REVIEW ARTICLE

Should Pacifiers Be Recommended to Prevent Sudden Infant Death Syndrome?

E. A. Mitchell, FRACP, DSc[a], P. S. Blair, PhD[b], M. P. L'Hoir, PhD[c]

[a]Department of Paediatrics, University of Auckland, Auckland, New Zealand; [b]Institute of Child Health, Education Centre, Bristol, United Kingdom; [c]Department of Medical Psychology, Division of Pediatrics, University Medical Center, Wilhelmina Children's Hospital, Utrecht, Netherlands

ABSTRACT

OBJECTIVES. Our aim was to review the evidence for a reduction in the risk of sudden infant death syndrome (SIDS) with pacifier ("dummy" or "soother") use, to discuss possible mechanisms for the reduction in SIDS risk, and to review other possible health effects of pacifiers.

RESULTS. There is a remarkably consistent reduction of SIDS with pacifier use. The mechanism by which pacifiers might reduce the risk of SIDS is unknown, but several mechanisms have been postulated. Pacifiers might reduce breastfeeding duration, but the studies are conflicting.

CONCLUSIONS. It seems appropriate to stop discouraging the use of pacifiers. Whether it is appropriate to recommend pacifier use in infants is open to debate.

IN 1979, Cozzi et al[1] postulated that pacifiers (also called "dummies" or "soothers") might protect against sudden infant death syndrome (SIDS). Support for this hypothesis was first reported in 1993.[2] Since then there have been other studies that have supported this observation,[2–10] although evidence is lacking for a biological underlying mechanism, and outside this field pacifier use has mainly been associated with detrimental effects. Our aim with this article is to review the evidence for a reduction in the risk of SIDS with pacifier use, discuss possible mechanisms for the reduction in SIDS risk, and briefly review other possible effects of pacifiers on infants and children.

There have been 7 case-control studies (refs 2–5, 8, and 9 and B. Alm, written correspondence, 2002) and 1 prospective study (E.A.M., unpublished data) that examined routine pacifier use and SIDS, all but one of which[8] observed an increased prevalence of use among the control subjects compared with case subjects (Table 1). The reduced risk of SIDS with routine pacifier use is significant when pooling the results (pooled odds ratio [OR]: 0.83; 95% confidence interval [CI]: 0.75–0.93). Eight case-control studies[2–4,6–10] have also examined pacifier use for the last sleep, and all of them showed a reduced risk of SIDS (Table 2) (pooled OR: 0.48; 95% CI: 0.43–0.54), the significance of which actually increased in all but 1 study when adjustment was made for potential confounders. These studies come from New Zealand, the Netherlands, United Kingdom, Republic of Ireland, Germany, Scandinavia and other European countries, and the United States and have occurred both before and after the reduction in SIDS that followed the recommendation to place infants supine to sleep. The results are remarkably consistent, showing that the use of pacifiers is associated with an approximate halving of the risk of SIDS, and come from many countries in the world, suggesting that the results are generalizable to other countries.

The mechanism by which pacifiers might reduce the risk of SIDS, or by its absence increase the risk, is unknown, but several mechanisms have been postulated. These include avoidance of the prone sleeping position,[11] protection of the oropharyngeal airway,[1,12] reduction of gastroesophageal reflux through nonnutrient sucking,[2] and lowering the arousal threshold.[13] Because pacifiers generally fall out within 30 minutes of the infant falling asleep,[13,14] the beneficial effect might not be a result of the presence of the pacifier at a specific time, which may explain the apparent protective effect of usual pacifier use rather than only at the last sleep. Alternatively, pacifier use may be a marker for some protective factors that have eluded measurement. The physiology of infant pacifier use, nonuse among routine users, and infant thumb-sucking deserves additional investigation.

The use of pacifiers varies considerably between countries and also within countries. In New Zealand, the prevalence of pacifier use was low (10.4%) but within the country varied from 3.6% in southern South Island to 32.3% in northern North Island.[2] In other countries, much higher pacifier use has been reported. In European countries pacifier use varies between 36% and 71%.[15] There is little information as to the reasons for such wide variation between countries and why pacifiers are introduced.[16] Turkish and Moroccan people dislike thumb-sucking and they actively try to prevent this by offering the breast and/or a pacifier.[17]

Other potential advantages of pacifier use are the management of pain or discomfort during blood sampling,[18] reduction of gastroesophageal reflux,[19] and reduction of dental malocclusion that occurs as a consequence of thumb- or finger-sucking in a child not given a pacifier.[20,21] However, Winberg[16] has asked if there is a risk that prolonged use of a pacifier would replace more adequate soothing measures. The authors of a recent systematic review of nonpharmacologic and nonsurgical therapies for gastroesophageal reflux concluded that the impact of pacifier use on gastroesophageal reflux was equivocal and depended on infant position.[19]

Before recommending the use of pacifiers, the potential disadvantages must be considered. From observational studies,[22–25] there seems to be a clear relationship between frequent or continuous pacifier use and a re-

TABLE 1 Relative Risk of SIDS Associated With Pacifier Use for Usual Sleep

Study			Case		Control		Univariate OR (95% CI)	Adjusted OR (95% CI)
			Yes	No	Yes	No		
Mitchell et al[2]	1987–1990	New Zealand	74	318	372	1219	0.76 (0.57–1.02)	0.71 (0.50–1.01)
Fleming et al[3]	1993–1995	United Kingdom	194	124	786	513	1.02 (0.79–1.32)	Not given
L'Hoir et al[4]	1995–1996	Netherlands	15	58	86	60	0.18 (0.09–0.36)	0.24 (0.11–0.51)
Arnestad et al[5]	1984–1992	Norway	63	58	193	114	0.64 (0.41–1.00)	Not given
McGarvey et al[8]	1994–1998	Ireland	119	36	411	209	1.68 (1.10–2.58)	1.47 (0.62–3.50)
Carpenter et al[9]	1992–1996	Europe	394	236	1492	738	0.83 (0.68–1.00)	0.74 (0.58–0.95)
Mitchell et al (unpublished data)[a]	1991–1993	New Zealand	5	116	95	822	0.37 (0.12–0.93)	Not given
Alm et al (unpublished data)[b]	1992–1995	Scandinavia	162	70	609	237	0.90 (0.65–1.25)	Not given

Adjusted ORs are as quoted by the authors.
[a] Prospective data collected at initial contact.
[b] Never versus sometimes or daily.

TABLE 2 Relative Risk of SIDS Associated With Pacifier Use for Last Sleep

Study			Case		Control		Univariate OR (95% CI)	Adjusted OR (95% CI)
			Yes	No	Yes	No		
Mitchell et al[2]	1987–1990	New Zealand	19	372	165	1421	0.44 (0.26–0.73)	0.43 (0.24–0.78)
Fleming et al[3]	1993–1995	United Kingdom	124	189	664	632	0.62 (0.48–0.81)	0.41 (0.22–0.77)
L'Hoir et al[4]	1995–1996	Netherlands	8	65	69	77	0.14 (0.06–0.32)	0.19 (0.08–0.46)
Hauck et al[6]	1993–1996	United States	39	221	83	177	0.38 (0.24–0.59)	0.33 (0.15–0.70)
Brooke et al[7]	1996–1999	Scotland	42	66	118	111	0.60 (0.37–0.98)	0.33 (0.15–0.77)
McGarvey et al[8]	1994–1998	Ireland	45	106	355	280	0.33 (0.22–0.50)	0.10 (0.03–0.31)
Carpenter et al[9]	1992–1996	Europe	130	229	653	532	0.46 (0.36–0.59)	0.44 (0.29–0.68)
Vennemann et al[10]	1998–2001	Germany	135	194	543	450	0.58 (0.44–0.75)	0.39 (0.25–0.59)

Adjusted ORs are as quoted by the authors.

duction in breastfeeding, although it was unclear from these studies whether the effect is causal or whether pacifier use is a marker for breastfeeding difficulties or reduced motivation to breastfeed. However, the interval between the introduction of the pacifier and weaning may be several months, which suggests that the use of the pacifier might reduce stimulation from suckling, thus resulting in a gradual reduction in breast milk production.[24,25] Randomized, controlled studies of pacifier use in term infants have produced conflicting results, with 1 study suggesting that pacifiers were detrimental to exclusive and overall breastfeeding[26] and the other not showing a detriment.[27] In preterm infants, 1 randomized, controlled study showed no effect of pacifier use on breastfeeding.[28]

Pacifier use has been associated with significantly higher risk of infective symptoms, especially otitis media.[29,30] Again, this may be a result of reverse causality; mothers try and soothe their infant with a pacifier when the infant has otitis media. Pacifier use is also positively associated with oral yeast infection.[31] Infrequent use of a pacifier, however, does not seem to be associated with these infective symptoms.[32]

Other potential disadvantages include accidents (airway obstruction,[33] strangulation by cords tied to the pacifier,[34] and eye injuries[35]) and dental malocclusion.[36] The association of pacifier use and lower IQ is controversial. Suspected developmental delay was higher in pacifier users than nonusers in one study,[37] but this effect disappeared after adjusting for duration of breastfeeding, suggesting that breast milk affects child development rather than not using a pacifier. However, a study by Gale and Martyn[38] looking at adult intelligence came to the opposite conclusion, namely that intelligence in adult life may have more to do with the child's social environment than with type of infant feeding.

So what should be advised? The evidence that pacifiers reduce the risk of SIDS is convincing. However, its use needs to be balanced against the established risks, especially the probable reduction in breastfeeding duration. Recent studies show that other behavioral and psychological factors are important predictors of breastfeeding duration, such as maternal intention,[39] timing of

decision-making about breastfeeding,[39] depressive symptoms,[40] and maternal perception of the adequacy of breast milk supply.[41]

It certainly seems appropriate to stop discouraging the use of pacifiers. Whether it is appropriate to recommend pacifier use in infants is open to debate. If parents choose to use one, which many do, evidence-based advice on how to use it needs to be given. Breastfeeding mothers should offer a pacifier only when breastfeeding is established, after the neonatal period. Parents who wish to give a pacifier should do so only for sleeping periods. At the end of the first year of life, pacifier use should be phased out.

REFERENCES

1. Cozzi F, Albani R, Cardi E. A common pathophysiology for sudden cot death and sleep apnoea: "the vacuum-glossoptosis syndrome." *Med Hypotheses.* 1979;5:329–338
2. Mitchell EA, Taylor BJ, Ford RP, et al. Dummies and the sudden infant death syndrome. *Arch Dis Child.* 1993;68:501–504
3. Fleming PJ, Blair PS, Pollard K, et al. Pacifier use and sudden infant death syndrome: results from the CESDI/SUDI case-control study. CESDI SUDI Research Team. *Arch Dis Child.* 1999;81:112–116
4. L'Hoir MP, Engelberts AC, van Well GT, et al. Dummy use, thumb sucking, mouth breathing and cot death. *Eur J Pediatr.* 1999;158:896–901
5. Arnestad M, Andersen M, Rognum TO. Is the use of dummy or carry-cot of importance for sudden infant death? *Eur J Pediatr.* 1997;156:968–970
6. Hauck FR, Herman SM, Donovan M, et al. Sleep environment and the risk of sudden infant death syndrome in an urban population: the Chicago Infant Mortality Study. *Pediatrics.* 2003;111(5 pt 2):1207–1214
7. Brooke H, Tappin DM, Beckett C, Gibson A. Dummy use on the day/night of death: case-control study of sudden infants death syndrome (SIDS) in Scotland, 1996–99 [abstract]. 6th SIDS International Conference; February 8–11, 2000; Auckland, New Zealand
8. McGarvey C, McDonnell M, Chong A, O'Regan M, Matthews T. Factors relating to the infant's last sleep environment in sudden infant death syndrome in the Republic of Ireland. *Arch Dis Child.* 2003;88:1058–1064
9. Carpenter RG, Irgens LK, Blair PS, et al. Sudden unexplained infant death in 20 regions in Europe: case control study. *Lancet.* 2004;363:185–191
10. Vennemann MM, Findeisen M, Butterfass-Bahloul T, et al.

Modifiable risk factors for SIDS in Germany: results of GeSID. *Acta Paediatr.* 2005;94:655–660

11. Righard L. Sudden infant death syndrome and pacifiers: a proposed connection could be a bias. *Birth.* 1998;25:128–129

12. Cozzi F, Morini F, Tozzi C, Bonci E, Cozzi DA. Effect of pacifier use on oral breathing in healthy newborn infants. *Pediatr Pulmonol.* 2002;33:368–373

13. Franco P, Scaillet S, Wermenbol V, Valente F, Groswasser J, Kahn A. The influence of a pacifier on infants' arousals from sleep. *J Pediatr.* 2000;136:775–779

14. Weiss PP, Kerbl R. The relative short duration that a child retains a pacifier in the mouth during sleep: implications for sudden infant death syndrome. *Eur J Pediatr.* 2001;160:60–70

15. Nelson EA, Yu LM, Williams S; International Child Care Practices Study Group Members. International Child Care Practices study: breastfeeding and pacifier use. *J Hum Lact.* 2005;21:289–295

16. Winberg J. Pacifier: partner or peril? *Acta Paediatr.* 1999;88:1177–1179

17. Sleuwen BE, L'Hoir MP, Engelberts AC, Westers P, Schulpen TWJ. Infant care practices related to cot death in Turkish and Moroccan families in the Netherlands. *Arch Dis Child.* 2003;88:784–788

18. Mitchell A, Brooks S, Roane D. The premature infant and painful procedures. *Pain Manag Nurs.* 2000;1:58–65

19. Carroll AE, Garrison MM, Christakis DA. A systematic review of nonpharmacological and nonsurgical therapies for gastro-esophageal reflux in infants. *Arch Pediatr Adolesc Med.* 2002;156:109–113

20. Svedmyr B. Dummy sucking: a study of its prevalence, duration and malocclusion consequences. *Swed Dent J.* 1979;3:205–210

21. Adair SM. Pacifier use in children: a review of recent literature. *Pediatr Dent.* 2003;25:449–458

22. Barros FC, Victora CG, Semer TC, et al. Use of pacifiers is associated with decreased breast-feeding duration. *Pediatrics.* 1995;95:497–499

23. Righard L, Alade MO. Breastfeeding and the use of pacifiers. *Birth.* 1997;24:116–120

24. Howard CR, Howard FM, Lanphear B, deBlieck EA, Eberly S, Lawrence RA. The effects of early pacifier use on breastfeeding duration. *Pediatrics.* 1999;103(3). Available at: www.pediatrics.org/cgi/content/full/103/3/e33

25. Vogel AM, Hutchison BL, Mitchell EA. The impact of pacifier use on breastfeeding: a prospective cohort study. *J Paediatr Child Health.* 2001;37:58–63

26. Howard CR, Howard FM, Lanphear B, et al. Randomized clinical trial of pacifier use and bottle-feeding or cupfeeding and their effect on breastfeeding. *Pediatrics.* 2003;111:511–518

27. Kramer MS, Barr RG, Dagenais S, et al. Pacifier use, early weaning, and cry/fuss behavior: a randomized controlled trial. *JAMA.* 2001;286:322–326

28. Collins CT, Ryan P, Crowther CA, McPhee AJ, Paterson S, Hiller JE. Effect of bottles, cups, and dummies on breast feeding in preterm infants: a randomised controlled trial. *BMJ.* 2004;329:193–198

29. 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

30. Uhari M, Mantysaari K, Niemela M. A meta-analytic review of the risk factors for acute otitis media. *Clin Infect Dis.* 1996;22:1079–1083

31. 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;68:33–36

32. Niemela M, Pihakara 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

33. 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

34. Feldman KW, Simms RJ. Strangulation in childhood: epidemiology and clinical course. *Pediatrics.* 1980;65:1079–1085

35. Stubbs AJ, Aburn NS. Penetrating eye injury from a rigid infant pacifier. *Aust N Z J Ophthalmol.* 1996;24:71–73

36. 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

37. Barros FC, Victora CG, Morris SS, Halpern R, Horta BL, Tomasi E. Breast feeding, pacifier use and infant development at 12 months of age: a birth cohort study in Brazil. *Paediatr Perinat Epidemiol.* 1997;11:441–450

38. Gale CR, Martyn CN. Breastfeeding, dummy use, and adult intelligence. *Lancet.* 1996;347:1072–1075

39. Donath SM, Amir LH; ALSPAC study team. The relationship between prenatal infant feeding intention and initiation and duration of breastfeeding: a cohort study. *Acta Paediatr.* 2003;92:352–356

40. Taveras EM, Capra AM, Braveman PA, Jensvold NG, Escobar GJ, Lieu TA. Clinician support and psychosocial risk factors associated with breastfeeding discontinuation. *Pediatrics.* 2003;112:108–115

41. Chapman DJ, Pérez-Escamilla R. Maternal perception of the onset of lactation is a valid, public health indicator of lactogenesis stage II. *J Nutr.* 2000;130:2972–2980