DART
Two hours of CDE credit

Non-nutritive sucking with a pacifier: Pros and cons

Jane A. Soxman, DDS

The detrimental effects of prolonged pacifier use on the developing oral structures are often the primary focus of dental professionals; however, non-nutritive sucking with a pacifier has other consequences that include not only harmful effectbut positive influences as well. This article will address some of the issues for consideration regarding the use of pacifiers and provide information for appropriate recommendations to parents of infants and toddlers regarding the use and cessation of non-nutritive sucking with a pacifier.

Received: May 31, 2006 Final revisions: September 20, 2006 Accepted: September 25, 2006

At birth, survival depends on instinctive sucking that occurs with stimulation of the lips and tongue. In addition to nourishment, sucking soothes infants, providing both physical and psychological comfort. The need for sucking is very strong during the first three months of life but it decreases around a infant's seventh month; by this time, the neuromuscular structures of the oral cavity are prepared for eating, drinking, and, ultimately, mastication. To allow for the infant's need for sucking while allowing for timely intervention prior to a malocclusion developing, the ideal time for cessation of non-nutritive sucking is during the second or third year of life; after this time, non-nutritive sucking is considered to be a prolonged sucking habit.[1] Because of the adverse effect of unbalanced muscle activity on dental arch development, the continuation of a pacifier habit beyond what is considered to be a normal developmental stage is discouraged.

Parents may question whether pacifier use or digit sucking is preferable in terms of the effect on the dentition and the ability to discontinue the habit. In a 2002 study by Warren and Bishara, pacifier and digit habits produced different malocclusions.[2] Although both habits were associated with an increase in open bite, pacifier habits were associated more often with posterior crossbite, while digit habits were associated with greater overjet, higher palatal vaults, and more diminished maxillary arch widths.[2]

In the primary dentition, a pacifier habit often leads to an increase in overjet with anterior openbite, a prevalence of edge-to-edge primary canines, and distal step primary molar relationship with posterior crossbite. The pacifier nipple displaces the tongue to the floor of the mouth, placing a lateral force on the mandibular primary molars. This lateral pressure tips the mandibular primary molars laterally, widening the lower arch. When the tongue cannot provide palatal support for the maxillary primary molars, palatal tipping of the maxillary primary molars and canines results.

A second component adds to palatal constriction at this age: the mid-palatal suture is open and pressure from the buccinator muscles during sucking enhances the maxillary arch constriction. The narrowed arch causes interference of the maxillary primary canines (Fig. 1) and a lateral slide into a functional crossbite (Fig. 2). With continued sucking and palatal constriction, one or both maxillary posterior segments move into a crossbite occlusion. The habitual protruded tongue position and pacifier nipple create an anterior open bite and overjet.

Pressure against the teeth must exist for at least six hours a day to cause tooth movement. Variations in terms of the amount of the time spent with a pacifier in the mouth (and the intensity of the child's sucking) may explain why some children do not develop a posterior crossbite.

Pacifier use should be discouraged as soon as canine interference is noted.[3] A 2001 study of 310 3-year-old children found that pacifier use led to a Class II canine relationship.[4] Ultimately, the effects of a sustained pacifier habit beyond 24–47 months of age may extend into the mixed dentition, contributing to a Class II molar relationship and an anterior open bite.[5]

In addition to the difference between a pacifier and digit habit, the design of the pacifier may be included in information provided to a parent. Manufacturers have created pacifiers that are designed to imitate a mother's breast, purporting that the muscular movements of sucking simulate those of nursing and that this, in turn, encourages normal arch development in the primary dentition.[6] The nipple of the conventional pacifier has a cherry-like shape and is thicker than the physiological pacifiers. Adair *et al* tested two physiological pacifiers against a conventional pacifier and found that they offered no significant advantage in terms of protection against a malocclusion.[6] This finding was confirmed by a 2002 study that found no significant difference between the physiological and conventional pacifier uses in terms of overjet, mean open bite, and posterior crossbite.[1]

When Viggiano *et al* compared the effects of breastfeeding, bottle feeding, and non-nutritive sucking, non-nutritive sucking was the main risk factor in terms of malocclusion and open bite developing in the primary dentition.[7] Bottle feeding infants instead of breastfeeding them between birth and six months of age has been associated with the development of a pacifier habit.[8] It has been speculated that infants learn to suck differently with a bottle nipple compared with the breast nipple, which may predispose children to prefer the stimulus of a pacifier as they grow older. There appears to be no association between bottle feeding and digit sucking habits.[8]

Multiple studies have noted another possible detrimental effect concerning pacifier introduction and breastfeeding: pacifier use during the first week of life has been shown to reduce exclusive and overall time spent breastfeeding by a significant amount.[9] Howard *et al*

Fig. 1. An example of primary canine interference.

Fig. 2. Functional crossbite due to primary canine interference.

Fig. 3. A 30-month-old child with a pacifier habit.

Fig. 4. The patient in Figure 3, six months after discontinuing the pacifier habit.

recommended delaying use of a pacifier until the infant was at least one month old.[9] A 2003 study by Ullah and Griffiths reported that infants who did not use a pacifier had an overall breastfeeding duration of 10 months, compared to 7.5 months for infants who used pacifiers; however, they concluded that occasional pacifier use could not be blamed definitively for reducing the duration of breastfeeding among infants.[10] In 2001, Kramer *et al* concluded that pacifier use may merely be an indicator of breastfeeding difficulties or a lack of motivation on the mother's part to breastfeed instead of the pacifier being the cause of earlier weaning; a 2002 study by Benis supported these findings.[11,12] Victora *et al* also reported that mothers who are less confident with breastfeeding or who were having difficulties in breastfeeding use pacifiers more often to wean infants.[13] Another investigation adjusted for breastfeeding problems and determined that reduced breast stimulation may have shortened the duration of breastfeeding, with a reduction in the number of times the infant was fed each day when a pacifier was introduced at two weeks of age.[14]

Morbidity associated with pacifier use has been evaluated in the literature. Castelo *et al* reported that pacifier use or other parafunctional sucking habits were not linked to temporomandibular joint dysfunction in the primary dentition.[15] Pacifier use among infants and toddlers has been associated with an increase in the occurrence of otitis media.[16] Pacifier use should be restricted to the time when the infant is falling asleep.[16] Warren *et al* assessed pacifier use as a risk factor for otitis media from birth to 12 months of age and reported similar findings.[17]

In general, the literature concludes that pacifier use is a modifiable risk factor for otitis media. To reduce the number of infections in those children who are most susceptible, it probably is most appropriate to give advice concerning the restricted use of pacifiers to parents of pacifier users who suffer from recurrent bouts of otitis media.[18] In a 1997 study, Brook and Gober investigated the presence of aerobic and facultative anaerobic bacteria on the surface of pacifiers used by children during recent episodes of otitis media and found that pacifiers do not contain high colony counts of microorganisms; as a result, pacifiers cannot be considered to be a significant source for

transfer of organisms.[19] The association between pacifier use and early childhood caries (ECC) also has been questioned. Pressini reported in 2003 that pacifiers did not have a strong or consistent association with ECC; in fact, pacifiers offered a mildly protective effect.[20]

Safety considerations for the use of pacifiers also should be included in the infant/toddler examination. Severe laceration could occur if the shield is held inside the lips, with the edges of the flanges touching the maxillary and mandibular mucobuccal folds. Pacifiers have been implicated in death from asphyxia, due to their becoming lodged in the pharynx.[21]

Simkiss *et al* recommended pacifiers with ventilation holes in pacifier flanges, a minimum vertical and horizontal dimension of 43 mm, and a ring.[22] The holes permit air passage, the larger flanges inhibit the pacifier from lodging behind the soft palate, and the ring can be used to remove the pacifier from the pharynx in case of aspiration. Cords attached to a pacifier may cause strangulation.[23] A symmetrical nipple permits the pacifier to remain in the correct sucking position, while large shield vents with a textured inner surface help to prevent irritation and rashes that would result from trapped saliva.

Recently, pacifiers have been suggested as another measure to reduce the risk of sudden infant death syndrome (SIDS). Placing infants in a supine position for sleep has resulted in a significant decrease in SIDS since the concept was first recommended in 1992.[24] Babies who sleep in their parents' bedroom (not in the parents' bed) and are offered a pacifier do not sleep as deeply as those who sleep in a separate bedroom without a pacifier.[24] In addition, pacifier sucking during sleep lowers the auditory arousal threshold, making it possible for the infant to be aroused from a deep sleep that could result in episodes of apnea.[25] Pacifiers should be offered for all sleep (including daytime naps) for all children up to one year of age to include the peak ages for SIDS risk and the time when an infant's need to suck is highest.[26] Cardiac autonomic controls are modified and could be regulated with pacifier use during sleep. These controls could be associated with mechanisms implicated in SIDS, which suggests that non-nutritive sucking may confer a protective effect.[27]

Pacifier sucking in combination with sweet solutions has been shown to provide a synergistic analgesic effect in newborn infants during minor painful procedures.[28] The pacifier, in combination with sucrose solutions, has been determined to be a safe and effective method for relieving pain in neonates.[29] One 1999 study reported that pacifiers were found to be even more effective for pain relief than concentrated sucrose and glucose solutions.[30]

Pacifier habits persist longer today than in the past and are considered to be socially acceptable into the preschool years. The appropriate time to discontinue a non-nutritive sucking habit varies, depending on such considerations as the developmental stage of the child, the harm or potential harm to the oral structures, whether any harmful results can resolve spontaneously, the availability of methods for stopping the habit, and the perceived need due to social or medical circumstances. With all issues considered, the time for intervention may be at approximately two years of age to minimize occlusal disharmonies.[31]

The examination of a toddler or preschooler also should include a discussion regarding prolonged use of a pacifier and its harmful effects on the developing dentition. Dentists may demonstrate this effect to the parent(s) by placing the child in centric occlusion with the lips retracted manually (Fig. 3). This step is important to make the parent(s) aware of the pacifier's detrimental effect and in motivating them to discontinue pacifier use. The crossbite usually will self-correct within six months after cessation of the habit (Fig. 4). Fifty percent of all children with a non-nutritive sucking habit will cease the habit without parental intervention by 24–28 months of age.

Digit habits may persist longer than pacifier sucking and may require appliance therapy for cessation.[32] Cessation of the habit usually is more of a challenge for the parent(s) than for the child. Parental withholding of the pacifier during the day may be a consideration but the parent's perception that the child requires the pacifier to transition to sleep often is the final issue that must be overcome. Various methods may be suggested for ending the pacifier habit, including dipping the nipple in white vinegar, making it distasteful; piercing the nipple with an ice pick or cutting the nipple shorter to reduce sucking satisfaction; leaving it behind on a trip; or forcing the child to go "cold turkey." Professional explanation from a dentist and abrupt permanent removal by the parent(s) seem to be the most effective methods for eliminating the habit.[33]

Discussion

Any consultation with parents regarding pacifier use should include the potential benefits as well as the risks and safety considerations. Harmful oral developmental effects can be avoided when cessation occurs while the child is approximately 2 years old. Delaying introduction until breastfeeding is firmly established and reducing pacifier use among children who suffer from recurrent incidences of otitis media can remove any negative effects in these areas. The proven value of pacifiers in reducing the incidence of SIDS, augmenting sucking satisfaction, and providing an undeniable source of comfort appear not only to justify their continued use in infants and toddlers but to support it.

Summary

Pacifier use should be continued for its physiological and psychological benefits, as long as the child receives an appropriate introduction and timely cessation. During the infant's examination, dentists should include discussion regarding various considerations for pacifier use.

Author information

Dr. Soxman is a diplomate of the American Board of Pediatric Dentistry and a member of the *General Dentistry* Advisory Board. She maintains a private practice in Allison Park, Pennsylvania.

References

1. Zardetto CG, Rodrigues CR, Stefani FM. Effects of different pacifiers on the primary dentition and oral myofunctional strutures of preschool children. Pediatr Dent 2002; 24:552-560.
2. Warren JJ, Bishara SE. Duration of nutritive and nonnutritive sucking behaviors and their effects on the dental arches in the primary dentition. Am J Orthod Dentofacial Orthop 2002;121:347-356.
3. Larsson E. Sucking, chewing, and feeding habits and the development of crossbite: A

longitudinal study of girls from birth to 3 years of age. Angle Orthod 2001;71:116-119.

4. Warren JJ, Bishara SE, Steinbock KL, Yonezu T, Nowak AJ. Effects of oral habits' duration on dental characteristics in the primary dentition. J Am Dent Assoc 2001;132:1685-1693.
5. Warren JJ, Slayton RL, Bishara SE, Levy SM, Yonezu T, Kanellis MJ. Effects of nonnutritive sucking habits on occlusal characteristics in the mixed dentition. Pediatr Dent 2005;27:445-450.
6. Adair SM, Milano M, Lorenzo I, Russell C. Effects of current and former pacifier use on the dentition of 24-to 59-month-old children. Pediatr Dent 1995;17:437-444.
7. Viggiano D, Fasano D, Monaco G, Strohmenger L. Breast feeding, bottle feeding, and non-nutritive sucking; effects on occlusion in deciduous dentition. Arch Dis Child 2004;89:1121-1123.
8. Charchut SW, Allred EN, Needleman HL. The effects of infant feeding patterns on the occlusion of the primary dentition. J Dent Child 2003;70:197-203.
9. Howard CR, Howard FM, Lanphear B, Eberly S, deBlieck EA, Oakes D, Lawrence RA. Randomized clinical trial of pacifier use and bottle-feeding or cup-feeding and their effect on breastfeeding. Pediatrics 2003;111:511-518.
10. Ullah S, Griffiths P. Does the use of pacifiers shorten breastfeeding duration in infants? Br J Community Nurs 2003; 10:458-463.
11. Kramer MS, Barr RG, Dagenais S, Yang H, Jones P, Ciofani L, Jane F. Pacifier use, early weaning, and cry/fuss behavior: A randomized controlled trial. JAMA 2001;286:322-326.
12. Benis MM. Are pacifiers associated with early weaning from breastfeeding? Adv Neonatal Care 2002;2:259-266.
13. Victora CG, Behague DP, Barros FC, Olinto MT, Weiderpass E. Pacifier use and short breastfeeding duration: Cause, consequence, or coincidence? Pediatrics 1997;99:445-453.
14. Binns CW, Scott JA. Using pacifiers: What are breastfeeding mothers doing? Breastfeed Rev 2002;10:21-25.
15. Castelo PM, Gaviao MB, Pereira LJ, Bonjardim LR. Relationship between oral parafunctional/nutritive sucking habits and temporomandibular joint dysfunction in primary dentition. Int J Paediatr Dent 2005;15:29-36.
16. Niemela M, Pihakari O, Pokka T, Uhari M. Pacifier as a risk factor for acute otitis media: A randomized, controlled trial of parental counseling. Pediatrics 2000;106:483-488.
17. Warren JJ, Levy SM, Kirchner HL, Nowak AJ, Bergus GR. Pacifier use and the occurrence of otitis media in the first year of life. Pediatr Dent 2001;23:103-107.
18. Hanafin S, Griffiths P. Does pacifier use cause ear infections in young children? Br J Community Nurs 2002;206:208-211.
19. Brook I, Gober AE. Bacterial colonization of pacifiers of infants with acute otitis media. J Laryngol Otol 1997;111:614-615.
20. Peressini S. Pacifier use and early childhood caries: An evidenced-based study of the literature. J Can Dent Assoc 2003; 69:16-19.
21. Wehner F, Martin DD, Wehner HD. Asphyxia due to pacifiers—Case report and review of the literature. Forensic Sci Int 2004;141:73-75.
22. Simkiss DE, Sheppard I, Pal BR. Airway obstruction by a child's pacifier—Could flange design be safer? Eur J Pediatr 1998; 157:252-254.
23. Adair SM. Pacifier use in children: A review of the literature. Pediatr Dent 2003; 25:449-458.
24. American Academy of Pediatrics Task Force on Sudden Infant Death Syndrome. The changing concept of Sudden Infant Death Syndrome: Diagnostic coding shifts, controversies regarding the sleeping environment, and new variables to consider in reducing risk. Pediatrics 2005;116:1245-1255.
25. Franco P, Scaillet S, Wermenbol V, Valente F, Groswasser J, Kahn A. The influence of a pacifier on infants' arousals from sleep. J Pediatr 2001;136:775-779.
26. Hauck FR, Omojokun OO, Siadaty MS. Do pacifiers reduce the risk of sudden infant death syndrome? A meta-analysis. Pediatrics 2005;116:716-723.
27. 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.
28. Akman I, Ozek E, Bilgen H, Ozdogan T, Cebeci D. Sweet solutions and pacifiers for pain relief in newborn infants. J Pain 2002;3:199-202.
29. Stevens B, Yamada J, Beyene J, Gibbins S, Petryshen P, Stinson J, Narciso J. Consistent management of repeated procedural pain with sucrose in preterm neonates: Is it effective and safe for repeated use over time? Clin J Pain 2005;21:543-548.
30. Carbajal R, Chauvet X, Couderc S, Olivier-Martin M. Randomized trial of analgesic effects of sucrose, glucose, and pacifiers in term neonates. BMJ 1999;27:1393-1397.
31. Warren JJ, Bishara SE, Steinbock KL, Yonezu T, Nowak AJ. Effects of oral habits' duration on dental characteristics in the primary dentition. J Am Dent Assoc 2001; 132:1685-1693.
32. Caglar E, Larsson E, Andersson EM, Hauge MS, Ogaard B, Bishara S, Warren J, Noda T, Dolci GS. Feeding, artificial sucking habits, and malocclusions in 3-year-old girls in different regions of the world. J Dent Child 2005;72:25-30.
33. Degan VV, Puppin-Rontani RM. Prevalence of pacifier-sucking habits and successful methods to eliminate them—A preliminary study. J Dent Child 2004;71: 148-151.