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Original Article

Artigo Original

Premature: growth and its relation to oral skills

Prematuros: crescimento e sua relação com as habilidades orais

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Keywords

Infant, premature
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ABSTRACT

Objective: To evaluate the influence of oral motor skills of premature infants on their oral feeding performance and growth, during neonatal hospitalization. **Methods:** Fifty-one newborns hospitalized in the neonatal intensive care unit of a hospital in Southern Brazil, between July 2012 and March 2013, were evaluated. The evaluation of oral feeding skills, according to Lau and Smith, was applied after prescription for starting oral feeding. The oral feeding performance was analyzed using the following variables: days taken to start independent oral feeding and hospital discharge. Growth was measured by weight, length, and head circumference, using the curves of Fenton, at birth, first and independent oral feeding, and hospital discharge. **Results:** At birth, 71% preterm infants were proper for gestational age, most of them were males (53%), with average of 33.6 (±1.5) weeks of gestational age. The gestational age in the assessment did not influence the oral feeding performance of the premature infant and did not differ between levels. Time of transition from tube feeding to oral feeding and hospital stay was shorter when the oral skills were higher. At birth, there was a tendency of low weight and low oral feeding performance. Level IV premature infants in the release of oral feeding presented higher weights. **Conclusion:** The level of oral skills of the premature infant interfered positively on time of feeding transition from tube to independent oral feeding and hospital stay. Growth, represented by weight gain, was not affected by the level of oral skill.

Descritores

Prematuro
Habilidade
Alimentação
Crescimento

RESUMO

Objetivo: Avaliar a influência da habilidade motora oral do prematuro sobre seu desempenho alimentar oral e crescimento, durante o período de internação neonatal. **Métodos:** Foram avaliados 51 recém-nascidos (RNs) internados na Unidade de Tratamento Intensivo (UTI) Neonatal de um hospital do Sul do Brasil, entre julho 2012 e março 2013. A avaliação da habilidade de alimentação oral, segundo Lau e Smith, foi realizada após prescrição para início da alimentação por via oral (VO). O desempenho alimentar oral foi avaliado por meio das variáveis dias de transição da sonda para VO plena e tempo de internação. O crescimento foi avaliado por peso, comprimento e perímetro cefálico (PC), utilizando as curvas de Fenton, no nascimento, liberação VO, VO plena e alta hospitalar. **Resultados:** Ao nascer, 71% dos prematuros eram adequados para idade gestacional, a maioria era do sexo masculino (53%), tendo média de 33,6 (±1,5) semanas de idade gestacional. A idade gestacional nos momentos avaliados não influenciou na habilidade oral do pré-termo, não diferindo entre os níveis. O tempo de transição da sonda para VO plena e o período de internação hospitalar foram menores quanto maior o nível de habilidade oral. Ao nascer, houve uma tendência a baixo peso e baixa habilidade oral. Na liberação da VO, as crianças do nível IV apresentaram maior peso. **Conclusão:** O nível de habilidade oral do prematuro interferiu positivamente no tempo de transição alimentar da sonda para VO plena e permanência hospitalar. O crescimento, representado pelo ganho de peso, não sofreu influência do nível de habilidade oral.

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INTRODUCTION

The growth of a preterm infant (PTI) during hospitalization in the neonatal intensive care unit (NICU) has been a great concern of all the teams, given the association of this period with short- or long-term problems. Inappropriate nutrition has an impact on neurodevelopment, and the feeding skill is closely related to this process, reflecting on the evolution of a premature infant.

The newborn (NB) presents, in general, gastrointestinal immaturity. However, the PTI not only has this condition but also many others that make proper growth and development difficult. From the nutritional point of view, the birth of a PTI represents an urgency, not only due to its scarce energetic supply but especially because the evidence that associate postnatal growth restriction with side and permanent effects is strong in the central nervous system development[1]. In the first years of life, suction has a necessary role for an effective oral feeding. It needs to be coordinated with swallowing and breathing[2]. Thus, one of the greatest challenges inside the NICU is to properly feed the premature infant by providing a growth that is similar to the fetal one.

To achieve proper oral feeding, it is essential that the stomatognathic system is integral. Therefore, for starting oral feeding, it is very important to assess the PTI oral skills and, if necessary, intervene on the oral motor system to minimize the observed difficulties[3].

However, the evaluation of premature oral skills to begin oral feeding has been a hard task, especially due to the lack of well-established outcome measures, even though oral skill evaluation scales or protocols (feeding promptness) have been proposed. These tools include the Neonatal Oral-Motor Assessment Scale[4], the Early Feeding Skill Assessment[5], and scales recommended by Brazilian investigators[6-8]. However, these instruments are based on subjective evaluations, that is, their results depend on observation and consequently on the professional's experience.

More recently, in 2011, the proposal of an evaluation protocol regarding the premature infant's oral feeding skill through objective analysis appeared in literature. It was done from the combination of the variables proficiency and transference rate that were obtained in the first oral breast-feeding[9]. On the basis of the value found for these variables, the authors classify oral feeding skill in levels and, according to such information, suggest the necessary intervention demands. This proposal seems promising regarding PTI care as it can help objectively the speech language pathologist with the therapeutic planning, thus avoiding unnecessary procedures.

On the basis of this information, the objective of this study was assessing, during the neonatal hospitalization period, the influence of the PTI oral skill on his/her oral feeding performance and growth.

METHODS

This is a descriptive longitudinal study comprising PTIs hospitalized in the NICU of a University Hospital in Southern Brazil, during the period from July 2012 to March 2013.

The inclusion criteria were the following: gestational age (GA) at birth lower than 37 weeks (calculated through clinical evaluation[10]); prescription to begin oral feeding (stable clinical picture, weight above 1,500 g, GA of about 34 weeks); and informed consent signed by parents or legal guardians. Exclusion criteria were the following: head and neck malformations; genetic syndromes; grades III and IV intracranial hemorrhage (diagnosed in the cranial ultrasound); perinatal asphyxia (defined at the fifth minute Apgar score lower or equal to 5); and bilirubin encephalopathy. On the basis of the inclusion and exclusion criteria, 51 PTI were chosen, analyzed, and followed-up in this study.

The following information was taken from medical records of the participants: gender, corrected GA (CGA) and at birth, clinical history, weight, length, and cephalic perimeter (CP) at birth, intrauterine growth (IUG) adequacy[11], and first and fifth minute Apgar scores. The CGA (post-conception age) was considered, and the chronological age (changed to weeks) was added to the GA at birth.

Oral feeding performance was analyzed through the following variables: days of transition from tube to independent oral feeding (acceptance of all oral breast-feeds, for a minimum period of 24 hours) and hospitalization time in days.

Growth was assessed by weight, length, and CP using specific curves for such population[11]. These measures were taken at hospital stay, oral feeding release, independent oral feeding achievement, and hospital discharge. A previously trained team took the measures.

The anthropometric variables were measured in duplicate (using the mean), with the NB wearing no garment at weighting, and instruments were gauged as recommended by the Ministry of Health[12]:

- weight: in grams, through a digital scale of Mic Baby®, which is exclusively used to weigh babies with at least 5 g and at most 15 kg.
- length: in centimeters, obtained with the NB in dorsal decubitus on a tough surface, using a plastic ruler (with a 0.1 cm closeness), where one extremity was fixed (cephalic) and the other was mobile (podalic), and another person from the team was helping to position the NB properly.
- CP: in centimeters, with an inextensible tape measure (closeness of 0.1 cm), considering the highest occipitofrontal diameter.

A speech language pathologist performed the oral skill assessment after the indication to begin oral feeding in the first milk offered through this oral pathway, following the suggested protocol[9]. A baby bottle with a nipple for premature infants from NUK® was used. It was kept throughout the entire study period. The PTI was on the evaluator's lap or in an incubator at an angle of about 45° and was orally fed during a maximum time of 20 minutes. Nobody handled the children for at least 30 minutes before the assessment to avoid fatigue. During feeding, the PTI were monitored with a pediatric oximeter from Ohmeda®.

For oral skill assessment, proficiency and transference rate were measured as further described:

- proficiency (PRO): percentage (%) of the swallowed volume (regarding the prescription) in the first 5 minutes of breast-feeding. Because there is a small fatigue in the first 5 minutes, this measure represents a skill index of the PTI's oral feeding.
- Transference rate (TR): amount of milk orally accepted compared to the time needed or spent for such (mL/minute). Because the TR is monitored through the entire breast-feeding act, it represents a resistance index.

From PRO and TR, oral feeding skill was classified into four levels that also determined the kind of speech language pathology and audiology intervention that should be performed:

- Level 1 = PRO<30% and TR<1.5 mL/min indicating low oral feeding skill and low resistance. Intervention: oral-sensorimotor stimulation and resistance training.
- Level 2 = PRO<30% and TR>1.5 mL/min indicating low oral feeding skill and high resistance. Intervention: oral-sensorimotor stimulation.
- Level 3 = PRO<30% and TR>1.5 mL/min indicating high oral skill and low resistance. Intervention: resistance training.
- Level 4 = PRO<30% and TR>1.5 mL/min indicating high oral skill and high resistance. There was no need of speech language pathology and audiology intervention.

A speech language pathologist performed this oral-sensorimotor stimulation program[13], once a day, before diet offer.

The resistance training meant the release through oral pathway for at most 5 minutes; after a daily addition of 20% in the oral acceptance, time was increased to 10, 15, and 20 minutes, in a progressive basis.

Results were typed in a database in Excel program and were then analyzed using the Stata software, version 10. Adherence to normality of variables was seen through Shapiro-Wilk test. Variables were expressed in mean, standard deviation, and frequencies. Comparison among groups for continued variables was performed through the analysis of variance, using Bonferroni post-test as a complement. A 5% significance level was accepted ($p<0.05$).

Ethical criteria were in the informed consent that was developed based on the determinations of Resolution 466/2012, from the National Commission of Ethics Research and from the Data Confidentiality Agreement. The study was approved by the research ethics committees from the teaching institution, with CAEE number 11155312.7.0000.5346 and approval number 187.634.

RESULTS

Fifty-one PTI participated in this study, 53% were boys and 47% were girls. The GA at birth was, in average, 33.6 (±1.5) weeks. Most of them (71%) were classified as appropriate, 25% were considered small, and 4% were big for the GA.

Table 1 presents the GA of participants in the four moments evaluated according to the level of oral skill found in the protocol used. In the studied group, 41% were considered level I, 10% level II, 18% level III, and 31% level IV. The GA at birth and in oral feeding does not influence the preterm oral skills, and it was not different between levels I, II, III, and IV. In the independent oral feeding, the CGA of level IV children was below, in average, a week, if compared to levels I, II, and III ($p=0.0172$).

The oral feeding performance assessed using the days of transition from tube to complete oral feeding and through hospitalization time, based on the level of oral skill, is present in Table 2. It has been seen that level IV children were fed independently through the oral pathway, in average, with 7 or more days than level I, II, and III children ($p=0.116$). Hospitalization time was also lower in level IV children as compared to children from levels I, II and III, although there was no statistical difference.

Table 3 presents the premature infant growth during hospitalization period, based on the presented oral skill level. A tendency of low weight and low oral skill ($p>0.05$) at birth was seen. After releasing oral feeding, level IV children weighted more, which is a statistically significant difference, when compared to children from level I ($p=0.021$). However, in independent oral feeding and hospital discharge, weight was similar, regardless the oral skill level of the PTI.

There was also a significant difference in the length (at birth and at oral feeding approval) and in the CP (in the oral feeding release) among children with levels I and IV of skill.

Table 1. Gestational age mean of preterm newborns in the four assessed moments based on their oral skill level[9]

Evaluation moment	Oral skill level				p-value**
	I	II	III	IV	
n (%)	21 (41)	5 (10)	9 (18)	16 (31)	–
Birth*	33.3±1.4	33.7±1.2	34.2±1.1	33.7±1.9	0.5159
Oral feeding release*	35.1±1.5	35.6±1.3	35.2±0.9	35.0±1.1	0.8289
Independent oral feeding*	37.3±1.6	37.9±1.8	37.8±1.0[a]	36.1±1.4[a]	0.0172
Discharge*	38.4±2.3	38.5±2.2	38.6±1.0	37.1±1.4	0.1171

*Values expressed in mean and standard deviation; **p-value: analysis of variance (ANOVA) and Bonferroni post-test (differences between superscript letters)
Caption: GA = gestational age

Table 2. Transition days from tube to independent oral feeding and hospitalization days based on the oral skill level[9]

Variables	Oral skill level				p-value**
	I	II	III	IV	
n (%)	21 (41)	5 (10)	9 (18)	16 (31)	–
Transition days*	15.2±7.7[a]	16.0±3.3	18.1±8.9[b]	7.6±8.9[a,b]	0.0116
Hospitalization days*	35.8±15.7	33.6±11.2	31.2±6.1	23.7±18.5	0.1307

*Values expressed in mean and standard deviation; **p-value: analysis of variance (ANOVA) and Bonferroni post-test (differences between superscript letters)

Table 3. Mean of weight, length, and cephalic perimeter in the four evaluated moments based on the oral skill level[9]

Anthropometric measures	Oral skill level				p-value**
	I	II	III	IV	
At birth*					
Weight (g)	1.692±452	1.645±302	1.800±198	2.120±685	0.066
Length (cm)	41.0±2.9[a]	42.4±2.1	41.5±2.5	43.9±3.4[a]	0.035
CP (cm)	29.1±2.1	29.6±1.9	30.7±0.8	30.6±2.4	0.129
Oral feeding release*					
Weight (g)	1.799±255[a]	1.820±259	1.800±209	2.169±556[a]	0.021
Length (cm)	43.2±3.2[a]	43±1.4	43.3±1.7	45.7±1.6[a]	0.049
CP (cm)	30.2±1.4[a]	29.2±1.0	31.2±1.2	31.8±1.9[a]	0.032
Independent oral feeding*					
Weight (g)	2.264±337	2.441±566	2.340±235	2.302±511	0.843
Length (cm)	45.3±2.7	–	45.7±1.2	45.8±1.6	0.790
CP (cm)	32.1±1.2	–	33.2±1.6	32.3±1.8	0.320
Hospital discharge*					
Weight (g)	2.459±323	2.549±592	2.502±238	2.502±459	0.964
Length (cm)	46.5±2.3	46.6±4.2	48.0±2.0	47.2±2.3	0.579
CP (cm)	32.9±1.4	34.2±1.9	34.2±1.4	32.6±1.5	0.082

*Values expressed in mean and standard deviation; **p-value: analysis of variance (ANOVA) and Bonferroni post-test (differences between superscript letters)
Caption: CP = cephalic perimeter.

DISCUSSION

This study assessed the oral skill level of PTI and its relationship with oral feeding performance and growth during the neonatal hospitalization period. It sought to verify if a good skill could contribute for a fast transition from tube feeding to oral feeding, and for weight gain. Many are the causes that interfere in the physical development of this group of children. Because weight evolution is directly connected to nutrient ingestion, it is believed that the presence of an oral feeding skill may have a positive influence in this meaning.

In this study, the PTI oral feeding skill was evaluated using the feeding performance from the first milk offer via oral pathway, based on the proposed protocol[9]. Hence, the proficiency and transference rate variables were determined and used to classify the skill in levels from I to IV, where level I was the worst performance, that is, low skill (PRO<30%) and low resistance to oral breast-feeding (TR<1.5 mL/min), and level IV was the best (good or high skill (PRO≥30%) and oral breast-feeding resistance (TR≥1.5 mL/min). It came to our attention that even though they were allowed to begin oral feeding, based on maturation criteria and favorable clinical condition, half of the 51 evaluated PTIs (51%) were classified as levels I and II, which means low skill for oral feeding. Only one-third of them (31%) had skills and resistance to breast-feeding (level IV), an ideal condition for an efficient and safe oral feeding, without the need of a speech language pathology and audiology intervention. Two aspects have to be highlighted based on this result.

The first one is about the importance and need of performing the oral motor skill evaluation in PTI, when he/she presents a clinical condition to begin oral feeding. This evaluation seems essential, because although many children have CGA that enables starting oral feeding, there is still not yet a stomatognathic system that has been properly developed for such role[9]. This was seen in this study, where the GA at birth and in the beginning of oral feeding did not differ in the groups formed based on the presented oral skill level (Table 1). This result clarifies that the GA is not an essential determiner to indicate the presence of a good oral skill.

Another aspect to be highlighted, which is also related to the importance of oral skill assessment, is its role in the

identification of PTI that really need speech language pathology and audiology intervention, not only to strengthen the structures of the stomatognathic system but also to provide breast-feeding conditioning, avoiding the interference of fatigue in feeding performance. Although there is no evidence about the undesirable effects of speech language pathology and audiology intervention, performing such measure in premature infants with good skill is an unnecessary procedure that could raise the risk of complications due to higher management.

Considering that the aim of this study was verifying if the presence of oral skill could contribute for a faster transition from tube feeding to oral feeding and also influence the PTI growth during neonatal hospitalization, we saw that if the skill level is higher, the transition from tube to oral feeding will be even higher, with a reflex on hospitalization time. The level IV PTI did the transition from tube to oral feeding, on average, in 1 week (7.6±8.9 days), whereas the others took a little less than 2 weeks (p=0.0116) (Table 2). Because the used protocol enables identifying individually the role of oral skill fatigue, level III children, with good skill and low resistance, were found to show the worst performance regarding feeding transition. This result reinforces what other authors have mentioned, that is, fatigue causes an impact on the PTI feeding performance in the same way as the presence of low skill for oral feeding[14,15].

Studies pointed out the effectiveness of the speech language pathology and audiology intervention with regard to previous stimulation of suction in PTI, provided that it is associated with better performance in oral feeding, hospital discharge, and global development of the NB. It is important to also learn that the suction stimulation in PTI is essential for an efficient, pleasurable, and functional feeding in the maternal breast[16].

A study from 2007 aimed at verifying the effectiveness of the speech language pathology and audiology intervention to decrease time of PTI until hospital discharge. The obtained results show the effectiveness of the intervention associated with lower time of hospital discharge[17]. The oral-sensorimotor stimulation has been approached in literature as a positive measure regarding the PTI development, improving the S/D/R coordination, fastening the transition from tube to oral feeding, decreasing hospitalization time, and favoring early weight gain and breast-feeding[18-21].

The PTI classified as levels I, II, and III (low skill and/or low resistance) received the speech language pathology and audiology intervention, whether by oral-sensorimotor stimulation or by resistance training, in this study. Although such attitude has not influenced on the days of feeding transition and hospitalization, it might have contributed for the PTI weight evolution.

Growth, mainly weight gain, based on the presented oral skill level, was also an object of analysis. Weight evolution is directly related to nutrient ingestion, which could be influenced, in the studied group of children, by the oral feeding skill.

At birth and in oral feeding release, weight was higher in the group of children with good skill and resistance to oral breast-feeding (level IV); however, in the achievement of independent oral feeding and hospital discharge, there was no difference between groups. Because children from levels I, II, and III took more time to become independent in oral feeding, it was seen that the level of skill did not have a negative influence on weight gain. On the contrary, the speech language pathology and audiology intervention may have favored weight gain in this group for strengthening oral skills and providing resistance to children from levels I, II, and III. This explains why these children are like those from level IV in independent oral feeding and hospital discharge.

The nutritional evaluation of NB is a hard and necessary task in an NICU, especially when caring PTI, as they were born before the period of larger somatic growth and nutrient storage. Furthermore, it is known that malnutrition in the neonatal period is associated with important problems, especially regarding neurodevelopment[1]. Under this situation, the nutritional evaluation is an essential tool in the daily lives of these children[22]. However, IUG restriction is high in premature infants and nutrient offer is a determiner for proper postnatal growth[23]. Thus, nutrition care, including the speech language pathology and audiology intervention, must have special attention in the neonatal period to ensure a proper growth and a neuropsychomotor development in the PTI, avoiding future sequels[24,1,25].

CONCLUSIONS

From the results provided in this paper, it was possible to conclude that the level of PTI oral skill significantly interfered on the transition time from tube to oral feeding, therefore PTI with higher levels of oral skill changed in less than half of the time if compared to the others. Consequently, these PTI received hospital discharge, in average, a week early.

However, the oral skill level did not influence growth, represented by weight gain. Thus, the advantageous role of the speech language pathology and audiology intervention should be emphasized. It not only improved oral skill but also made possible that the PTI acquired resistance to breast-feeding and, therefore, to have a satisfactory weight evolution in the feeding transition period.

**CLV participated in all processes of this paper, from data collection to writing of this manuscript; LCB took part in data collection, application of speech language and pathology protocol, and contributed in the theoretical referential; EMSS participated in data collection and tabulation and contributed in the theoretical referential; LSP contributed in data collection and application of the speech language and pathology protocol; GB participated in data collection and application of the speech language and pathology protocol; MKS participated in the co-orientation of all processes in this paper; ARMW took part in the guidance to all processes of this paper.*

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