



## EFFECT OF ORAL MOTOR MUSCLE STIMULATION ON OUTCOMES OF PRETERM INFANT SYSTEMATIC REVIEW OF PUBLISHED LITERATURE, 2006-2019.

### Neonatology

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### ABSTRACT

Prematurity is incredibly common in children within the Indian scenario. Techniques for oral motor stimulation have been explored, therefore the preterm newborn develops the transition to full oral feeding safer and active suck in an exceedingly shorter time. This study aims to hold out a systematic scientific review of national and international literature reporting different techniques and elucidate their effectiveness, regarding the oral sensorimotor stimulation of preterm neonates that remained hospitalized. According to the literature, the foremost current technique utilized in India is that non-nutritive sucking with a gloved finger or orthodontic pacifier. Other countries also recorded the technique of non-nutritive sucking in pacifiers followed by oral motor muscle stimulation as a current new approach. These techniques have been positively affecting neonates' oral function development. Regarding the need for promotion of exclusive breastfeeding, recent publications highlighted a concerning percentage of synthetic nipples usage for stimulation in neonatal intensive care medical units.

### KEYWORDS

Infant, Newborn; Infant, Premature; Feeding; Intensive Care, Neonatal; Breast Feeding, oral motor muscle stimulation

### INTRODUCTION

Prematurity is one of the main factors that provoke neonatal complications because it retains the newborn's (NB) natural development. Besides, the preterm infant is inclined to other future complications, as cognitive function development compromising<sup>1</sup>.

According to WHO, the preterm newborn (PTNB) or premature is that the one that was born before the 37th gestational week. The classification for those neonates is predicated on the gestational age (GA), birth weight, on the relation weight and GA, and also corrected gestational age (CGA). These data help to evaluate the baby's size and development after the 40th weeks of gestation<sup>2</sup>.

The intrauterine fetal growing is fast and therefore the organs are constantly through cell division necessary to finish development, therefore the prematurity or interruption of the right gestational time exposes the NB to factors that compromise their pulmonary maturation, the oral sensorimotor system (OSM), and the thermoregulatory function, also to restrict the nutritive reserve of fat due to anatomic-physiologic issues<sup>3</sup>.

Organic maturity deficiency causes incoordination in breathing, swallowing, and sucking (BSS) and treated the Preterm Newborn less than 34 gestational weeks with the use of a gastric tube as a feeding alternative. This invasive procedure is necessary but retains the infant to receive sensorial stimuli important for OSM development<sup>4</sup>.

Knowing the techniques used in children's hospitals and also of the impact in a child's life is essential to promote exclusive breastfeeding, contributing not only to early discharge of the preterm neonate but also to a correct alimentation, safe and effective.

Regarding oral motor muscle stimulation therapy, this article aims to develop a systematic review of national and international literature to establish different techniques of OSM maturation and discuss their effectiveness in preterm neonates that remain in the hospital environment.

### METHODS

It is a systematic review of the literature published national and international. From the years 2006 to 2019 were selected articles published in journals indexed on PUBMED, Google Scholarly Articles, "Scientific Electronic Library" (SciELO), and "Medical Literature Analysis and Retrieval System Online" (MEDLINE).

It was selected the keywords: newborn, oral stimulation, and feeding. The study descriptors were combined and isolatedly inserted in all possible manners, respecting the restrictors: a human, newborns, and publication language used is English. The researcher read the texts and it was selected only articles that emphasize techniques applied in a neonatal hospital environment with preterm newborns, published from

2006 to 2019.

Data were analyzed qualitatively and quantitatively. The qualitative analysis was made by disposing of the results in the following categories: techniques used in India; techniques used in other countries; techniques consider being effective; techniques consider being not effective or not statistically significant. The classification with regards to the effectiveness of the techniques was justified based on publication conclusions analysis.

The quantitative analysis was based on getting the absolute and relative percentage frequency of the results classified on the categories above cited.

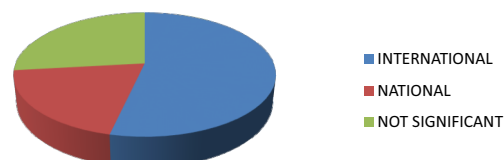
It was disqualified articles published out of the period proposed, repeated articles, not available online or that did not attend the research objectives.

### Literature Review

#### General View

First, it was found 56 articles, though, only 41 (30 International +11 National journals) fulfilled the inclusion criteria and they were analyzed (Figure 1).

**FIG. 1 - TOTAL ARTICLES ANALYZED**



The majority of the studies, both conducted in a national and international scope, had their sample constituted from the themes with prematurity. Among national articles, it had been evident the practice of non-nutritive sucking (NNS) with a gloved finger because the main technique applied in NICUs. Also, an alternative to oral stimulation and feeding is the nutritive sucking (NS) with a bottle. Those interventions were cited because the most applied and therefore the NNS in empty breast and the NS within the maternal breast are the techniques less referred by authors (Table 1).

**Table 1:** International Journals Citation of techniques performed with preterm newborns in neonatal therapy cares (2006-2019)

Techniques	No of citation in articles	Percentage (%)
NNS in gloved finger	10	33.33
NNS in orthodontic pacifier	6	20

NS in bottle	2	6.67
Oral motor stimulation	4	13.33
NS in cup	2	6.67
NS in maternal Breast	2	6.67
NNS in Empty Breast	2	6.67
NS finger like tube	2	6.67
Total	30	100

Legend: NNS=Non-nutritive suction; NS=Nutritive Suction.

The international articles mentioned the NNS technique with synthetic nipple and therefore the oral sensorimotor stimulation because the most current within the stimulation of preterm neonates. The NNS was performed with a replacement technologic device, a pressured electronic pacifier named NTrainer(r) (Table 2).

**Table 2:** National Journals Citation of techniques performed with preterm newborns in neonatal therapy cares (2006-2019)

Techniques	No of citation in articles	Percentage (%)
NNS with pacifier	3	27
Oralsensorimotor stimulation	3	27
Tactile-Kinesthetic stimulation	2	19
NNS electronic pacifier(nTrainer®)	1	9
NNSgloved finger	1	9
NSin bottle + oral support	1	9
Total	11	100

Legend: NNS=Non-nutritive suction; NS=Nutritive Suction.

Contrary to India the NSS in the gloved finger was less cited by international authors. When international articles were analyzed, the natural feeding techniques similar to this practice were not described. Although there are differences within the described interventions in national and international articles, the studies focused that techniques closer to natural breastfeeding are rarely used with preterm neonates. Most of the analyzed studies agreed that the oral stimulation in PTNB provides the acceleration within the maturation of oral functions and, therefore, decrease hospitalization time (Table 3).

The effectiveness of the techniques applied was quantified in (Table 3). The gloved finger NNS is presented as Best, emphasizing the benefits for OSS maturation. The improvement within the oral pattern suggests the importance of intervention on these PTNB babies.

**Table 3:** Number of publications evaluating the efficacy of the techniques for maturation of the oral sensorimotor system, according to the conclusion of the authors studied.

Techniques	Effective (N)	Not Effective Not Significant (N)
NNSin gloved finger	9	2
NNS pacifier	6	1
NNS electronic pacifier	2	0
NNS empty breast	1	0
NScup	2	0
NS maternal Breast	2	0
NS finger tube	1	0
NS bottle	3	2
NS bottle + oral support	1	0
Oral sensorimotor stimulation	5	2
Tactile-kinesthetic stimulation	2	0
Total	34	7

Legend: NNS=Non-nutritive suction; NS=Nutritive Suction.

The literature describes the NNS stimulation as benefic since it fits the oral muscles, contributes to NB's weight gain, stables the awareness states, and simplifies the digesting process, enabling to anticipate the transition of a feeding tube to OF.

The NNS is generally performed using the small finger gloved. This technique is effective to promote NB oral reflex maturation which ultimately provides proper coordination on Breathing, sucking, and swallowing<sup>3</sup>. The NNS soothes, and improves the organization of preterm babies and also helps the cerebral oxygenation<sup>6</sup>.

The literature review highlighted that NNS in little finger gloved related to intraoral manipulation accelerates the transition of the tube

to oral via, without compromise the weight gain in preterm newborns. The sensible observations of breathing and heart frequency, the time between the tube and complete oral feeding, and weight gain verify the effectiveness of this intervention on PTNB. The intervention improves the neonate's maturation process and muscle coordination<sup>9, 10</sup>. The NNS within the gloved small finger and oral motor stimulation of OSS enhance the responses of oral reflexes, the NS pattern, and thus the advantages of oral diet, contributing to exclusive breastfeeding<sup>11</sup>.

Pimenta et al.<sup>12</sup> to evaluation and stimulation 98 PTNB of very low weight and concluded that those are having significant benefits used the NNS technique with a gloved small finger.

Rocha and Delgado<sup>13</sup> stated the oral-tactile stimulation in PTNB affected by gastroschisis (gastric pathology) related to prematurity. They stated that the NNS associated with a gloved finger to non-oral stimulation provided adequacy of the stomatognathic system and contributed to enhancing breastfeeding.

Delgado<sup>14</sup> reports positive results for the transition of gastric to OF by stimulation of the PTNB stomatognathic system presenting genetic syndromes (Popliteal Pterygium Syndrome). The results weren't specifically significant to the technique of NNS with small finger gloved, but to the association with an orthodontic pacifier and bottle sucking.

Costa et al.<sup>15</sup> investigated the impact of oral-stimulation associated with oral and non-oral manipulation on heart and breathing frequencies, and transference index (value obtained from dividing the ingested volume by the prescribed volume in milliliters), time on the transition gastric feeding to exclusive oral feeding and PTNB weight gain; the conclusion was among the 13 stimulated infants and thus the 15 of the control group were statistically insignificant.

It is pre-recognized to perform the oral and non-oral stimulation before the NB feeding time and therefore the sucking stimulation occurs during gastric feeding the baby associates satiation to the sucking action. Some authors<sup>6, 12, 13</sup> disagree with the usage of the gloved finger NNS and an orthodontic pacifier in such interventions.

Delgado et al.<sup>14</sup> used the NNS technique with small finger gloved only to find out the PTNB pattern of sucking. Focusing on the development of the OSS they choose to use orthodontic nipples as the main stimulation resources. Therefore, the success of the intervention with the use of artificial nipples was associated.

The impact of the pacifier on the PTNB's life during the hospitalization period and also after discharge has been the focus of several discussions about the benefit and malefaction of using the synthetic nipple during this type of stimulation.

By the sample of the publications analyzed, it had been possible to watch that a lot of professionals use the pacifier as an NNS technique in preterm neonates.

Pimenta et al.<sup>12</sup> reports that the PTNB of very low weight are often beneficiated by NNS with a gloved finger and artificial nipple, proved by the development in sucking process, development in OSS, and hospital discharge with breastfeeding allowed. The authors stated that shorter time SSB in newborns related to pacifier sucking during gastric feeding.

The NNS stimulation with pacifiers must follow strict specific criteria. The majority of the articles ask the precise pacifier for preterm of the brand Nuk(r), as ideal to stimulation.

Neiva and Leone<sup>17</sup> emphasized that the sucking of pacifiers with such specifications may contribute to the lip closure, tongue central groove formation, and coordination among SSB, important aspects to early OF diet and hospital discharge.

Neiva and Leone<sup>18</sup> suggest that the evolution post-birth of the sucking rhythm is especially associated with the maturation process, that is, although the advantages highlighted about the sucking stimulation with the orthodontic nipple.

In the studies defending the use of pacifier as an efficient oral motor stimulus, Volkmer<sup>19</sup> reinforces the use as a stimulus source, to require

care of the PTNB in alert, which can be associated with better feeding and greater behavioral organization. He affirms the NNS stimulation with pacifier don't alteration on breathing patterns, which is important for these babies, that since very early got to be submitted to oxygen therapy and surfactants.

The pacifier is an instrument much used for NNS stimulation, however, it is preconized the use of gloved finger and cup so the newborn does not make confusion with synthetic and maternal nipples<sup>3</sup>. Studies show that synthetic nipples sucking is usually associated with early weaning<sup>20,21</sup>. Unfortunately, according to Venson et al.<sup>22</sup>, oral-tactile stimulation has been away hardly used.

The technique of the empty breast NNS is an alternative so the PTNB does not make confusion with nipples and breastfeeding is encouraged. At the same time, it stimulates the NNS, is safe to the baby that does not coordinate the SSB, and establishes an affective bond between mother and son<sup>23</sup>.

The inadequate use of pacifiers causes damages to speak development since it reduces the babbling, sound imitation and words evoke. Castilho and Rocha<sup>24</sup> add that, regarding the stomatognathic system, this NNS modifies the tongue mobility and its rest position within the mouth, making it difficult the swallowing and also chewing. The tongue anteriorization modifies the intraoral pressure resulting in teeth protrusion collaborating to oral breathing in the future. The PTNB who uses a pacifier during the stimulation period is predisposed to the addition of this type of NNS and susceptible to the alteration mentioned above through childhood<sup>24</sup>.

The PTNB when presenting favorable conditions as proper sucking, SSB coordination, and proper gastric feeding weaning. The NS within the bottle or maternal breast is additionally an option for feeding and stimulates the PTNB. The natural stimulation within the maternal breast is preferred to bottle feeding, since it provides the perioral muscles exercise for correct development of the stomatognathic system, satisfies the baby emotionally narrowing the bond between mother and son and anticipates hospital discharge<sup>25</sup>.

A study conducted with PTNB suffering from popliteal pterygium syndrome which also causes craniofacial anomalies presented improvement in oral patterns after speech therapy intervention. The transition from gastric feeding to OF was developed with NS in the bottle. Results presented mouth opening normalization, adequacy of biting, and gag reflexes, increasing within the quantity of strong sucking and proper coordination, breathing stability, and completely OF diet. It is important to mention that this study, developed the NNS stimulation before offering the OF diet, which contributed essentially to results<sup>14</sup>.

Delgado<sup>14</sup> suggests when, besides prematurity, the baby carries any pathology that difficult or makes impossible the positioning within the maternal breast, the techniques are often adapted, regarding the characteristics of each newborn. It is emphasized that breastfeeding should be a priority since it is essential for babies in this phase.

In according, Pedras et al.<sup>26</sup> emphasize that breast milk is important for neonates, because it feeds fully, the sucking movements provide craniofacial development, enhancing breathing-chewing-swallowing and speaking functions. Also contributing to the affective bond between mother and baby reduces costs, and overall, results in decreasing the infant morbi-mortality index<sup>26</sup>.

Concerning effective breastfeeding, the NS in a bottle used in NICU can be applied as a favorable technique, when developed properly<sup>23</sup>. According to Medeiros and Bernardi<sup>21</sup>, the bottle can be used to verify the presence or absence of sucking but does not contribute to the OSS maturation in PTNB. Some authors<sup>17,27</sup> believe that the OSS maturation and thus the first hospital discharge also are results of the GAC advance. Therefore, it's questionable for these authors if the bottle use brings any benefits during the hospitalization period of those babies.

Neiva<sup>28</sup> enounce that using the bottle can put the NB life at risk since the nipples have a bigger flow of milk and can cause choking. Besides, synthetic nipples contribute to early weaning and thus, are directly connected to noxious habits that influence negatively chewing, swallowing, breathing, and phoneme articulation<sup>28</sup>.

World Health Organization, aiming to promote exclusive breastfeeding

and following "ten steps to succeed in breastfeeding" includes the use of cups in this issue.

It is an alternate method for OF within the mother's absence, therefore the NB doesn't confuse the bottle and therefore the maternal nipple<sup>26</sup>.

Besides, the cup is described as a technique that helps babies there are in the transitory phase from gastric feeding to OF in maternal breast and also as an evaluative tool of SSB on PTNBs<sup>11,23</sup>.

Although, according to Almeida and Modes<sup>3</sup>, it is an alternative to avoid using bottles and providing mothers confidence to follow exclusive breastfeeding.

Another option to avoid synthetic nipples, inside children's hospital, is NS using the finger tube. Calado and Souza<sup>11</sup> quote that this system is often applied to the evaluation of the sucking, swallowing, and coordination reflexes among SSB. The study was based on the amount of diet ingested by NB and it was proved to present better use of the OF diet by enhancing oral reflexes and NNS patterns.

According to Almeida and Modes<sup>3</sup>, the finger tube technique can be indicated to newborns that did not receive the diet in the cup, that need longer hospitalization time, or presented neurologic complications<sup>3</sup>.

Fujinaga et al.<sup>29</sup> reported that the finger tube technique applied along with the gastric tube connected to a syringe with the plunger and attached to a little finger gloved, this technique should help in fitting the sucking pattern of PTNB or on term NB who presented oral disorders<sup>29</sup>.

Hwang et al.<sup>33</sup> It was offered the pacifier as NNS stimuli. Both stimulated PTNB and control group did not present performance statistically significant, but regarding the NNS work, the stimulated group presented a greater number of sucking than the control group.

It was applied the NNS stimulation in little finger gloved in less than half of the international articles analyzed, which is disagreeing compare to Brazilian findings, in which there is a priority to practice this technique.

## FINAL CONSIDERATIONS

The analyzed sample of national articles attested the non-nutritive sucking technique with the little finger gloved as the most current practice in neonatal intensive care units, followed by the non-nutritive sucking with pacifier. Both techniques presented to be effective in the OSMS maturation process, providing an early the hospital discharge of the preterm newborns.

The sample of international articles showed that the practice of the non-nutritive sucking technique associated to body and oral and non-oral manipulation reflect positively on neonates' development of the oral function. Further, it brings further knowledge about technologies aiming to improve the sucking patterns in preterm newborns.

Breastfeed should be promoted on children hospital environment and the techniques of NNS and NS performed in PTNB may contribute to the success of breastfeed or provoke an early weaning process, when occurs the use of synthetic nipples.

New studies should be developed focusing the impacts of oral motor muscle stimulation with NNS with orthodontic pacifier and NS in bottle during the lactation process. There is a necessity of systematic and scientific data about the progressive outcome of preterm infant during the period of PTNB hospitalization and after hospital discharge.

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