

ORIGINAL ARTICLE

Effects of pacifier use on transition to full breastfeeding and sucking skills in preterm infants: a randomised controlled trial

Vildan Kaya and Aynur Aytekin

Aims and objectives. To determine the effects of pacifier use on transition to full breastfeeding and sucking skills in preterm infants.

Background. Feeding problems in preterm infants cause delays in hospital discharge, extend mother–infant reunification and increase medical cost. Nutritive sucking skills of preterm infants may develop by improving non-nutritive sucking skills and increasing sucking experiences.

Design. A prospective, randomised controlled trial conducted in the Eastern Turkey.

Methods. Seventy infants were randomised into two groups: a pacifier group ($n = 34$) and a control group ($n = 36$). Pacifier use was applied in the preterm infants in the pacifier group, up to switching to full breastfeeding. The infants in the control group did not use pacifiers. Data were collected by a researcher using the Preterm Infant Introductory Information Form, the Preterm Infant Monitoring Form and the LATCH Breastfeeding Assessment Tool. For the study, ethics committee approval, official permission and written informed consents of the families were obtained.

Results. The time to transition to full breastfeeding (123.06 ± 66.56 hours) and the time to discharge (434.50 ± 133.29 hours) in the pacifier group were significantly shorter compared to the control group (167.78 ± 91.77 and 593.63 ± 385.32 hours, respectively) ($p < 0.05$). The weight at transition to full breastfeeding (1944.12 ± 275.67 g) and the weight of discharge (1956.45 ± 268.04 g) in the pacifier group were significantly lower compared to the control group (2155.58 ± 345.57 and 2159.75 ± 341.22 g, respectively) ($p < 0.05$). Sucking skills of the infants in the pacifier group at 48 hours after transition to oral feeding and before the discharge was better than in the control group ($p < 0.05$).

Conclusion. Pacifier use improved the sucking skills and shortened the time to transition to full breastfeeding and to discharge in preterm infants receiving complementary feeding.

Relevance to clinical practice. Pacifier use may be recommended to accelerate transition to full breastfeeding and to improve the sucking skills in preterm infants who were fed by both oral route and complementary feeding in the neonatal intensive care units.

What does this study contribute to the wider global clinical community?

- Feeding problems in preterm infants may cause cessation of body weight gain, a return to gavage feeding and a prolonged discharge in preterm infants. Therefore, after transition to oral feeding, it is quite important to improve sucking skills and accelerate transition to full breastfeeding in preterm infants.
- This study will provide information about infants with poor sucking skills in the transition period to full breastfeeding. Moreover, scientific evidences obtained from this study will guide neonatal nurses, who are responsible for the care of preterm infants in the neonatal intensive care unit.

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Key words: full breastfeeding, nursing, pacifier, preterm infant, sucking skills

Accepted for publication: 9 October 2016

Introduction

Feeding problems in preterm infants cause delays in hospital discharge, extend mother–infant reunification and increase medical cost. Safe, successful and efficient oral feeding accelerates to transition to full breastfeeding in preterm infants (Lau & Hurst 1999). Therefore, preterm infants should have well-coordinated sucking, swallowing and breathing skills (Mizuno & Ueda 2003). Although sucking activity is present by 28 weeks of gestation, preterm infants younger than 34 weeks of gestational age are not able to coordinate sucking, swallowing and breathing (Savaşer 2008, Can 2009, Çavuşoğlu 2013).

There are two types of sucking, namely nutritive and non-nutritive sucking (Dağoğlu 2008). Nutritive sucking skills of preterm infants may develop by improving non-nutritive sucking skills and increasing sucking experiences (Palmer 1993, Pickler & Reyna 2004, Pinelli & Symington 2009, Bingham *et al.* 2010, Yildiz & Arıkan 2012). Studies on this topic have recommended applications of non-nutritive sucking during gavage feeding and after transition to oral feeding in order to improve sucking skills of preterm infants (Hernandez-Reif & Field 2000, Field *et al.* 2004, Efe & Savaşer 2005, Boiron *et al.* 2007, Bragelien *et al.* 2007). One of these applications is the use of pacifiers (Dağoğlu 2008, Pinelli & Symington 2009, Bingham *et al.* 2010, Yildiz & Arıkan 2012).

Background

Pacifier use is the application that enhances non-nutritive sucking by oral stimulation. Pacifiers can be used during gavage feeding and in feeding intervals after transition to oral feeding for achieving sucking coordination (Dağoğlu 2008). There are studies emphasising the benefits of pacifier use in providing the coordination between breathing and sucking–swallowing in preterm infants (Pinelli & Symington 2009, Arvedson *et al.* 2010, Bingham *et al.* 2010, Yildiz & Arıkan 2012).

There are many studies in the literature on pacifier use or oral stimulation applications (Dowling & Thanattherakul 2001, Efe & Savaşer 2005, Boiron *et al.* 2007, Fucile *et al.* 2011, Yildiz & Arıkan 2012). While most of these studies are related to period of gavage feeding, only one study has focused on the sucking skills of preterm infants after

transition to oral feeding (Lau & Smith 2012). In fact, while daily nutritional needs of preterm infants are provided in a controlled manner during gavage feeding, problems are encountered in providing daily requirements of an infant unable to successfully suck his/her mother's breast after transition to oral feeding. Moreover, although a mother is willing to breastfeed, a preterm infant is unable to suck despite all efforts of both mother and nurse. This leads the mother and nurse to become desperate from time to time. These problems may cause cessation of body weight gain, a return to gavage feeding and a prolonged discharge in preterm infants. Therefore, after transition to oral feeding, it is quite important to improve sucking skills and accelerate transition to full breastfeeding in preterm infants. This study will provide information about infants with poor sucking skills in the transition period to full breastfeeding. Moreover, scientific evidences obtained from this study will guide neonatal nurses, who are responsible for the care of preterm infants in the neonatal intensive care unit (NICU). Based on this information, this study aimed to determine the effects of pacifier use on transition to full breastfeeding and sucking skills in preterm infants.

In this study, three hypotheses were advanced: (1) time to transition to full breastfeeding will shorten, (2) time to discharge will shorten, and (3) sucking skills will improve in preterm infants using pacifiers as compared to control not using pacifiers.

Methods

Design

This study was a prospective, randomised controlled trial conducted at a NICU of a university hospital in the Eastern Turkey between 01 November 2013 and 01 March 2014. In this study, a pacifier group including preterm infants using pacifiers and a control group including infants not using pacifiers were compared in terms of time to transition to full breastfeeding and sucking skills of preterm infants. Approval of the Ethics Committee of Ataturk University Faculty of Health Sciences (date: 10 October 2013) and the official permissions from the hospital where the study was conducted were obtained. Additionally, written informed consent was obtained from the family of each preterm infant.

Participants

One-hundred and forty infants were eligible, and 75 of them fulfilling the inclusion and exclusion criteria were included. Preterm infants who were at 30–34 weeks of gestational age with a birthweight of ≥ 1000 g and an Apgar score of >6 and not using pacifiers were included. Preterm infants with a congenital malformation that may cause asphyxia and affect breathing and those with respiratory distress, cranial bleeding, hyperbilirubinemia requiring exchange transfusion, and intestinal anomalies or necrotising enterocolitis were excluded.

Sample size was calculated using the Java Applets Power and Sample Size calculation program (Lenth 2014). According to the power calculation, the power of the study was determined 95% with the effect size of 0.92 (large) at confidence interval of 95% and significance level of 0.05 for analysis of *t*-test ($n_1 = 34$, $n_2 = 36$, $Mean_1 = 6.83$, $SD_1 = 1.27$, $Mean_2 = 7.85$, $SD_2 = 0.92$) (Lenth 2014). According to the sample size calculation, number of infants in the groups was found to be sufficient. The study was completed with 70 preterm infants, of whom 34 were in the pacifier group and 36 were in the control group. The study flow diagram for the enrolment of the preterm infants is illustrated in Fig. 1.

A simple randomisation method was used to allocate infants to groups in order to prevent selection bias or unconscious manipulation in selection. After study groups were matched, control and pacifier groups were determined

by using the method of drawing from a hat. The infants were divided into two groups as follows: (1) control group including infants not using pacifiers and (2) pacifier group including infants using pacifiers.

Previous studies have reported that gestational age and sucking experience are among the factors affecting sucking behaviour of the preterm infants (Palmer 1993, Barlow 2009, Yildiz & Arikian 2012). In this study, the infants were matched in terms of gestational age (30–32 and 33–34 weeks) and LATCH scores (0–2, 3–6 and 7–10 points). LATCH score indicates sucking success of the infants.

Infants were also divided into three according to their LATCH scores as follows: those with a 0–2 points, those with a 3–6 points and those with a 7–10 points. The assessment of the sucking scores of the preterm infants required for assignment to control and pacifier groups was performed at the first breastfeeding performed at the time of transition from gavage feeding to oral feeding.

The assignment of the first preterm infant to one of the groups was performed by drawing of lots. Thereafter, an infant at the same gestational age group and sucking score group was assigned to the other group. By this way, random assignment of the infants to the study groups according to gestational age and sucking score was performed. For instance, an infant in the 30–32 weeks of gestational age with a LATCH score between 3 and 6 points was assigned to the study group by drawing one of the cards marked as A or B. The subsequent preterm infant at the

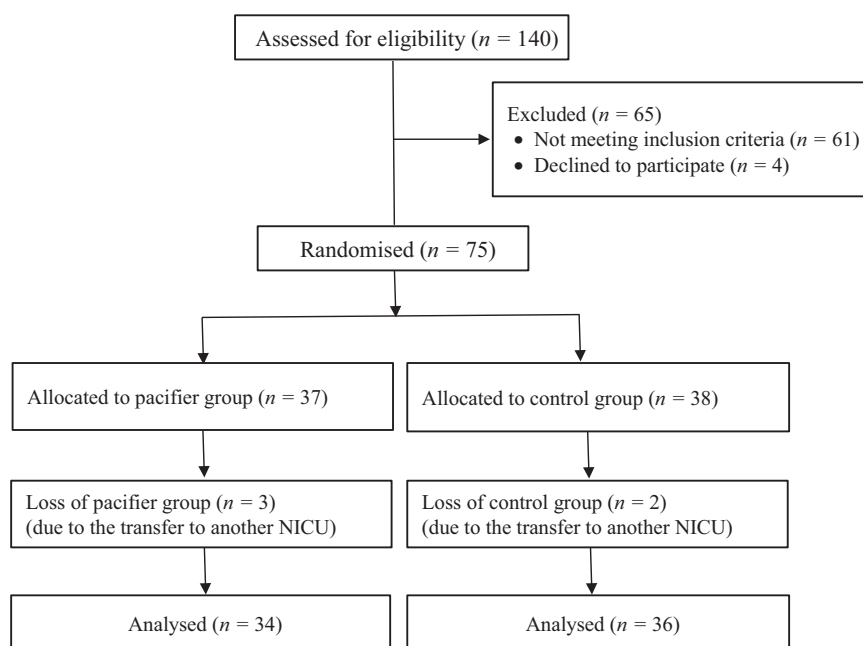


Figure 1 Flow of study.

same gestational age and sucking score was assigned to the other study group. These procedures were repeated for the assignment of all infants to the study groups. Thus, the groups were matched in terms of gestational age and sucking score. The researcher was responsible for the randomisation and the matching of the study groups. Therefore, the researcher was not blinded to the group assignment but the observer was blinded.

Data collection

Data were collected by the researchers using the Preterm Infant Introductory Information Form (PIIF), the Preterm Infant Monitoring Form (PIMF) and the LATCH Breastfeeding Assessment Tool via a face-to-face interview. The PIIF was prepared according to the literature (Standley 2003, Efe & Savaşer 2005, Yıldız *et al.* 2011, Cristofalo *et al.* 2013, Aydın & Yıldız 2014) by the researchers in order to collect informative information about the infant. PIMF is a monitoring form developed by the researchers in order to follow up the infant after switching to oral feeding. This form was used to record the time to transition to oral feeding (transition from gavage feeding to oral feeding), transition to full breastfeeding (transition from partial breastfeeding and spoon-feeding to full breastfeeding), and discharge and the information regarding body weight of the preterm infants.

The LATCH Breastfeeding Assessment Tool was developed by Jensen *et al.* (1994) in Oregon. The LATCH Breastfeeding Assessment Tool is a diagnostic tool with a scoring system similar to the Apgar scoring system. Similar to the Apgar scoring system, it can be scored easily and quickly (Jensen *et al.* 1994, Yenil & Okumuş 2003). The validity of LATCH Breastfeeding Assessment Tool in Turkish population was performed by Yenil and Okumuş (2003). The LATCH Breastfeeding Assessment Tool consists of five evaluation criteria: L (Latch on breast), how well the infant latches onto the breast; A (Audible swallowing), the amount of audible swallowing noted; T (Type of nipple), the mother's nipple type; C (Comfort, breast/nipple), the mother's level of comfort in relation to the nipple; and H (Hold/Help), the amount of help the mother needs to hold her infant to the breast. Each item is rated from 0–2, with the total score of 0 being the lowest and 10 being the highest (Adams & Hewell 1997, Yenil & Okumuş 2003). High scores indicate successful sucking. Cronbach's alpha correlation coefficient of LATCH Breastfeeding Assessment Tool was reported as 0.95 by Yenil and Okumuş (2003), and it was found to be 0.80 in this study.

The other equipment used in this study was a digital infant scale (Seca 727, Hanover, MD, USA), preterm infant

pacifiers (Small Beginnings Inc., Lul' pace & Nu' pace pacifiers, Hesperia, CA, USA), breastmilk storage bottle, baby bottle steriliser and baby bottle warmer. Before use, baby bottle steriliser, baby bottle warmer and infant scale were calibrated.

The procedures were applied at three feeding times every day at 09:00 am, 12:00 am and 3:00 pm. Additionally, every day, the infants were weighed before the first meal (at 09:00 am) and their daily body weights were recorded by the researcher. All data were collected by the researcher; however, as the LATCH Breastfeeding Assessment Tool is a form based on observation, it was filled by the researcher and an observer. Before the initiation of the study, the observer was trained by the researcher on the use of the LATCH Breastfeeding Assessment Tool. The researcher and the observer assessed each preterm infant by scoring the LATCH Breastfeeding Assessment Tool simultaneously but independent from each other at three breastfeeding periods. The inter-rater reliability for the LATCH Breastfeeding Assessment Tool was measured using kappa statistics for the agreement between the two independent observers (Kappa = 0.82); it was close to perfect (Gwet 2012).

Intervention

The PIIF was filled by the researcher with a face-to-face interview in approximately 5–10 min. Information that could not be obtained from the family (gestational age, birthweight, Apgar score, etc.) was obtained from the medical files of the infants. The feeding plan of the infants included in the study was determined according to the feeding protocol of the NICU.

Clinical feeding protocol

Daily nutritional needs of preterm infants switched from gavage feeding to oral feeding are met by breastfeeding followed by spoon-feeding. The required amount of breastmilk that should be given to the preterm infant during spoon-feeding was calculated by the neonatology specialist according to the daily nutritional needs of the infant. The expressed breastmilk for spoon-feeding was warmed to body temperature using a bottle warmer. While this breastfeeding protocol was used for all infants, infants in the pacifier group were also given pacifiers. There was no pacifier use in the routine practice of the NICU.

Control group (n = 36)

In the control group, during the three feeding times (09:00 a.m., 12:00 p.m. and 03:00 p.m.), the mothers were asked to first breastfeed their babies and then to give the required

amount of breastmilk to the infant by spoon-feeding method. Before the first feeding time of each day, the preterm infants were weighed and their body weights were recorded to the PIMF. Pacifiers were not applied in the control group.

Experimental group (n = 34)

In the pacifier group, one hour before each of the three feeding times (09:00 a.m., 12:00 p.m. and 03:00 p.m.), infants were made to use pacifiers. Based on the findings of the previous studies (DiPietro *et al.* 1994, Fucile *et al.* 2011, Lau & Smith 2012), pacifier use was restricted to 15 min at each feeding time. This application was performed without taking infants out of the incubators/open crib. The pacifier was placed in the mouths of the infants by the researcher. If the infant rejected the pacifier, the researcher placed it again. The pacifier use was not applied to the infants at any other time. One hour after pacifier use, the mothers were asked to first breastfeed their babies and then to give the required amount of breastmilk to the infant by spoon-feeding method. Before the first feeding time of each day, the preterm infants were weighed and their body weights were recorded to the PIMF. The pacifiers use continued until transition to full breastfeeding. A different pacifier was used for each infant, and the pacifiers were sterilised in the baby bottle steriliser before use.

The preterm infants in the pacifier and control groups were followed up until discharge. Apart from the information obtained by the PIMF, the preterm infants were assessed by the researcher and observer simultaneously but independently from each other 48 hours after transition to oral feeding (first breastfeeding) and before discharge using the LATCH Breastfeeding Assessment Tool.

Statistical analysis

Statistical analyses were performed using the Statistical Package for the Social Sciences software program (SPSS Inc., Chicago, IL, USA) for Windows (version 18.0). Descriptive statistics were expressed as percentage, mean and standard deviation. The control and pacifier groups were compared by chi-square test and independent *t*-test. Independent *t*-test was used to assess the differences between the pacifier and control groups in terms of time to transition to oral feeding and full breastfeeding and discharge as well as gestational age and body weights at the relevant times. Independent *t*-test was also used to compare the control and pacifier groups in terms of mean scores of LATCH Breastfeeding Assessment Tool. Cronbach's alpha coefficient calculation was used to test the internal

consistency of LATCH Breastfeeding Assessment Tool. Kappa analysis was used to estimate the agreement between the two independent observers. A *p*-value <0.05 was considered statistically significant.

Results

Descriptive characteristics of preterm infants and mothers are presented in Table 1. The groups were comparable due to matching. As seen in Table 1, there was no significant difference between the control and pacifier groups in terms of descriptive characteristics. There was also no significant difference between the groups according to the LATCH scores at first breastfeeding ($p > 0.05$).

The comparison of the control and pacifier groups is presented in Table 2. There were no significant differences in time to transition to oral feeding and the mean body weight at that time. There were also no significant differences in the gestational age at the time of transition to oral feeding and full breastfeeding and discharge ($p > 0.05$). However, there were significant differences between the groups in terms of time to transition to full breastfeeding, the mean body weight at that time ($p < 0.05$). There were also significant differences between the groups regarding the mean time to discharge and body weight at discharge ($p < 0.05$).

The comparison of control and pacifier groups in terms of the mean scores of LATCH Breastfeeding Assessment Tool is presented in Table 3. The mean LATCH score of the pacifier group at 48 hours after transition to oral feeding and before the discharge was significantly higher than that of the control group ($p < 0.05$).

Discussion

Studies have recently focused on non-nutritive sucking interventions that enhance oral feeding performance in preterm infants. In these studies, it has been reported that pacifier use, one of the non-nutritive sucking applications in preterm infants, improves sucking skills, allows transition to full oral feeding at an earlier period and reduces medical cost (Boiron *et al.* 2007, Bragelien *et al.* 2007, Pinelli & Symington 2009, Arvedson *et al.* 2010, Bingham *et al.* 2010, Yildiz & Arikan 2012).

In the present study, the time to transition to full breastfeeding, the time to discharge and the mean body weights at both transition to full breastfeeding and discharge in the pacifier group were lower than in the control group. This indicates that although the mean body weight of the infants in the pacifier group was lower than in the control group, pacifier use provided transition to full breastfeeding at a

Table 1 Comparison of control and pacifier groups according to the preterm infant's and mother's descriptive characteristics

Variable	Control Group (<i>n</i> = 36)				Pacifier Group (<i>n</i> = 34)				χ^2 -value	<i>t</i> value	<i>p</i> value
	<i>n</i>	%	Mean	SD	<i>n</i>	%	Mean	SD			
Gestational age			32.19	1.51			32.71	0.94		1.692	0.095
Birthweight (g)			1662.22	490.51			1704.15	306.18		0.426	0.671
Height (cm)			42.19	5.06			42.59	3.11		0.389	0.698
1st minute APGAR scores			7.19	0.40			7.17	0.39		0.191	0.849
5th minute APGAR scores			8.28	0.45			8.24	0.43		0.401	0.690
Gender											
Female	20	55.6			24	70.6			1.692		0.193
Male	16	44.4			10	29.4					
Gestational age group, weeks											
30–32	19	52.8			17	50.0			0.054		0.816
33–34	17	47.2			17	50.0					
Delivery type											
Vaginal	03	8.3			07	20.6			2.145		0.143
Caesarean	33	91.7			27	79.4					
Number of children											
Two	13	36.1			11	32.4			0.110		0.741
Three or ↑	23	63.9			23	67.6					
LATCH score groups at first breastfeeding											
0–2 scores	–	–			–	–			0.610		0.806
3–6 scores	18	50.0			16	47.1					
7–10 scores	18	50.0			18	52.9					

SD, standard deviation.

Table 2 Comparison of control and pacifier groups according to the characteristics of discharge, to transition period to oral feeding and full breastfeeding

Characteristics	Control Group (<i>n</i> = 36)		Pacifier Group (<i>n</i> = 34)		<i>t</i> value	<i>p</i> value
	Mean	SD	Mean	SD		
Time for transition to oral feeding (h)	358.66	249.87	301.41	111.21	1.226	0.224
Weight at transition to oral feeding (g)	1970.14	309.96	1874.50	279.74	1.353	0.181
Gestational age at transition to oral feeding (wk)	34.33	1.33	34.50	0.92	0.620	0.537
Time for transition to full breastfeeding (h)	167.78	91.77	123.06	66.56	0.322	0.023*
Weight at transition to full breastfeeding (g)	2155.58	345.57	1944.12	275.67	2.820	0.006*
Gestational age at transition to full breastfeeding (wk)	35.32	1.47	35.23	0.96	0.319	0.751
Time to discharge (h)	593.63	385.32	434.50	133.29	2.282	0.026*
Weight of discharge (g)	2159.75	341.22	1956.45	268.04	2.758	0.007*
Gestational age at discharge (wk)	35.73	1.71	35.29	1.04	1.276	0.276

h, hour; g, gram; wk, week; SD, standard deviation.

**p* < 0.05

shorter duration by improving oral feeding skills of these infants. Accordingly, the pacifier group discharged from the hospital earlier compared with the control group.

Studies on this subject have reported that pacifier use in preterm infants helps make the baby awake and active before feeding. It also helps in increasing the secretion of gastrointestinal hormones by accelerating the development of sucking reflexes of the infant. Moreover, it shortens the time to transition to full oral feeding, increases daily weight gain and provides early hospital discharge (Efe & Savaşer

2005, Bragelien *et al.* 2007, Yildiz & Arikan 2012). Gaebler and Hanzlik (1996) determined that the length of hospital stay in preterm infants receiving oral stimulation for five minutes before feeding was shorter than that of the infants in the control group. In their study, Yildiz & Arikan (2012) found that the time to transition to full oral feeding and to discharge were shorter in the preterm infants receiving oral stimulation by pacifiers three times a day compared with the control group. In the meta-analysis by Daley and Kennedy (2000) on interventions used in feeding the

Table 3 Comparison of control and pacifier groups in terms of score means of LATCH Breastfeeding Assessment Tool

Scale	Control Group (<i>n</i> = 36)		Pacifier Group (<i>n</i> = 34)		<i>t</i> value	<i>p</i> value
	Mean	SD	Mean	SD		
LATCH score at first breastfeeding	6.39	1.29	6.73	1.18	1.165	0.248
LATCH scores at 48 hours after transition to oral feeding	6.83	1.27	7.85	0.92	3.808	0.000*
LATCH scores before discharge	8.44	1.05	9.05	0.95	2.555	0.013*

SD, standard deviation.

**p* < 0.05

preterm infants, it was concluded that oral stimulation methods used before and during feeding supported the transition to oral feeding in infants. In another study, strong positive findings were obtained by non-nutritive sucking on improvement in some variables related to feeding or swallowing physiology and on reduction in time to transition to oral feeding (Arvedson *et al.* 2010). In contrast, Lau and Smith (2012) determined that the time to transition to independent oral feeding in the sucking group using pacifiers was similar to that of the control group.

Sucking success is one of the required criteria for NICU discharge of preterm infants, as it allows the provision of daily nutritional needs by breastfeeding and regular body weight gain in infants (Nyqvist *et al.* 1999). Therefore, studies have recommended the use of various interventions (pacifier use, music therapy, odour of breastmilk, kangaroo care, etc.) supporting the development of sucking skills during gavage feeding and/or oral feeding in preterm infants receiving NICU care (Hernandez-Reif & Field 2000, Field *et al.* 2004, Efe & Savaşer 2005, Boiron *et al.* 2007, Bragelien *et al.* 2007, Yildiz *et al.* 2011). In the present study, the sucking success of the preterm infants in the pacifier group at 48 hours after transition to oral feeding and before discharge was significantly higher than in the control group. In the literature, there are many studies using interventions with or without oral stimulation to improve the sucking skills of preterm infants in NICU (DiPietro *et al.* 1994, Boiron *et al.* 2007, Pinelli & Symington 2009, Bingham *et al.* 2010, Yildiz *et al.* 2011, Lau & Smith 2012, Yildiz & Arıkan 2012, Lima *et al.* 2013, Aytėkin *et al.* 2014). Pinelli and Symington (2009) reported that stimulation of non-nutritive sucking (pacifier use) before oral feeding enhanced the sucking success of the preterm infants. In their study, Yildiz and Arıkan (2012) evaluated the sucking skills of preterm infants by giving them pacifiers or making them to listen to lullabies in the NICU and found that the sucking skills of the pacifier group improved more than that of the control and lullaby groups.

Bingham *et al.* (2010) performed a study on 51 preterm infants with a gestational age between 25 and 34 weeks

and evaluated the relation between non-nutritive sucking and oral feeding skills of the infants. They determined that the sucking behaviours were more successful and time to transition to full oral feeding was shorter in the preterm infants receiving non-nutritive sucking applications than in the control group. Standley (2003) conducted a study on premature infants receiving baby bottle feeding in addition to gavage feeding in order to support nutritive sucking and used lullabies and pacifiers for stimulation 15 minutes before baby bottle feeding. In that particular study, it was demonstrated that sucking potential was increased and duration of nutrient intake was shorter in the infants in the experimental group than in the control group. Many previous studies have reported that pacifier use or non-nutritive sucking application improves the sucking behaviours of preterm infants by developing their sucking skills (Gaebler & Hanzlik 1996, Efe & Savaşer 2005, Boiron *et al.* 2007, Bragelien *et al.* 2007, Yildiz & Arıkan 2012).

In the literature, there are also studies indicating that pacifier use has negative effects on the health of the infants and leads to nipple confusion (Mizuno & Ueda 2003, Collins *et al.* 2008, Yurttutan & Uraş 2013). Neifert *et al.* (1995) has been shown that the use of a pacifier, when the infant is learning to suck from the breast in the early postpartum period, may interfere the nipple confusion. Howard *et al.* (1999) determined that the pacifier use in the first 6 weeks was independently associated with shortened full and overall breastfeeding duration. Therefore, it is known that the use of pacifier is not a method required to be absolutely used in every infant but it is a method required to be applied in cases where its benefits are believed to be more than its side effects (Dağođlu 2008). Consequently, taking up-to-date studies on this issue into account (Gaebler & Hanzlik 1996, Efe & Savaşer 2005, Boiron *et al.* 2007, Bragelien *et al.* 2007, Yildiz & Arıkan 2012), the contribution of pacifier use or non-nutritive sucking experience on sucking skills of preterm infants appear as an undeniable reality. In the literature, pacifier use, as an oral stimulation intervention providing non-nutritive sucking, is also recommended during gavage feeding and at feeding intervals to

provide sucking organisation. By using pacifiers, intra-oral salivary glands of the premature infant are stimulated and a large amount of serous and mucous secretions are released. The swallowed secretions keeps the immature gastrointestinal system of the preterm infant in a functional state even if oral feeding is not present and shorten the time to transition from gavage feeding to oral feeding by accelerating absorption (Palmer 1993). When these evidences are considered, the results of the present study are in parallel with the findings of the previous studies in terms of the benefits of pacifier use on sucking skills of preterm infants.

A limitation of the study was that the researcher was not blinded. As the researcher was responsible for the randomisation and matching of the study groups, she was not blinded. Therefore, the observer which assessed the sucking success (LATCH Breastfeeding Assessment Tool) of the infants was ensured to be blinded. The inter-rater reliability for the LATCH Breastfeeding Assessment Tool was close to perfect for the agreement between the two independent observers (Kappa = 0.82).

Another limitation of the study was that the pacifier procedure was carried out only at three feeding times of the day for the infants in the pacifier group. The pacifier procedure was carried out by the researcher. The pacifier procedure was planned by considering hours when the researcher was present in NICU. Additionally, the pacifier procedure was limited with three feeding times by taking previous studies as references (Yildiz *et al.* 2011, Yildiz & Arikan 2012,).

Conclusion

In the present study, pacifier use in preterm infants, who were not able to provide their daily nutritional needs by

breastfeeding despite being transitioned to oral feeding, improved the sucking skills of the infants and shortened the time to transition to full breastfeeding and to discharge. Thus, pacifier use may be recommended to accelerate transition to full breastfeeding and to improve the sucking skills in preterm infants who were fed by both oral route and complementary feeding in the NICUs.

Relevance to clinical practice

The findings of this study suggest that pacifier use is an appropriate intervention to improve the sucking skills and to shorten the time to transition to full breastfeeding and to discharge in preterm infants receiving complementary feeding. Pacifier use may be recommended to accelerate transition to full breastfeeding and to improve the sucking skills in preterm infants who were fed by both oral route and complementary feeding in the neonatal intensive care units.

Contributions

Study design: VK, AA; data collection and analysis: VK, AA; manuscript preparation: VK, AA.

Funding

No Funding.

Conflicts of interest

The authors declare that they have no conflict of interests.

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