving care and don't exhibit any symptoms of hunger cues and no changes in muscular tone. A score of 5 denotes tachypnea, apnea, and/or bradycardia with care in the newborn, or some degree of medical instability.

Part III: Quality of Nippling Scale: it was adopted from Ludwig & Waitzman, 2007 and used to assess how well the infant is being nipple fed. Nipple feeding success depends on swallowing the recommended quantity fast. The Quality of Nipple Scale, which goes from 1 (strong, coordinated sucking during feeding) to 5 (uncoordinated suck-swallow-breath responses), encourage researchers to observe and document the infant's feeding behaviors.

Validity and reliability:

Five experts in the specialty of pediatric nursing assessed the usefulness of the tool's Content validity. Their opinions were elicited regarding the consistency, correctness, and relevancy of the tool. Standardized tool is used. The validity was depended on research data and expert clinical judgments and its reliability was tested resulting Cronbach's α of 0.824.

Ethical considerations:

The Mansoura University Faculty of Nursing's Research Ethical Committee gave its approval for the conduct of this study. The parents of the premature infants in the study group provided their consent after being informed of the study's goals, instructions for applying, and assurances about the confidentiality of the data acquired.

Pilot study:

To evaluate the clarity, viability, and usefulness of this tool, pilot study including four premature newborns, representing 10% of the study population, was carried out. Consequently minor adjustments were made, and the pilot research sample was not incorporated in the study.

Fieldwork:

Over eight months, from the beginning of August 2020 to end of march 2021, data was collected. After examining the literature review, researchers developed an oral stimulation intervention El-Mashad, El Saied, & Mekawy (2021). The researchers perform the oral stimulation intervention to the study group just before gavage feeding. Each infant received oral stimulation, including even if he/she was not nipple-fed. Every 12 hours, oral stimulation was performed for 5 minutes, and if the infant didn't achieve score one or two on the Feeding Readiness Scale, gavage feeding was continued. Oral feeding was given to the infant in line with breast or bottle compliance with the purpose of testing the quality of nipping ability when the infant achieved a score of one or two on the feeding Readiness Scale. If the infant receives a score of more than two on the feeding test, it cannot be fed safely.

These intervention included items as the researchers wearing non-latex gloves, gently tapping the infant's lips with the index finger, moving in a circlular motion when the infant opens the mouth, and putting the index finger on the tip of the lip. For one minute, gently tap the infant's tongue with your index finger while being cautious not to stick your finger too deep inside their mouth. For one minute, gently stroke the baby's tongue with your index finger by pressing down and drawing the finger back in your direction. Stroke the newborn's mouth for one minute, being cautious not to insert your finger too deeply, and then let the infant to sucking on your gloved finger or pacifier for two minutes. Premature infants in the control group received just routine care without any assistance from the researchers. The researchers used the previously described tool to examine the impact of oral stimulation on oral feeding in premature infants for the study and control groups, and the results were documented.

Statistical analysis:

Data were collected, coded, and entered using a Personal Computer (PC). The Statistical Package for Social Sciences (SPSS) version 24 was used for computer-aided entry and statistical analysis of the gathered data. Numbers/percentages, the mean, and the standard deviation are used. The T test used for comparing means and of $p < 0.05$ was considered significant and $p < 0.01$ was considered highly significant.

Results:

Table 1 clarified that, concerning the study group and control groups, it was found that 65% and 45% respectively of premature infants were male, with a statistically difference among both groups. Additionally, the mean gestational ages were 32.5± 1.89 weeks for the study group and 31.9 ±1.76 weeks for the control group. Furthermore the control group's was 1.711±0.324 kg, while the study group's was 1.688±0.276 kg. There was no significant difference among both groups in terms of type of delivery ($p > 0.05$).

Table (2) displays that 60% of the study group was alert and had good tone and rooting, while 35% of the control group was drowsy, with some rooting and adequate tone with statistically difference among both groups ($p < 0.01$).

Table (3) reveals that 40% of the study group was Nipples with a strong coordinated suck during the feed, while 35% of the control group was Nipples that suck consistently but have difficulty coordinating swallowing, partial fluid loss, or difficult pacing benefit from external pacing with statically difference among both groups ($p < 0.05$).

Table (4) shows that the mean of chronological age at first oral feeding in the study group was 3.84±0.98 days while that in the control group was 4.76 ± 0.86 times Also, the mean of chronological age at full oral feeding in the study group was 6.53±1.44 days while that in the control group was 8.01 ± 1.62 times. In addition, the mean of chronological age at discharge in the study group was 11.52±2.68 days while that in the control group was 13.87 ± 3.03 times with statistically difference among both groups ($p < 0.05$).

Table (5) detects that the mean of infant weight at admission in the study group was 1.710±0.235 k.g while that in the control group was 1.695±0.240 k.g with no significant difference between the two groups ($p > 0.05$). Also, the mean of infant weight during the middle stay at the hospital in the study group was 1.850±0.276 k.g while that in the control group was 1.764±0.199 k.g. In addition, the mean of infant weight at discharge in the study group was 2.050±0.309 k.g while that in the control group was 1.910±0.287 k.g with a significant difference among both groups ($p < 0.05$).

Table (1): Distribution of the premature infants in the study and control group according to their characteristics (n=20).

Characteristics	Study N=20		Control N=20		T test P value
Gender					
Male	13	65	9	45	**3.998**
Female	7	35	11	55	**<0.05***
Gestational age					
30- <32	7	35	7	35	
32- <34	8	40	9	45	**1.340**
34- 36	5	25	4	20	**>0.05**
$\bar{x}$ ±	**32.5±1.89**		**31.9±1.76**		
Birth weight					
< 1.500 Kg.	6	30	5	25	**1.011**
From 1.500 < 2.000 Kg.	12	60	11	55	**>0.05**
From 2.000 - 2.500 Kg.	2	10	4	20	
$\bar{x}$ ±	**1.688±0.276**		**1.711±0.324**		
Type of delivery					
Normal	12	60	13	65	**1.447**
Caesarean section	8	40	7	35	**>0.05**

Table (2): Distribution of the premature infants in the study and control group according to their oral feeding readiness (n=20)

Score Description	Study N=20		Control N=20		ANOVA test
	N	%	N	%	
Drowsy, alert before care. Rooting /taking of pacifier. Good tone	12	60	6	30	
Drowsy or alert once handled Some rooting or taking of pacifier Adequate tone.	6	30	7	35	10.954
Briefly alert with care No hunger behaviors No change in tone	2	10	5	25	<0.01**
Sleeps throughout care No hunger cues No change in tone	0	0	2	10	
Needs increased oxygen with care Apnea and/or bradycardia with care Tachypnea greater than baseline with care	0	0	0	0	

Table (3): Distribution of the premature infants in the study and control group according to their Quality of Nipping (n=20).

Score	Study N=20		Control N=20		Significant T-test
	No	%	No	%	
Nipples with a strong coordinated suck during a feed.	8	40	3	15	7.745 <0.05*
The nipples initially have a strong, coordinated suck, but fatigue as they progress.	6	30	2	10	
Nipples that suck consistently but have difficulty coordinating swallowing, partial fluid loss, or difficult pacing benefit from external pacing.	3	15	7	35	
Weak/inconsistent nipple sucking with little to no rhythm, rest may be needed.	2	10	5	25	
Unable to coordinate suck-swallow-breathe pattern despite pacing.	1	5	3	15	

Table (4): Distribution of the premature infants in the study and control group according to their chronological age at first, full nipple feeding, and discharge (n=20)

Items	Study group	Control group	T-test P value
	Mean (SD)	Mean (SD)	
Chronological age at first nipple feeding.	3.84 (0.98)	4.76 (0.86)	6.052 <0.05*
Chronological age at full nipple feeding.	6.53 (1.44)	8.01 (1.62)	7.159 <0.05*
Chronological age at discharge.	11.52 (2.68)	13.87 (3.03)	6.202 <0.05*

Table (5): Distribution of the premature infant in the study and control group according to their weight (n=20)

Items	Study group	Control group	T-test
	Mean (SD)	Mean (SD)	P value
At admission	**1.710±0.235**	**1.695±0.240**	2.017 >0.05
In the middle stay at the hospital	**1.850±0.276**	**1.764±0.199**	6.301 <0.05*
At discharge	**2.050±0.309**	**1.910±0.287**	5.914 <0.05*

Discussion

Premature infants' transition from tube feeding to oral feeding can be difficult since it needs coordination of the jaw, lips, tongue, palate and throat, upper trunk, and respiratory systems to confirm a safe swallow. Oral stimulation of the lips, jaw, tongue, soft palate, pharynx, larynx, and respiratory muscles is identified as early OMIs, and it is hypothesized to impact the physiological foundations of the oropharyngeal mechanism to advance its functioning (El Mashad et al., 2021). Thus this study aimed to evaluate the effectiveness of oral stimulation intervention on premature infants' oral feeding at the neonatal intensive care unit.

The current study's findings indicate that 65% and 45% of the subjects in the study and control groups, were male. The mean gestational age in the study group was 32.5±1.89 weeks, whereas it was 31.9±1.76 weeks in the control group. Additionally, the control group's mean birth weight was 1.711 0.324 kg, compared to 1.688 0.276 kg for the study group. Regarding the type of delivery, there was no discernible difference among both groups ($p>0.05$). El Mashad et al. (2021) got findings that are comparable to those of the current study and indicated that 64% of the study group was male. Both groups were matched for sex and age. The mean age of the intervention group was 34.3±0.75 weeks, with no statistically difference among both groups. This findings was inconsistent with Rahmani, Armanian, & Namnabati, (2018) who found that the mean age of intervention group was 32.9 (3.5) weeks and 32.1 (0.9) weeks for control group, and reported that there were no statistically difference among both groups about the demographic characteristics, such as gender, postnatal age, gestational age, mode of delivery, and weight on the first day of the intervention.

Concerning to the premature infants at study and control group according to their feeding readiness, the current study discovered that 60% of study group was alert and had good tone and rooting, compared to more than a third of the control group drowsy, some rooting and adequate tone with highly significant difference between both groups ($p <0.01$). Also, in relation to the quality of nipping scale, its revealed that 40% of study group was nipples with a strong coordinated suck during feed, while more than one third of control group was Nipples that suck consistently but have difficulty coordinating swallowing, partial fluid loss, or difficult pacing benefit from external pacing with a statistically difference both groups ($p <0.05$). This result was supported with Calk, (2019) who revealed that best skills through employing four areas of intervention: oral motor stimulation, non- nutritive sucking, oral support, and co-interventions. Also, he proved that non- nutritive sucking with and without oral/perioral stimulation due to strong positive findings for enhancement in certain feeding/swallowing physiology variables and statistically reduction in time to oral feeding. Pre-feeding stimulation showed equivocal results across the outcomes. While, this result was not alinging El-Shahat et al., (2018) who found that, more than half of preterm neonates in both groups diagnosed as preterm with reduced sucking (56.7%, 53.3%, respectively). Also this finding was contradicted with study carried by Said, & Mahmoud, (2016), who proved that 80.8 % of them were alert post program compared to 7.7% preprogram.

As regards premature infant at study and control group according to their chronological age at first, full feeding and discharge. Prominently, the current study demonstrated that mean chronological age at first nipple feeding, full nipple feeding, and at discharge in the study group was statistically different between two groups at ($p <0.05$) for all. This significantly due to effect of oral stimulation intervention on premature infants related to the improved of their oral feeding. This finding is agreed with results of El-Shahat et al., (2018) study who noticed that in the 3rd day of the intervention the maximum mean volume of milk intake in neonates in the intervention group than the control group. This conclusion might be explained by the fact that intra-oral stimulation given to the research group's

upper and lower gums improved tongue range of motion, supported suck to enhance suction, and stimulated swallowing to enhance milk intake per suck. Also, Rocha, Moreira, Pimenta, Ramos, & Lucena (2007) stated in their study that the first oral feeding happened at weeks 35–36 of the Post-Menstrual Age. While in the study by Lessen, (2011) the first oral feeding happened at week 31.5, and in Ghomi et al., (2019) study, the first oral feeding started at week 31.23. The present study shows that the mean of chronological age at first nipple feeding in the study group was 3.84±0.98 days while that in the control group was 4.76 ± 0.86. This finding may be due to the time of intervention in other studies.

In relation to the premature infant at study and control group according to their weight. Significantly, the current study detects that no significant difference of the mean of infant weight at admission between both groups. Furthermore, a statistically difference of the mean of infant weight at middle stay at hospital between two groups (p <0.05). In addition, a statistically difference of the mean of infant weight between both groups at discharge. The present study is consistent with, Thakkar et al., (2018) who reported their study finding included the intervention group demonstrated improved feeding efficiency, a quicker shift to independent oral feeding, greater weight gain, and a shorter length of hospital stay. Mahmoodi et al., (2019) illustrated that the study group accomplished self-regulating feeding significantly earlier than the control group. In addition, the length of hospitalization was less in the intervention group, compared to that of the control group. While it is contradicted with Ghomi et al., (2019) who studied showed that first oral feeding, eight oral feedings, and discharge happened sooner for the intervention group. No difference in weight gain throughout discharge between the two groups.. Furthermore, Rahmani et al., (2018) found that there was no statistically difference noticed among both groups with consideration to weight gain. Additionally, El Mashad et al., (2021) revealed that the weight of the studied groups was comparable at admission and had no statistically differences (P = 0.07) as well as on discharge (P = 0.13).

Conclusion

According to our findings, premature infants who received oral stimulation intervention exhibited an improvement in oral feeding compared to premature infants who did not receive it.

Recommendations:

In the light of the findings of the present study it is recommended that:

- Replication of the present study in greater samples.
- Educational programs should be implemented to enhance neonatal care providers' understanding of and proficiency with oral stimulation interventions for premature infants.
- Future research might concentrate on how oral stimulation interventions affect infants' long-term outcomes.

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