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Pacifier habit: history and multidisciplinary view

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Abstract

Objectives: To review the history of pacifiers and to compile a multidisciplinary literature review, searching for pros and cons with the purpose of providing health professionals with arguments when parents request guidance.

Sources: History and art books, as well as non-medical literature and museums were used in the historical survey. Multidisciplinary data were collected from MEDLINE, LILACS, SciELO, and The Cochrane Library. Search criteria were: the keyword "pacifiers" present in articles published in the last 5 years that included abstract and were written in Portuguese, English, or Spanish.

Summary of the findings: There is evidence that their precursors have been used since the Neolithic Period to calm down children. Small balls made of fabric containing food were portrayed in paintings. Other balls made of non-perishable material persisted throughout time. Pacifiers have been used to stimulate sucking or to coordinate this reflex, promoting an earlier beginning of the oral feeding of newborns. Some authors suggest that pacifiers reduce the incidence of the sudden death syndrome, but the topic is controversial. Pacifiers prevent the establishment of breastfeeding and lead to weaning. Their use may cause suffocation, poisoning, or allergies and increase the risk of caries, infections, and intestinal parasitic diseases. Harmful effects are related to frequency, duration, and intensity of the habit. It should be discontinued by the age of 3 or 4, in order not to affect speech and dentition.

Conclusions: There are more harmful effects than benefits. It is advisable that health professionals inform parents of the pros and cons of pacifiers so that they can make a conscious decision regarding its use.

J Pediatr (Rio J). 2009;85(6):480-489: Pacifier, sucking behavior.

Introduction

Textbooks of different health-related fields hardly mention anything about history of pacifier.[1] Even though most health professionals do not recommend the use of pacifiers when questioned about it, families often offer them to their children based on the common belief passed down through generations that pacifiers can calm down children.[2,3]

Pacifiers usually are included in the baby layette and are bought even before the child's birth. Studies have shown that the prevalence of pacifier use is high in the first month of live even among those babies who are born at Child-Friendly Hospitals, where mothers are instructed not to offer pacifiers to avoid nipple confusion, difficulty to establish breastfeeding, or early weaning.[2]

This is a controversial topic, and the answer to the mother's question may vary according to what the professional (psychologist, dentist, speech therapist, pediatrician, otolaryngologist, infection disease specialist)

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wishes to promote.

The objective of the present study was to review the history of pacifiers and to compile a multidisciplinary literature review, searching for pros and cons with the purpose of providing health professionals with arguments when parents request guidance.

Method

Science, history, and art books, as well as non-medical literature and museums were searched. Data were also collected from the medical literature, textbooks, and scientific journals on each specialty using the databases of MEDLINE, LILACS, SciELO, and The Cochrane Library.

The following keywords were used: "nonnutritive," "pacifiers," "dummies," and "comforters" and the research criteria were: articles published in the last 5 years, containing an abstract, with text in Portuguese, English, or Spanish.

After reading the abstracts, we classified the articles according to the topic, as shown in Table 1. The full text of the most relevant articles were obtained and read, and the references cited in these articles were also searched.

Results

History review

Pacifiers were first mentioned in the medical literature at the end of the 15th century by Metlinger (1473) and Rosslin (1513).[1] According to Levin,[1] almost all citations previous to 1900 appeared in texts written in Germany, a region where during the Middle Age breastfeeding was not considered an adequate or healthy feeding method. However, the history of pacifiers dates back to thousands of years ago, since ancient texts by Sorano (2nd century) and Oribasius (4th century) mentioned that sugary objects or honey were used to calm down newborns.[4,5]

Excavations of 3,000-year-old baby's tombs revealed objects made of clay in the shape of pigs, frogs or horses with one hole where honey could be poured in and another hole, in the animal's mouth, that enabled the child to suck their content.[6]

In 1506, Albrecht Dürer portrayed the pacifier on his painting Madonna with a Siskin as a piece of fabric

Table 1 - Classification according to topic of the articles searched in each database

Articles/topic	MEDLINE* n = 110 (19 literature reviews)	SciELO n = 22	LILACS* n = 55	Cochrane Library n = 4 (4 literature reviews)
Accidents	3	–	–	–
Breastfeeding	18	15	19	–
Temporomandibular joint	1	–	1	–
Dental caries	6	–	2	–
Controversies	4	–	5	1
Pain	15	–	–	1
Speech therapy	9	1	5	–
Pacifier shape	3	–	3	–
Infection	6	3	5	–
Temperature measurement	1	–	–	–
Sudden death	21	–	–	–
Orofacial muscles	1	–	–	–
Airway obstruction or clearance	2	–	1	–
Dental occlusion, open bite or crossbite	28	1	14	–
Repeated otitis	3	–	1	1
Psychology	3	1	6	–
Lip and tongue positioning	4	–	–	–
Gastroesophageal reflux	–	–	–	1
Oral breathing	2	–	–	–
Overweight	1	–	–	–
Sleep	1	–	–	–
Toxicity	2	1	2	–

* Some articles were classified at more than one topic.

tied as a padding with food inside it (bread, grains, fat, meat or fish), or embedded in sweet liquid, used to calm down and feed children.[1] It has been also mentioned that these pacifiers could be immersed in alcoholic beverages (brandy) or could contain opiates, being used to calm down those children who were hungry or feeling pain, "making them fall asleep."[5] The painter certainly portrayed on his painting a usual habit of that time. These fabric balls were used for many centuries (up to the 19th century). In the book Ropes of Sand and Other Stories, published in 1873, these objects were described[7]: "[...] a small piece of old linen, from which he cut a scrap carefully; then he proceeded to put a spoon of rather sandy sugar in the center of it; after which he gathered it up into a little ball, and tied a thread tightly around it. "There's a sugar-teat for you" he said with great satisfaction, as he introduced it into the rosy mouth of the child, who tugged at it vigorously [...]."

Pacifiers used to be large enough so that children did not swallow them, and one of the ends had a ring so that it could be held or fastened to the baby's clothes or crib. Many people considered them anti-hygienic.[1]

At the end of the pre-industrial era, as the habit of breastfeeding became less frequent, nonnutritive sucking (NNS) habits became more frequent.[5,8] Until then, breastfeeding (maternal breast or wet nurse) on demand was the predominant method of feeding infants. Breast sucking fulfilled both the infants' nutritional and emotional needs.[5]

Children are born with adaptive reflexes (search, sucking, and swallowing) that help them to survive.[9] Sucking begins between the 17th and 24th week of intrauterine life.[10] Therefore, it is possible to observe babies sucking their fingers while still inside their mothers' uterus.

Newborns suck their mothers' breast because they are hungry, and it is a source of pleasure since their hunger is satiated. Breastfeeding on demand fulfills both their nutritional needs and this drive (search for pleasure).[9] Such reflex, however, starts to change during the first months of life, when it becomes a habit; even when babies are not hungry, they suck, putting every object that seems interesting in their mouths trying to achieve emotional satisfaction.[9,11]

Oral habits (sucking, biting nails, smoking, chewing) relieve tension during anxious situations.[11] Pacifiers are usually offered to children when they cry. The use of pacifiers has been a topic of discussion in the last few years, mainly since 1970, when maternal breastfeeding started to be promoted.[12] Pacifier use has been contraindicated since then not only because it causes nipple confusion and impairs the establishment of breastfeeding but also because it postpones the breastfeeding session when it is used to calm down the baby who is actually hungry, favoring early weaning.[3,13-15] The less the child sucks his/her mother's breast, the less the breast is stimulated to produce milk.

In 1997, Aveling[16] published an article showing that there is evidence of the habit of chewing since the Neolithic Period. According to this author, a 6,500-year-old piece of material had marks of a child's teeth, which may suggest that this habit was used to help to extract deciduous teeth and to relieve the pain of tooth eruption.

Modern pacifiers were designed based on teethers offered to children during the phase of tooth eruption to comfort them. The word "pacifier" demonstrates its usefulness, since the term originates from the verb "to pacify," which means "to calm down." In the 16th century, tooth eruption was considered to be the cause of many deaths.[1] Old teethers (17th century) can be seen in museums such as the Metropolitan Museum of Art in New York,[17] the Victoria and Albert Museum of Childhood,[18] the Norfolk Museum,[19] both located in England, and the Museum of the Royal College of Surgeons, in Edinburgh, Scotland.[20] These objects, made of metal, included a whistle, rattles and a hard part made of choral, bone, ivory, or mother-of-pearl.[6,17] They were not used only to relieve the pain caused by tooth eruption but they also had a mystical meaning, since the rattles and the whistle were used to keep bad spirits and diseases away, which were believed to be responsible for the high rates of child mortality. According to Levin,[1] after the Middle Age, wax candles or gummy root sticks with a sweetened flavor, such as liquorice, dipped in honey were recommended as teethers. In the 18th century, George Armstrong and William Buchan, two English physicians, prescribed crusts and/or "finger-like shaped cookies" for 4- or 5-month-old babies instead of metal teethers.[1,6]

Even though rubber was used in America, it only became popular in Europe after the great discoveries period. Thus, it started to be used to make teethers.[6] Catalogues of Maws (1839) and Sears (1902) showed teethers with a ring at one end and a finger-like shaped stick at the other. Obviously, pacifiers, such as those used nowadays, originated from these teethers.[1,6] At that time, Ellijah Pratt (1845) patented the rubber nipple in the USA. Since its color, flavor and smell were unpleasant, it took a long time for it to begin to be used, and people preferred to use nipples made of cork, ivory, silver, copper, tin, glass, or wood.[21]

In 1894, Luther Emmet Holt published the book "The care and feeding of children: a catechism for the use of mothers and children's nurses," containing instructions on how to take care of a newborn. In this guide, the author warned that it was not advisable to allow babies to suck "rubber nipples" while sleeping.[20]

Industry, mainly during the post-war period, developed the semi-synthetic rubber and, then, the synthetic rubber, eliminating bad smell and unpleasant flavor, as well as traces of lead and allergenic substances (resulting of the chemical

products added to the latex in order to provide it with more elasticity) that could be a risk for health.[6] Since then, the shape of pacifiers changed little.[1] Latex, which did not allow repeated sterilization and was easily torn, was replaced by silicon. Pacifiers, which were initially manufactured as several parts that could disconnect and be dangerous for children (nipple, lip support, and a ring that allowed the pacifier to be held or tied with a ribbon around the neck), started to be made as a single piece including the nipple, the lip support and a round part so that it could be held. The round piece that touches the lips was then shaped as a "kidney," avoiding obstruction of the nostrils in the upper part of the pacifier. Covers were also designed in order to protect pacifiers and avoid contamination while they were not being used.

Some decades ago (1980), dental problems (open bite, crossbite) caused by the prolonged and frequent use of pacifiers prompted the design of orthodontic models. Researchers tried to reduce the harmful effects of pacifiers by changing their shape and making them take the shape of the palate, thus decreasing the forces that contribute to change tooth positioning. During the next years, some studies have demonstrated that these pacifiers do not solve the problem completely.[22]

In spite of the widespread use of pacifiers by families, health professionals have not reached a consensus on their use, and many experts reject pacifiers due to the problems they may cause.[23]

Multidisciplinary view

Psychology

Sucking is an innate reflex, being present since intrauterine life.[9] By sucking, children get in touch with the external world, fulfilling their affective and nutritional needs.

Psychoanalytical theories consider that the human behavior is controlled by conscious and unconscious processes (drives).[9] According to Freud, during the first stage of human psychological development (oral phase, in the first year of life), the motivating force of behavior (drive or libido) is in the oral zone, since it is by sucking the breast that children fulfill their nutritional needs and have pleasure.[9,24] Since the drive is focused on a target, when this target is reached, the tension created by the drive diseppears.[11] The need of sucking is usually reduced at the end of the first year of life, and children go on to the next developmental phase.

Breast sucking, when offered on demand, requires strength, satiates children's hunger, and satisfies their desire of sucking.[11] However, when children are bottle fed, their hunger is satiated, but their drive is not satisfied, which causes NNS with that purpose.[8] Sertório & Silva[3] commented that mothers who do not breastfeed acknowledge the need of sucking not related to feeding and, when they offer their children a pacifier, they notice that "children calm down." With regard to that, Pansy et al.[25] assessed 174 Austrian pairs (mothers and children) using a semi-structured questionnaire and found that 31% of the mothers had changed their opinion regarding the use of pacifiers until their babies turned 5 months. According to the authors, soon after the birth, most mothers (135/174) intended to offer a pacifier to their children and only 39 (out of 174) did not intend to do that. The prevalence of the use of pacifiers when the children were 5 months old was high (111/174; 78%), and in 69% of the cases pacifiers had been introduced in the first week of life. Among the mother who initially intended to offer the pacifier (115/143), 91 reported that their children were using pacifiers and 24 children were not using because they had rejected them (24/24). Of the 28/143 mothers who did not intend to offer the pacifier, 20 changed their opinion, and the reason for that was that the pacifier calmed down their children.

Skinner, a researcher of behavioral psychology, stated that "the organisms tend to repeat responses that lead to a positive result and do not repeat those that lead to a neutral or negative result"[26] (free translation based on the text in Portuguese). Repetition of a certain behavior makes it unconscious and turns it into a habit.[9] If in the beginning of their lives babies suck their mothers' breasts because they are hungry, after that, even when they are not hungry, they try to suck for pleasure, and this habit reduces their anxiety and stress.[11] Once it is well-established, the habit of NNS can last for a long period, being present up to the next developmental phase.[8]

According to Melanie Klein,[27] a post-Freudian psychoanalyst, it is important to keep a balance between physical and psychic needs. Based on that, she stated that the use of pacifiers is useful, "in spite of the disappointment it causes when the child does not get the milk she/he desires while sucking (partial satisfaction of the desire)."

Countless studies have been published regarding the use of NNS as a way to relieve stress during painful procedures in newborns and infants, both when used alone and in combination with music or sugary solutions. Whipple[28] assessed level of stress and behavior during heel puncture procedure in preterm newborns using their heart rate, respiratory frequency, and levels of oxygen saturation, comparing children who used pacifiers, children who used pacifiers and listened to music, and children who did not use pacifiers nor listened to music. Pacifier use or pacifier combined with music showed a significant decrease in the level of stress.

Both the use of sugary solutions and the use of pacifiers have proven to be efficient to reduce pain in newborns. Curtis et al.[29] assessed Canadian children in the first 6

months of life and found that saccharose did not change the result of pain score, time of crying, or heart rate in these children. However, it has a better effect on children younger than 3 months who also showed shorter time of crying after vein puncture using only pacifiers.

A systematic review including only randomized studies and published by The Cochrane Library in 2008[30] on the use of saccharose in newborns who underwent painful procedures concluded that the sugary solution is efficient to reduce pain. However, the authors stated that there is no enough evidence regarding the dose and administration route of such solution. This means that it is not possible to conclude that its use combined with the use of pacifiers is better than when the solution is administered using a nasogastric tube, drops, or syringe.

Other studies have demonstrated that the pacifier increase the pain threshold in newborns,[31] improves sleep quality (in children from 1 to 4 years old,[32] reduces heart rate both while awaken and when sleeping),[33] and improves weight gain when combined with music in preterm infants.[34] On the other hand, a systematic literature review that compared the reaction of newborns who were breastfed or who received expressed breast milk during painful procedures with controls (placebo, pacifier, sugary solutions or position) concluded that the breastfed group showed a lower increase in heart rate and cried less than the group who used the pacifier or was wrapped in swaddling cloths.[35] This review also showed that the effect of the administration of sugary solutions is similar to the effect caused by breastfeeding. Nevertheless, further studies are necessary so that the effect of expressed breast milk can be understood in such situations.

In the articles found in the scientific literature, we could not find negative aspects in the field of psychology that could support the contraindication of the use of NNS provided that children quit this habit as they grow older.[8,36] On the contrary, conflicts between libidinal drive and external prohibition (deprivation of the sucking desire) can cause frustration, anxiety, stress, imprinting, regression, and even development of diseases.[8,11]

Speech therapy

Sucking, chewing, swallowing, and breathing are vital vegetative-reflexive functions for human beings. The stomatognathic system is responsible for nutrition, dental stability in its correct angles and preparation of the phono-articulatory organs, adapting them for speech.

When the development of these functions (feeding, hearing, and speech) is stimulated, communication disorders are prevented.

Breastfeeding, as mentioned above, fulfills both the child's nutritional and emotional needs.[11] Valdrighi et al.[37] studied the influence of breastfeeding on the prevalence of NNS (finger or pacifier) and found these habits in 82% of the non-breastfed children, 79% of those breastfed for a period shorter than 6 months, and only 34% of those breastfed for longer than 6 months, showing that breastfeeding should be promoted.

Bottle fed children are more prone to need to use pacifiers. However, NNS habits are considered harmful regarding speech aspects when they become potential etiologic factors for disorders related to any of the functions of the stomatognathic system. When the pacifier is necessary to provide the child with emotional stability, it should be used in a rational manner, since the severity of the adverse effects is related to the duration (period of time), frequency (number of times a day) and intensity (duration of each sucking movement and activity of the muscle involved) of its use (Graber's triad), which can cause dental malocclusion, incorrect positioning of the tongue, and articular problems.[39] The child's growth pattern and the orofacial muscle tonicity also contribute to the intensity of its harmful effects.[40]

In order to ensure adequate feeding it is necessary that sucking, swallowing, and breathing are coordinated. Thus, patients with neuropathies, who do not suck or preterm infants who do not coordinate these functions need to be stimulated. Such stimulation can be done by means of NNS. With regard to that, Neiva & Leone[41] compared the sucking pattern of preterm newborns and found that it improves according to the gestational age, with the stimulation of sucking (gloved finger or pacifier) increasing the probability of lip sealing, rhythm, tongue central groove formation, tongue peristaltic movement and coordination between sucking, swallowing, and breathing, showing that the gloved finger is more efficient than the pacifier.

NNS is also used to introduce oral feeding earlier in newborns who were initially fed by means of a nasogastric tube. A study has shown that sucking stimulation using a pacifier or a gloved finger promotes the earlier beginning of nutritive sucking, contributing to oral and motor development and maturation of preterm newborns.[42] However, NNS does not seem to have an influence on the rhythm of sucking that coordinates the effectiveness of this function.[43]

When used in an inappropriate manner, the pacifier has a harmful effect on speech development, since it fills the oral cavity, restricting the ability to babble, mimic sounds, and say words, leading to impaired vocalization.[8,44,45] Pacifiers cause alterations in the tongue and perioral muscle movements, making these organs flabby and establishing incorrect positioning of the tongue, which impairs swallowing and also affects the ability of chewing later on.[46] Since balance between the internal pressure of the tongue and the external pressure of the lips is necessary to ensure an adequate dental and maxillomandibular growth, when this balance does not exist, there is dental occlusion and oral

breathing problems, and the forward position of the tongue during swallowing promotes dental protrusion.[46]

Pacifiers have been suggested to be a risk factor for otitis relapse.[23,47] The presence of fluid inside the middle ear impairs hearing. Since otitis is more frequent during the first year of life, studies have demonstrated that its relapse may cause, to a larger or shorter extent, speech development delay or problems.[48]

Thus, with regard to speech, pacifiers are, at the same time, used to consolidate sucking and coordinate sucking-swallowing-breathing and considered a negative habit. According to this point of view, pacifiers may affect the orofacial muscles and dental positioning, compromising speech development, and they can also impair hearing, since they may lead to repeated otitis with consequent hypoacusis.

Dentistry

The prevalence of NNS varies according to different populations because it is closely related to cultural aspects.[49] The use of pacifiers is more frequent in the modern Western society than in the primitive societies, but even nowadays pacifiers are rarely used by the populations of developing countries, where breastfeeding is a prevalent practice.[8]

Many people believe that pacifiers should be included in the baby layette, and mothers take them to the maternity hospital as part of the baby layette.[3,8]

The presence and the severity of oral dental problems related to the use of pacifiers, such as in the case of speech disorders, depends on the duration, frequency, and intensity of the habit, as well as the position of the pacifier inside the child's mouth, the age the child quits the habit, and the growth pattern and level of hypotonicity of orofacial muscles.[39,40,50]

The pacifier acts in the child's mouth as an unintentional force that may produce and/or worsen dental malocclusion by affecting peri- and intraoral muscle tonus. Hence, it may postpone the total eruption of incisors (open bite), forcing also their protrusion, and making the upper arch narrower, increasing the muscular activity on the canines and reducing it on the molars, which causes posterior crossbite.[8,23]

Some studies have suggested that the severity of the open bite is related to the time of use of the pacifier.[51] Most children stop using pacifiers when they are around 3 or 4 years old, and the contact between upper and lower incisors is repaired.[8] On the other hand, when the child does not quit this habit, its effect on the permanent dentition is significant.

Some children use pacifiers in an atypical manner, compromising even further their dentition, since, in addition to having an open bite, they also have an asymmetric bite.[8]

Posterior crossbite is established as the upper arch gets narrow and it occurs before 2 years old in children who suck pacifiers.[8] With the purpose of reducing such effect, in the 1950s, pacifiers with orthodontic nipples were designed under the allegation that, because they promoted muscular movements more similar to those performed during breast sucking, they did not cause alterations in the palate.[22] Many studies have been published demonstrating the effectiveness of the orthodontic pacifier.[52-54] Bishara et al.[55] did not find differences in the measures of the upper arch while comparing breastfed children and children who were fed using bottles with orthodontic nipples. Adair et al.,[22] on the other hand, found that children who used orthodontic pacifiers have more protrusion of incisors and those who use conventional pacifiers have a higher proportion of open bite, although the authors stated that the differences in the occlusion they found were not significant. This topic remains controversial in the literature.

Several authors have published articles relating the use of pacifiers to dental caries. Yonezu & Yakushiji[56] found that the use of pacifiers at 18 months of life is a risk factor for the development of caries. According to Vázquez-Nava et al., this risk is twice higher in children who use pacifiers than in those who do not have this habit.[57]

Finally, it is necessary to mention that pacifiers are not used only to calm down children but they may also be offered with the purpose of avoiding the habit of finger sucking. On this topic, Larsson,[8] apud Zadik et al.,[58] mentions a study conducted in Israel showing that the number of children that developed the habit of finger sucking was five times higher among those children who lived in kibbutzim where the use of pacifiers was not recommended. However, both pacifier sucking and finger sucking cause problems when these habits continue after the child is 3 or 4 years old.

Pediatrics

Pacifiers have been culturally associated with children and they are often offered before breastfeeding has been established due to the influence of grandmothers and aunts,[3,59] which affects tongue and perioral muscle movements. Therefore, children who use pacifiers tend to place their tongues in a wrong position while sucking their mothers' breast. Since they are not able to get milk, they cry because they are hungry and reject the breast, which favors early weaning.[2,59,60] This dynamics is known as nipple confusion.[2]

The use of pacifiers is deeply consolidated in our culture.[3] Soares et al.[2] reported that among 273 children who were born at a Child-Friendly Hospital, where mothers were instructed not to offer pacifiers to avoid nipple confusion, 61.6% of the children were using pacifiers at the end of the first month of life, and most of them were using since the first week of life.

In addition to compromising breastfeeding and favoring early weaning, pacifiers also have an influence on breastfeeding duration. Howard et al.[61] found that pacifiers are correlated both with exclusive breastfeeding duration and nonexclusive breastfeeding duration. According to Binns & Scott,[62] it happens because mothers offer their breast less frequently to those children who use pacifiers and the lack of stimulation decreases milk production.

In agreement with these data, the Survey of the Prevalence of Breastfeeding in the Brazilian Capital Cities and in the Federal District, conducted in 1999, showed that the Southeast region had the lowest national rate of exclusive breastfeeding in children from 0 to 4 months (Southeast, 28.7%; São Paulo - capital city, 25%) and also demonstrated one of the highest percentages of prevalence of pacifier use among children from 0 to 12 months in these places (Southeast, 60.7%; São Paulo - capital city, 66%).[63]

Another aspect that should be mentioned regarding pediatrics is related to the (physical, chemical and immunological) safety of the pacifier use. Countless studies have described the possibility of suffocation and choke caused by pieces of pacifiers that get loose or by strings tied to pacifiers, and the possibility of lacerating the oral mucosa or the basis of the nose when children fall down with pacifiers inside their mouths.[23] Thus, it is recommended that pacifiers have shape and size compatible with the child's mouth (varying according to age: younger or older than 6 months). The support for the lips should be slightly curved (concave) towards the child's mouth and with holes in the sides for ventilation. The part close to the basis of the nose should be trimmed to provide good lip sealing. Ribbons and strings tied to the pacifier should be avoided, because they may cause suffocation.[64,65] With regard to this topic, there are technical standards recommending that noncompliant products are removed from the market due to the possibility of causing risk to children's health.

During natural rubber processing and synthetic rubber manufacturing process, several substances are added to the latex with the purpose of providing it with more elasticity.[6] In spite of the repeated extractions, N-nitrosamine and its precursors may remain in the rubber. When they get in touch with the saliva, these products volatize and may be harmful for health.[23] That is why there are also standards regulating the amount of toxic products (N-nitrosamine, phthalates and siloxane) contained in the material (nipple, lip support, and ring) used to manufacture pacifiers.[23,66,67]

Adair[23] warned about the possibility of some children being allergic to latex. In the reported cases, there was improvement of the symptoms when the pacifier was replaced by a silicon nipple. The clinical manifestations may vary from local erythema and itching, restricted to the region of contact, to respiratory symptoms, such as rhinitis, conjunctivitis, and bronchial spasm, that may be part of a systemic reaction (systemic urticaria, anaphylactic shock) or may be induced by the inhalation of allergens.[68]

The use of pacifiers was suggested as a method able to reduce gastroesophageal reflux. However, a systematic review did not find evidence showing that it improves the total time and/or reduces the number of episodes of reflux.[69] Similarly, in the last few years, pacifiers have been recommended for some children with the purpose of reducing the risk of sudden death syndrome (SDS).[23,70] Adair[23] concluded, after performing a literature review, that there is not consensus regarding the effect of the pacifier in the prevention of SDS, since the studies investigated (level of evidence II-2) did not prove the causality, in addition to the fact that there are possible biases that may lead to confusion. On the other hand, Hauck et al.,[70] when searching for evidence on the same topic by means of a meta-analysis, mentioned that one death can be avoided for each 2,733 infants with the use of pacifiers. Therefore, these authors suggested that pacifiers are offered to babies before they fall asleep (during the day and at night). Nevertheless, due to its potential adverse effects, they recommend such a measure only for children up to 1 year old, which is the age group most frequently affected by the SDS. For children who are breastfed, they recommend that pacifiers are offered only after breastfeeding is well-established. The following factors are among the possible mechanisms suggested as responsible for the reduction in the number of cases of SDS: forward position of the tongue when the pacifier is inside the mouth, which reduces the possibility of airway obstruction; increase in the upper airway muscle tonus, preventing them from collapsing; and slightly increased CO_2 serum levels, which stimulate breathing.[23,71,72]

With regard to the recommendation of pacifiers as a factor that helps to reduce the incidence of SDS, it is important to highlight that a case-control study conducted in Germany with 333 infants with a diagnosis of SDS and 998 healthy patients of the same age group being used as controls demonstrated that breastfeeding reduces the risk of sudden death in 50% at all ages.[73] Since pacifiers favor early weaning, one should be cautious before promoting their use with that purpose, since more benefits can be achieved by means of breastfeeding.

Infectious disease studies

As any other object inserted in the mouth, pacifiers may cause infections such as otitis, oral candidiasis, and dental caries.[23,47,74,75]

Lubianca Neto et al.[47] found that pacifiers are a risk factor for the development of recurrent acute otitis media (RAOM). When studying a sample comprising 938 Finnish children, Niemelä et al.[76] observed that those children who used pacifiers had a higher risk of having RAOM in comparison with those who did not have this habit. Pacifiers increased in

25% the annual incidence of acute otitis media in the group assessed.[77] In a randomized clinical trial, the authors found that in the group that underwent intervention (explanation about the harmful effects of pacifiers and guidance to restrict their use), the occurrence of otitis was 29% lower.[78]

Otitis media is one of the most common diseases during childhood. Weaning, early attendance of day care centers, contact with a large number of children, and pacifier use, among others, are risk factors for its incidence.[49] Relapse of such episodes can be a sign of the persistent presence of fluid in the middle ear, leading to hearing loss as there is an increase in the audibility threshold at the highest frequencies.[79] Hearing impairment affects speech acquisition and prevents the child from developing adequately.

The constant contact of the pacifier with the oral flora provides an excellent environment for the growth of bacteria and funguses in the nipples. A study conducted with the purpose of identifying germs found 80% of positive cultures, with Staphylococcus and Candida being the most frequent genera.[74] Latex nipples were more contaminated that those made of silicon. These results corroborate the fact that pacifiers are potential reservoirs of infection. In Brazil, Mattos-Graner et al.[80] found funguses in the mouth of 58.3% of the children between 0 and 8 months, with a significant association between pacifiers and infection. The prevalent species were *Candida parapsilosis* and *Candida albicans.*

In a longitudinal follow-up of Japanese children, the authors did not find a significant statistical difference regarding the prevalence of caries in children who had the habit of NNS at 18 months of age. At 36 months, however, the prevalence of caries was higher in the group who used pacifiers (24.4%) in comparison with the children who sucked their fingers (10.6%) or with the control group (17.1%).[56] In Mexico, the presence of caries in children from 4 to 5 years old was also significantly associated with pacifier use, suggesting that it is an important source of contamination.[57] Other studies have demonstrated that silicon pacifiers have a lower association with caries than those made of latex.[23]

In terms of gastrointestinal diseases, a study conducted in the South region of Brazil did not find association between the use of pacifiers and diarrhea, although fecal coliforms have been found in pacifiers.[81] Another study, carried out in Alfenas, state of Minas Gerais, found that 11.3% of the pacifiers assessed were contaminated with eggs of *Ascaris lumbricoides*, *Enterobius vermiculares*, *Trichuris trichiura*, *Taenia sp* and larvae of *Ancylostomatidae*, confirming the possibility of these pacifiers being responsible for the transmission of enteroparasitosis.[82]

Conclusion

The pacifier or its precursors have been used since human beings started to look for alternatives to solve daily life problems. They have been used both to calm down children and to feed them. Objects such as balls of fabric have been portrayed in paintings and described in books. Other pacifiers made of non-perishable material (clay, ivory, choral, cork, among others) were used for a long time. The teethers originated the pacifiers used nowadays.

Pacifiers have been used to stimulate sucking in children with neuropathies, to coordinate sucking-swallowing-breathing, anticipating oral feeding to preterm newborns, as well as to reduce the stress of painful procedures babies have to undergo. It is a partial way of fulfilling the emotional needs of a child who cannot be breastfed. Nevertheless, the literature presents more harmful effects than benefits of pacifier use. The use of pacifiers prevents babies from achieving breast sucking and induces weaning when pacifiers are offered to children when they cry, since longer time intervals between the breastfeeding sessions reduce the stimulus to milk production. It is responsible for a shorter duration of breastfeeding. It may cause suffocation, poisoning or allergies and increases the risk of caries, infections, and parasitoses. It originates dental and speech problems, mainly if it lasts even after the child is 3 or 4 years old. If, on one hand, some authors have related the pacifier use to a lower incidence of SDS, on the other hand, studies have shown that breastfeeding reduces the risk of sudden death in 50% and, therefore, it is advisable to be cautious before suggesting that pacifiers are a protective factor against sudden death because they also reduce the duration of breastfeeding.

The decision of using or not a pacifier is made by the family. It is the responsibility of health professionals to inform parents of the pros and cons of pacifier use so that they can make a conscious decision about this topic.

References

1. Levin S. Dummies. S Afr Med J. 1971;45:237-40.
2. Soares ME, Giugliani ER, Braun ML, Salgado AC, de Oliveira AP, de Aguiar PR. Uso de chupeta e sua relação com o desmame precoce em população de crianças nascidas em Hospital Amigo da Criança. J Pediatr (Rio J). 2003;79:309-16.
3. Sertório SC, Silva IA. As faces simbólica e utilitária da chupeta na visão das mães. Rev Saúde Pública. 2005;39:156-62.
4. Magner LN. A history of medicine. 2nd ed. Boca Raton: Taylor & Francis Group; 2005.
5. Fildes VA. Breasts, bottles and babies: a history of infant feeding. Edinburgh: Edinburgh University Press; 1986.
6. Baby-bottle museum. [website]. The history of the feeding bottle. http://www.babybottle-museum.co.uk/articles.html. Access: 17/01/2009.
7. Jamison CV. Ropes of sand and other stories. Boston: James R Osgood and Company; 1873. p. 10-1. [website]. Disponível em: http://www.letrs.indiana.edu/cgi/t/text/pageviewer-idx?sid=e2e7968cc4668c3376685e0f6b7ce995&idno=wright2-1337&c=wright2&cc=wright2&seq=6&view=text. Access: 24/01/2009.
8. Larsson E. The influence of oral habits on the developing dentition and their treatment: clinical and historical perspectives. 2nd ed. Edited by S. Bishara. [n.p.] Sweden: CELA Grafiska; 2003.

9. Bee H. O ciclo vital (traduzido por Garcez R). Porto Alegre: Artes Médicas; 1997.
10. Medeiros AM. A existência de "sistema sensório-motor integrado" em recém-nascidos humanos. Psicol USP. 2007;18:11-3.
11. Bergeret J, Bécache A, Boulanger J-J, Chartier J-P, Dubor P, Houser M, et al. Psicopatologia: teoria e clínica (traduzido por Settineri). 9ª. ed. Porto Alegre: Artmed; 2006.
12. Giugliani ER, Lamounier JA. Aleitamento materno: uma contribuição científica para a prática do profissional de saúde. J Pediatr (Rio J). 2004;80:S117-8.
13. Rea MF. Substitutos do leite materno: passado e presente. Rev Saude Publica. 1990;24:241-9.
14. Howard CR, Howard FM, Lanphear B, Eberly S, deBlieck EA, Oakes D, et al. Randomized clinical trial of pacifier use and bottle-feeding or cup-feeding and their effect on breastfeeding. Pediatrics. 2003;111:511-8.
15. Araújo de França GV, Brunken GS, da Silva SM, Escuder MM, Venancio SI. Breastfeeding determinants on the first year of life of children in a city of Midwestern Brazil. Rev Saude Publica. 2007;41:711-8.
16. Aveling E. Chew, chew, that ancient chewing gum. British Arch. 1997;21. [Website]. Disponível em: http://www.britarch.ac.uk/ba/ba21/ba21feat.html. Access: 19/01/2009.
17. The Metropolitan Museum of Art. [website]. Rattle, whistle and bells. Disponível em: http://www.metmuseum.org/toah/hd/roco/hod_47.70.htm. Access: 10/01/2009.
18. Victoria and Albert Museum of Childhood. [website]. Rattles. Disponível em: http://www.vam.ac.uk/moc/collections/childcare/rattle/index.html. Access: 19/01/2009.
19. Norfolk Museums. [website]. The little oak bedroom. Disponível em: http://www.museums.norfolk.gov.uk/default.asp?Document=200.23.001.05. Access: 19/01/2009.
20. Colon AR, Colon PA. Nurturing children: a history of pediatrics. Westport: Greenwood Press; 1999.
21. Greenberg MH. Neonatal Feeding. In: Smith GF, Vidyasagar D, editors. Historical review and recent advances in neonatal and perinatal medicine. Mead Johnson Nutritional Division; 1980 [Website]. Disponível em: http://www.neonatology.org/classics/mj1980/ch04.html. Access: 24/01/2009.
22. Adair SM, Milano M, Dushku JC. Evaluation of effects of orthodontic pacifiers on the primary dentitions of 24- to 59-month-old children: preliminary study. Pediatr Dent. 1992;14:13-8.
23. Adair SM. Pacifier use in children: a review of recent literature. Pediatr Dent. 2003;25:449-58.
24. Bukatko D, Daehler MW. Child development: a thematic approach. 5th ed. Boston: Houghton Mifflin Company; 2004.
25. Pansy J, Zotter H, Sauseng W, Schneuber S, Lang U, Kerbl R. Pacifier use: what makes mothers change their mind? Acta Paediatr. 2008;97:968-71.
26. Weiten M. Introdução à psicologia: temas e variações (versão abreviada) (traduzido por Brasil ML, Botelhos ZG, Colotto CA, dos Santos CB). São Paulo: Pioneira; 2002.
27. Klein M, Isaacs S, Sharpe EF, Searl N, Middlemore MP. A educação de crianças à luz da investigação psicanalítica (traduzido por Spira AM). 2ª ed. Rio de Janeiro: Imago; 1973.
28. Whipple J. The effect of music-reinforced nonnutritive sucking on state of preterm, low birthweight infants experiencing heelstick. J Music Ther. 2008;45:227-72.
29. Curtis SJ, Jou H, Ali S, Vandermeer B, Klassen T. A randomized controlled trial of sucrose and/or pacifier as analgesia for infants venipuncture in a pediatric emergency department. BMC Pediatr. 2007;7:27.
30. Stevens B, Yamada J, Ohlsson A. Sucrose for analgesia in newborn infants undergoing painful procedures. Cochrane Database Syst Rev. 2004;(3):CD001069.
31. Abdulkader HM, Freer Y, Fleetwood-Walker SM, McIntosh N. Effect of sucking on the peripheral sensitivity of full-term newborn infants. Arch Dis Child Fetal Neonatal Ed. 2007;92: F130-1.
32. Deakin A. Children's choice of comforters and their effects on sleep. Br J Community Nurs. 2004;9:126-30.
33. Franco P, Chabanski S, Scaillet S, Groswasser J, Kahn A. Pacifier use modifies infant's cardiac autonomic controls during sleep. Early Hum Dev. 2004;77:99-108.
34. Cevasco AM, Grant RE. Effects of the pacifier activated lullaby on weight gain of premature infants. J Music Ther. 2005;42:123-39.
35. Shah PS, Aliwalas L, Shah V. Breastfeeding or breastmilk to alleviate procedural pain in neonates: a systematic review. Breastfeed Med. 2007;2:74-82.
36. Frager R, Fadiman J. Personality and personal growth. 5th ed. New Jersey: Pearson Education; 2002.
37. Valdrighi HC, Vedovello Filho M, Coser RM, de Paula DB, Rezende SE. Hábitos deletérios x aleitamento materno (sucção digital ou chupeta). RGO. 2004;52:237-9.
38. Dalvi KF, Motta AR. Visão dos médicos que atuam em Pediatria no extremo sul da Bahia em relação aos hábitos orais deletérios. Rev Soc Bras Fonoaudiol. 2007;12:281-6.
39. Silva EL. Hábitos bucais deletérios. Rev Para Med. 2006;20:47-50.
40. Degan VV, Puppin-Rontani RM. Remoção de hábitos e terapia miofuncional: restabelecimento da deglutição e repouso lingual. Pro-Fono. 2005;17:375-82.
41. Neiva FC, Leone CR. Sucção em recém-nascidos pré-termo e estimulação da sucção. Pro-Fono. 2006;18:141-50.
42. Neiva FC, Leone CR. Efeitos da estimulação da sucção não nutritiva na idade de início da alimentação via oral em recém-nascidos pré-termo. Rev Paul Pediatr. 2007;25:129-34.
43. Neiva FC, Leone CR. Evolução do ritmo de sucção e influência da estimulação em prematuros. Pro-Fono. 2007;19:241-8.
44. Neiva FC, Cattoni DM, Ramos JL, Issler H. Desmame precoce: implicações para o desenvolvimento motor-oral. J Pediatr (Rio J). 2003;79:7-12.
45. Shotts LL, McDaniel DM, Neeley RA. The impact of prolonged pacifier use on speech articulation: a preliminary investigation. CICSD. 2008;35:72-5.
46. Ramirez-Yañez GO, Farrel C. Soft tissue dysfunction: a missing clue when treating malocclusions. Ortop Rev Int Ortop Func. 2005;1:483-94.
47. Lubianca Neto JF, Hemb L, Silva DB. Systematic literature review of modifiable risk factors for recurrent acute otitis media in childhood. J Pediatr (Rio J). 2006;82:87-96.
48. Roberts JE, Rosenfeld RM, Zeisel SA. Otitis media and speech and language: a meta-analysis of prospective studies. Pediatrics. 2004;113:e238-48.
49. Caglar E, Larsson E, Andersson EM, Hauge MS, Ogaard B, Bishara S, et al. Feeding, artificial sucking habits, and malocclusions in 3-year-old girls in different regions of the world. J Dent Child (Chic). 2005;72:25-30.
50. Corrêa MS. Odontopediatria na Primeira Infância. São Paulo: Livraria Santos; 1998.
51. Larsson E. The effect of dummy-sucking on the occlusion: a review. Eur J Orthod. 1986;8:127-30.
52. Rutrick RE. Crossbite correction with a therapeutic pacifier. ASDC J Dent Child. 1974;41:442-4.
53. Margolis FS. Ordinary versus orthodontic pacifiers. Dent Surv. 1980;56:44-5.
54. Levrini L, Merlo P, Paracchini L. Different geometric patterns of pacifiers compared on basis of finite element analysis. Eur J Paediatr Dent. 2007;8:173-8.
55. Bishara SE, Nowak AJ, Kohout FJ, Heckert DA, Hogan MM. Influence of feeding and non-nutritive sucking methods on the development of dental arches: longitudinal study of the first 18 months of life. Pediatr Dent. 1987;9:13-21.
56. Yonezu T, Yakushiji M. Longitudinal study on influence of prolonged non-nutritive sucking habits on dental caries in Japanese children from 1.5 to 3 years of age. Bull Tokyo Dent Coll. 2008;49:59-63.

57. Vázquez-Nava F, Vázquez RE, Saldivar GA, Beltrán GF, Almeida AV, Vázquez RC. Allergic rhinitis, feeding and oral habits, toothbrushing and socioeconomic status. Effects on development of dental caries in primary dentition. Caries Res. 2008;42:141-7.

58. Zadik D, Stern N, Litner M. Thumb- and pacifier-sucking habits. Am J Orthod. 1977;71:197-201.

59. França MC, Giugliani ER, de Oliveira LD, Weigert EM, do Espírito Santo LC, Köhler CV, Bonilha AL. Uso de mamadeira no primeiro mês de vida: determinantes e influência na técnica de amamentação. Rev Saude Publica. 2008;42:607-14.

60. Victora CG, Behague DP, Barros FC, Olinto MT, Weiderpass E. Pacifier use and short breastfeeding duration: cause, consequence, or coincidence? Pediatrics. 1997;99:445-53.

61. Howard CR, Howard FM, Lanphear B, deBlieck EA, Eberly S, Lawrence RA. The effects of early pacifier use on breastfeeding duration. Pediatrics. 1999;103:e33. [website]. Disponível em: http://pediatrics.aappublications.org/cgi/content/full/103/3/e33. Access: 04/04/2009.

62. Binns CW, Scott JA. Using pacifiers: what are breastfeeding mothers doing? Breasfeed Rev. 2002;10:21-5.

63. Ministério da Saúde. Secretaria de Políticas de Saúde. Área de Saúde da Criança. Pesquisa de Prevalência de Aleitamento Materno nas Capitais Brasileiras e Distrito Federal PPAM-CDF, 1999. [website]. Disponível em: http://www.bvsam.icict.fiocruz.br/gotadeleite/01/arqs/pesqnacprevalencia99.ppt. Access: 08/06/2009.

64. Santos CL, Menezes JV. Chupetas: quais e quando usar. Rev Dens. 2007;15:101.

65. Lima CB, Medeiros MI, Leal C, Valença AM. Avaliação de chupetas disponíveis no Mercado nacional segundo os requisitos da ABNT e ANVISA. Rev Odonto Cienc. 2007;22:112-7.

66. Corea-Téllez KS, Bustamante-Montes P, Garcia-Fábila M, Hernandéz-Valero, Vázquez-Moreno F. Estimated risks of water and saliva contamination by phthalate diffusion from plasticized polyvinyl chloride. J Environ Health. 2008;71:34-9.

67. Horii Y, Kannan K. Survey of organosilicone compounds, including cyclic and linear siloxanes, in personal-care and household products. Arch Environ Contam Toxicol. 2008;55:701-10.

68. Anda M, Gómez B, Lasa E, Arroabarren E, Garrido S, Echechipía S. Alergia al látex. Manifestaciones clínicas en la población general y reactividad cruzada con alimentos. An Sist Sanit Navar. 2003;26 Suppl 2:75-80.

69. Carroll AE, Garrison MM, Christakis DA. A systematic review of nonpharmacological and nonsurgical therapies for gastroesophageal reflux in infants. Arch Pediatr Adolesc Med. 2002;156:109-13.

70. Hauck FR, Omojokun OO, Siadaty MS. Do pacifiers reduce the risk of sudden infant death syndrome? A meta-analysis. Pediatrics. 2005;116:e716-23.

71. Tonkin SL, Lui D, McIntosh CG, Rowley S, Knight DB, Gunn AJ. Effect of pacifier use on mandibular position in preterm infants. Acta Paediatr. 2007;96:1433-6.

72. Tonkin SL, Vogel SA, Gunn AJ. Upper airway size while sucking on a pacifier in infants with micrognathia. J Paediatr Child Health. 2008;44:78-9.

73. Vennemann MM, Bajanowski T, Brinkmann B, Jorch G, Yücesan K, Sauerland C, et al. Does breastfeeding reduce the risk of sudden infant death syndrome? Pediatrics. 2009;123:e406-10.

74. Comina E, Marion K, Renaud FN, Dore J, Bergeron E, Freney J. Pacifiers: a microbial reservoir. Nurs Health Sci. 2006;8:216-23.

75. Ersin NK, Eronat N, Cogulu D, Uzel A, Aksit S. Association of maternal-child characteristics as a factor in early childhood caries and salivary bacterial counts. J Dent Child (Chic). 2006;73:105-11.

76. Niemelä M, Uhari M, Hannuksela A. Pacifiers and dental structure as risk factors for otitis media. Int J Pediatr Otorhinolaryngol. 1994;29:121-7.

77. Niemelä M, Uhari M, Mötönen M. A pacifier increases the risk of recurrent acute otitis media in children in day care centers. Pediatrics. 1995;96:884-8.

78. Niemelä M, Pihakari O, Pokka T, Uhari M. Pacifier as a risk factor for otitis media: randomized, controlled trial of parental counseling. Pediatrics. 2000;106:483-8.

79. Ferreira MS, de Almeida K, Atherino CC. Limiares de audibilidade em altas freqüências em crianças com história de otite média secretora bilateral. Rev Bras Otorrinolaringol. 2007;73:231-8.

80. Mattos-Graner RO, de Moraes AB, Rontani RM, Birman EG. Relation of oral yeast infection in Brazilian infants and use of a pacifier. ASDC J Dent Child. 2001;68:33-6.

81. Tomasi E, Victora CG, Post PR, Olinto MT, Béhague D. Uso de chupeta em crianças: contaminação fecal e associação com diarréia. Rev Saude Publica. 1994;28:373-9.

82. Siqueira RV, Pedroso RS. Pesquisa de cistos de protozoários, larvas e ovos de helmintos em chupetas. J Pediatr (Rio J). 1997;73:21-5.

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