

Sudden Infant Death Syndrome (SIDS) and Pacifiers: A Selected Annotated Bibliography

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 Aug 20; [Epub ahead of print].

Aim: It has been hypothesized that the association of pacifier use with reduced risk of sudden infant death is mediated by forward movement of the mandible and tongue that helps open the upper airway. Our aim was to examine whether the mandible is moved forward when an infant is sucking on a pacifier, and if so, whether the mandible remains advanced after the pacifier is removed. **Methods:** In sixty clinically stable premature infants (corrected gestation age 36.5 +/- 0.3 weeks, mean +/- SEM) the distance from each ear where the pinna met the cheek to the most prominent point of the chin was measured bilaterally, and the average was used as an index of mandibular position. Mandibular position was determined before and after allowing the infants to suck on a pacifier for 10-15 min, and after removing the pacifier. **Results:** There was a significant forward movement of the mandible when the infants were sucking on the pacifier (59.5 +/- 0.7 vs. 58.6 +/- 0.7 mm, $p = 0.001$), with no significant change after the pacifier was removed. **Conclusions:** Pacifier use in preterm infants was associated with a small significant forward displacement of the jaw. These data suggest that pacifier use may help protect the upper airway.

Full-text available at: <http://www.blackwell-synergy.com/>

Comina E, Marion K, Renaud FN, Dore J, Bergeron E, Freney J.
Pacifiers: A microbial reservoir.
Nurs Health Sci. 2006 Dec; 8(4):216-23.

The permanent contact between the nipple part of pacifiers and the oral microflora offers ideal conditions for the development of biofilms. This study assessed the microbial contamination on the surface of 25 used pacifier nipples provided by day-care centers. Nine were made of silicone and 16 were made of latex. The biofilm was quantified using direct staining and microscopic observations followed by scraping and microorganism counting. The presence of a biofilm was confirmed on 80% of the pacifier nipples studied. This biofilm was mature for 36% of them. Latex pacifier nipples were more contaminated than silicone ones. The two main genera isolated were *Staphylococcus* and *Candida*. Our results confirm that nipples can be seen as potential reservoirs of infections. However, pacifiers do have some advantages; in particular, the potential protection they afford against sudden infant death syndrome. Strict rules of hygiene and an efficient antibiofilm cleaning protocol should be established to answer the worries of parents concerning the safety of pacifiers.

Full-text available at: <http://www.blackwell-synergy.com>

Thompson JM, Thach BT, Becroft DM, Mitchell EA
Sudden infant death syndrome: Risk factors for infants found face down differ from other SIDS cases.
J Pediatr. 2006 Nov;149(5):630-633.

OBJECTIVE: To test the hypothesis that infants with sudden infant death syndrome (SIDS) found face down (FD) would have SIDS risk factors different from those found in other positions (non-face-down position, NFD). **STUDY DESIGN:** We used the New Zealand Cot Death Study data, a 3-year, nationwide (1987 to 1990), case-control study. Odds ratios (univariate and multivariate) for FD ($n = 154$) and NFD SIDS ($n = 239$) were estimated separately, and statistical differences between the two groups were assessed. **RESULTS:** Of 12 risk factors for SIDS, there were 8 with a statistically significant difference between FD and NFD infants. After adjustment for the potential confounders, younger infant age, Maori ethnicity, low birth weight, prone sleep position, use of a sheepskin, and pillow use were all associated with a greater risk of SIDS in the FD than the NFD group. Sleeping during the nighttime, maternal smoking, and

bed-sharing were associated with a risk of SIDS only in the NFD group. Pacifier use was associated with a decreased risk for SIDS only in the NFD group, whereas being found with the head covered was associated with a decreased risk for SIDS for the FD group.
CONCLUSIONS: Infants with SIDS in the FD position appear to be a distinct subgroup of SIDS. These differences in risk factors provide clues to mechanisms of death in both SIDS subtypes.

Full-text available at: <http://www.sciencedirect.com>

Talbert DG.

Dysphagia as a risk factor for sudden unexplained death in infancy.

Med Hypotheses. 2006; 67(4):786-91. E-pub 2006 Jun 23.

The TRIAD of encephalopathy, subdural haemorrhages, and retinal haemorrhages is commonly considered diagnostic of Shaken Baby Syndrome, but the original paper describes a statistically linked QUADRAD of features, the fourth of which is a previous history of feeding difficulties (dysphagia). Recent reviews of giving pacifiers (dummies) to infants during sleeping periods have found a significant reduction in the incidence of Sudden Infant Death Syndrome. Stimulation of swallowing is a possible connection with dysphagia, which is examined here, illustrated by a well documented case. Although amniotic fluid passes freely through the larynx of fetal mammals during fetal breathing, application of pure water to the laryngeal epithelium in infants causes choking and laryngeal closure. "Water sensors" in the surface respond to lack of chloride ions and adapt very slowly or not at all. Others have found in puppies that following application of pure water only 32% resume breathing in less than 30-40s. The rest needed at least one saline flush, and some required artificial ventilation in addition. These receptors also respond to high potassium concentrations and acid or alkaline solutions. Normally, airway closure during swallowing or vomiting prevents entry of feed or oesophageal reflux, but in some forms of dysphagia leakage can occur, causing paroxysmal coughing, reflex laryngeal closure, and so prolonged apnoea. Recently, it has been realised that the TRIAD injuries can also result from high intracranial vascular pressures transmitted from intra-thoracic pressure surges during paroxysmal coughing, choking, etc. Triggering of such pressure surges by dysphagic accidents provides a physiological link to injuries commonly considered diagnostic of Shaken Baby Syndrome, completing the statistically identified QUADRAD of features. Further dysphagic research might reveal predictive factors, and preventative measures such as feeds of optimal pH.

Full-text available at: <http://www.sciencedirect.com>

Joanna Briggs Institute

Early childhood pacifier use in relation to breastfeeding, SIDS, infection and dental malocclusion.

Nurs Stand. 2006 May 31-Jun 6; 20(38):52-5.

This information on best practice is based on a systematic review (Callaghan et al 2005) conducted by the Institute Nurses' Network (Telethon Institute of Child Health Research), Western Australian community and child health nurses and the Western Australian Centre for Evidence Based Nursing and Midwifery, a collaborating centre of the Joanna Briggs Institute. The primary references on which this information is based are available online via Blackwell Synergy: <http://www.blackwell-synergy.com> and to members of the institute via the web site: <http://www.joannabriggs.edu.au>

Li DK, Willinger M, Petitti DB, Odouli R, Liu L, Hoffman HJ.

Use of a dummy (pacifier) during sleep and risk of sudden infant death syndrome (SIDS): population based case-control study.

BMJ. 2006 Jan 7; 332(7532):18-22. E-pub 2005 Dec 9.

Objectives: To examine the association between use of a dummy (pacifier) during sleep and the risk of sudden infant death syndrome (SIDS) in relation to other risk factors. Design: Population based case-control study. Setting: Eleven counties in California. Participants: Mothers or carers of 185 infants whose deaths were attributed to SIDS and 312 randomly selected controls

matched for race or ethnicity and age. Main outcome Measures: Use of a dummy during sleep determined through interviews. Results: The adjusted odds ratio for SIDS associated with using a dummy during the last sleep was 0.08 (95% confidence interval 0.03 to 0.21). Use was associated with a reduction in risk in every category of sociodemographic characteristics and risk factors examined. The reduced risk associated with use seemed to be greater with adverse sleep conditions (such as sleeping prone or on side and sleeping with a mother who smoked), although the observed interactions were not significant. In addition, use of a dummy may reduce the impact of other risk factors for SIDS, especially those related to adverse sleep environment. For example, infants who did not use a dummy and slept prone or on their sides (v on their back) had an increased risk of SIDS (2.61, 1.56 to 4.38). In infants who used dummies, there was no increased risk associated with sleeping position (0.66, 0.12 to 3.59). While cosleeping with a mother who smoked was also associated with increased risk of SIDS among infants who did not use a dummy (4.5, 1.3 to 15.1), there was no such association among those who did (1.1, 0.1 to 13.4). Conclusions: Use of a dummy seems to reduce the risk of SIDS and possibly reduces the influence of known risk factors in the sleep environment.

Full-text downloading available at: bmj.bmjournals.com/cgi/reprint/332/7532/18

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 Nov; 116(5):1245-55. E-pub 2005 Oct 10.

There has been a major decrease in the incidence of sudden infant death syndrome (SIDS) since the American Academy of Pediatrics (AAP) released its recommendation in 1992 that infants be placed down for sleep in a non prone position. Although the SIDS rate continues to fall, some of the recent decrease of the last several years may be a result of coding shifts to other causes of unexpected infant deaths. Since the AAP published its last statement on SIDS in 2000, several issues have become relevant, including the significant risk of side sleeping position; the AAP no longer recognizes side sleeping as a reasonable alternative to fully supine sleeping. The AAP also stresses the need to avoid redundant soft bedding and soft objects in the infant's sleeping environment, the hazards of adults sleeping with an infant in the same bed, the SIDS risk reduction associated with having infants sleep in the same room as adults and with using pacifiers at the time of sleep, the importance of educating secondary caregivers and neonatology practitioners on the importance of "back to sleep," and strategies to reduce the incidence of positional plagiocephaly associated with supine positioning. This statement reviews the evidence associated with these and other SIDS-related issues and proposes new recommendations for further reducing SIDS risk.

Full-text downloading available at: <http://www.pediatrics.org>

Hauck FR, Omojokun OO, Siadaty MS.

Do pacifiers reduce the risk of sudden infant death syndrome? A meta-analysis.

Pediatrics. 2005 Nov; 116(5):e716-23. E-pub 2005 Oct 10.

Objective: Pacifier use has been reported to be associated with a reduced risk of sudden infant death syndrome (SIDS), but most countries around the world, including the United States, have been reluctant to recommend the use of pacifiers because of concerns about possible adverse effects. This meta-analysis was undertaken to quantify and evaluate the protective effect of pacifiers against SIDS and to make a recommendation on the use of pacifiers to prevent SIDS. Methods: We searched the Medline database (January 1966 to May 2004) to collect data on pacifier use and its association with SIDS, morbidity, or other adverse effects. The search strategy included published articles in English with the Medical Subject Headings terms "sudden infant death syndrome" and "pacifier" and the keywords "dummy" and "soother." Combining searches resulted in 384 abstracts, which were all read and evaluated for inclusion. For the meta-analysis, articles with data on the relationship between pacifier use and SIDS risk were limited to published original case-control studies, because no prospective observational reports were found; 9 articles met these criteria. Two independent reviewers evaluated each study on

the basis of the 6 criteria developed by the American Academy of Pediatrics Task Force on Infant Positioning and SIDS; in cases of disagreement, a third reviewer evaluated the study, and a consensus opinion was reached. We developed a script to calculate the summary odds ratio (SOR) by using the reported ORs and respective confidence intervals (CI) to weight the ORs. We then pooled them together to compute the SOR. We performed the Breslow-Day test for homogeneity of ORs, Cochran-Mantel-Haenszel test for the null hypothesis of no effect (OR = 1), and the Mantel-Haenszel common OR estimate. The consistency of findings was evaluated and the overall potential benefits of pacifier use were weighed against the potential risks. Our recommendation is based on the taxonomy of the 5-point (A-E) scale adopted by the US Preventive Services Task Force. Results: Seven studies were included in the meta-analysis. The SOR calculated for usual pacifier use (with univariate ORs) is 0.90 (95% confidence interval [CI]: 0.79-1.03) and 0.71 (95% CI: 0.59-0.85) with multivariate ORs. For pacifier use during last sleep, the SORs calculated using univariate and multivariate ORs are 0.47 (95% CI: 0.40-0.55) and 0.39 (95% CI: 0.31-0.50), respectively. Conclusions: Published case-control studies demonstrate a significant reduced risk of SIDS with pacifier use, particularly when placed for sleep. Encouraging pacifier use is likely to be beneficial on a population-wide basis: 1 SIDS death could be prevented for every 2733 (95% CI: 2416-3334) infants who use a pacifier when placed for sleep (number needed to treat), based on the US SIDS rate and the last-sleep multivariate SOR resulting from this analysis. Therefore, we recommend that pacifiers be offered to infants as a potential method to reduce the risk of SIDS. The pacifier should be offered to the infant when being placed for all sleep episodes, including daytime naps and nighttime sleeps. This is a US Preventive Services Task Force level B strength of recommendation based on the consistency of findings and the likelihood that the beneficial effects will outweigh any potential negative effects. In consideration of potential adverse effects, we recommend pacifier use for infants up to 1 year of age, which includes the peak ages for SIDS risk and the period in which the infant's need for sucking is highest. For breastfed infants, pacifiers should be introduced after breastfeeding has been well established.

Full-text downloading available at: pediatrics.aappublications.org/cgi/reprint/peds.2004-2631v1

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 Aug; 21(3):289-95.

Although the Baby-Friendly Hospital Initiative advises that no pacifiers be given to breastfeeding infants, both breastfeeding and pacifier use may protect against sudden infant death syndrome. The International Child Care Practice Study data set on child care practices associated with sudden infant death syndrome risk from 21 centers in 17 countries was used to describe infant-feeding practices and pacifier use and assess factors associated with breastfeeding. At approximately 3 months of age, rates of breastfeeding only (4%-80%) and pacifier use (12.5%-71%) varied between centers. Pacifier use was negatively associated with breastfeeding, and a dose-response effect was noted. Other negative (multiple birth, smoking by mother) and positive (intention to breastfeed, bed sharing, mothers' education) associations with breastfeeding only were identified. Although causality should not be inferred, these associations are consistent with previous studies. Advice on pacifiers should include potential benefits as well as risks.

Full-text available at: jhl.sagepub.com/cgi/reprint/21/3/289

Franco P, Chabansk S. et al.
Pacifier Use Modifies Infant's Cardiac Anomic Controls during Sleep.
Early Hum Dev. 2004 Apr; 77(1-2): 99-108.

Objective: The risk for sudden infant death (SIDS) was postulated to decrease with the use of a pacifier and by conditions increasing parasympathetic tonus during sleep. We evaluated the influence of a pacifier on cardiac autonomic controls in healthy infants. Study design: Thirty-four healthy infants were studied polygraphically during one night: 17 infants regularly used a pacifier during sleep and 17 never used a pacifier. Thumb users or occasional pacifier users were not included in the study. The infants were recorded at a median age of 10 weeks (range

6-18 weeks). Autonomic nervous system (ANS) was evaluated by spectral analysis of the heart rate (HR). The high frequency component of HR spectral analysis reflected parasympathetic tonus and the low frequency on high frequency ratio corresponded to the sympathovagal balance. Results: Most infants (63.6%) lost their pacifier within 30 min of falling asleep. Sucking periods were associated with increases in cardiac sympathovagal balance. During non-sucking periods, in both REM and NREM sleep, infants using a pacifier were characterized by lower sympathetic activity and higher parasympathetic tonus compared with non-pacifier users. Conclusions: The use of pacifiers modifies cardiac autonomic controls during both sucking and non-sucking sleep periods. Non-nutritive sucking could regulate autonomic control in infants. These findings could be relevant to mechanisms implicated in the occurrence of sudden infant deaths during sleep.

Full-text available at: <http://www.sciencedirect.com>

Matthews T, McDonnell M, McGarvey C, Loftus G, O'Regan M.
A multivariate time based analysis of SIDS factors.
Archives of Disease in Childhood. 89(3):267-271, March 2004.

Aims: To investigate the influence of analytical design on the variability of published results in studies of sudden infant death syndrome (SIDS). Methods: The results of a prospective case-control study, of 203 cases of SIDS, and 622 control infants are presented. All variables significant on univariate analysis were included in a multivariate model analysed in nine stages, starting with sociodemographic variables, then sequentially and cumulatively adding variables relating to pregnancy history, current pregnancy, birth, the interval from birth to the week prior to death, the last week, the last 48 hours, and the last sleep period. A ninth stage was created by adding placed to sleep prone for the last sleep period. Results: As additional variables are added, previously published SIDS risk factors emerged such as social deprivation, young maternal age, ≥ 3 previous live births, maternal smoking and drinking, urinary tract infection in pregnancy, reduced birth weight, and the infant having an illness, regurgitation, being sweaty, or a history of crying/colic in the interval from birth to the week before death, with co-sleeping and the lack of regular soother use important in the last sleep period. As the model progressed through stages 1-9, many significant variables became non-significant (social deprivation, young maternal age, maternal smoking and drinking) and in stage 9 the addition of placed to sleep prone for the last sleep period caused ≥ 3 previous live births and a reduced birth weight to become significant. Conclusion: The variables found to be significant in a case-control study, depend on what is included in a multivariate model.

Full-text available at: <http://www.adc.bmj.com/>

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 Dec; 88(12):1058-64.

Aim: To identify risk factors for sudden infant death syndrome (SIDS) in the sleeping environment of Irish infants. Methods: Five year population based case-control study with parental interviews conducted for each case and three controls matched for age, place of birth, and last sleep period. A total of 203 SIDS cases and 622 control infants born 1994-98 were studied. Results: In a multivariate analysis, co-sleeping significantly increased the risk of SIDS both as a usual practice (adjusted OR 4.31; 95% CI 1.07 to 17.37) and during the last sleep period (adjusted OR 16.47; 95% CI 3.73 to 72.75). The associated risk was dependent on maternal smoking (OR 21.84; 95% CI 2.27 to 209.89), and was not significant for infants who were $>$ or ≥ 20 weeks of age (OR 2.63; 95% CI 0.49 to 70.10) or placed back in their own cot/bed to sleep (OR 1.07; 95% CI 0.21 to 5.41). The use of pillows, duvets, and bedding with tog value $>$ or ≥ 10 were not significant risk factors when adjusted for the effects of confounding variables, including maternal smoking and social disadvantage. However, the prone sleeping position remains a significant SIDS risk factor, and among infants using soothers, the absence of soother use during the last sleep period also significantly increased the SIDS risk (OR 5.83; CI 2.37 to 14.36). Conclusion: Co-sleeping should be avoided in infants who are < 20 weeks of

age, or whose mothers smoked during pregnancy. The prone position remains a factor in some SIDS deaths, and the relation between soother use and SIDS is a complex variable requiring further study.

Full-text available at: <http://www.archdischild.com>

Adair SM.

Pacifier Use in Children: A Review of Recent Literature.

Pediatr Dent 2003; 25(5): 449-58.

Pediatric dentists are generally well aware of the oral implications of nonnutritive sucking (NNS). NNS via digit or pacifier can effect changes in the occlusion, including open bite, excessive over jet, and possibly posterior cross bite. Skeletal changes have also been attributed to NNS. There is some evidence that pacifiers may do less harm to the dentition, particularly because pacifier habits are often spontaneously shed at about 2 to 4 years of age. Digit habits are more likely to persist into the school-age years and can require appliance therapy for discontinuation. Thus, some authorities suggest that pacifiers be recommended for infants who engage in NNS. While pediatric dentists understand the oral and perioral effects of pacifiers, they may be less well versed in other aspects of pacifier use that have been reported in the medical, nursing, chemical, and psychological literature. This paper provides reviews of literature concerning the role of pacifier NNS in 4 areas: (1) sudden infant death syndrome; (2) breast-feeding; (3) otitis media and other infections; and (4) safety. Knowledge of current literature in these areas may assist pediatric dentists with their decisions of whether to recommend or discourage pacifier use in infants.

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 May; 111(5 part 2): 1207-1214.

Objective: To examine risk factors for sudden infant death syndrome (SIDS) with the goal of reducing SIDS mortality among blacks, which continues to affect this group at twice the rate of whites. Methods: We analyzed data from a population-based case-control study of 260 SIDS deaths that occurred in Chicago between 1993 and 1996 and an equal number of matched living controls to determine the association between SIDS and factors in the sleep environment and other variables related to infant care. Results: The racial/ethnic composition of the study groups was 75.0% black; 13.1% Hispanic white; and 11.9% non-Hispanic white. Several factors related to the sleep environment during last sleep were associated with higher risk of SIDS: placement in the prone position (unadjusted odds ratio [OR]: 2.4; 95% confidence interval [CI]: 1.7-3.4), soft surface (OR: 5.1; 95% CI: 3.1-8.3), pillow use (OR: 2.5; 95% CI: 1.5-4.2), face and/or head covered with bedding (OR: 2.5; 95% CI: 1.3-4.6), bed sharing overall (OR: 2.7; 95% CI: 1.8-4.2), bed sharing with parent(s) alone (OR: 1.9; 95% CI: 1.2-3.1), and bed sharing in other combinations (OR: 5.4; 95% CI: 2.8-10.2). Pacifier use was associated with decreased risk (unadjusted OR: 0.3; 95% CI: 0.2-0.5), as was breastfeeding either ever (OR: 0.2; 95% CI: 0.1-0.3) or currently (OR: 0.2; 95% CI: 0.1-0.4). In a multivariate model, several factors remained significant: prone sleep position, soft surface, pillow use, bed sharing other than with parent(s) alone, and not using a pacifier. Conclusions: To lower further the SIDS rate among black and other racial/ethnic groups, prone sleeping, the use of soft bedding and pillows, and some types of bed sharing should be reduced.

Full-text downloading available at: pediatrics.aappublications.org/cgi/reprint/111/5/S1/1207

Zotter H, Kerbl R, Kurz R, Muller W.

Pacifier use and sudden infant death syndrome: Should health professionals recommend pacifier use based on present knowledge?

Wien. Klin. Wochenschr. 2002 Sept 20; 114(17-18): 791-794.

The aim of this paper is to review and compare results from different studies describing the possible preventive effect of pacifiers on the sudden infant death syndrome. A Medline and

Pubmed search was performed in order to find relevant references. Four groups of researchers were found, and referring to the most recent publications of each working group, these papers were reviewed with regard to sample size, setting of the studies, odds ratios and confidence intervals. All four-research groups found an association between pacifier use and a reduced risk of sudden infant death syndrome, but they all concluded that the association does not necessarily imply that the use of a pacifier is protective against the sudden infant death syndrome. Therefore, they provide no definite recommendation for pacifier use on the grounds of protection against the sudden infant death syndrome.

Kahn A, Sawaguchi T, Sawaguchi A, Groswasser J, Franco P, Scaillet S, Kelmanson I, Dan B. **Sudden infant deaths: from epidemiology to physiology.** Forensic Sci Int. 2002 Sep 14; 130 Suppl: S8-20.

The incidence of sudden infant death syndrome (SIDS) has dropped significantly in most countries following the development of education campaigns on the avoidance of risk factors for SIDS. However, questions have been raised about the physiological mechanism responsible for the effects of these environmental risk factors. Since 1985, a series of prospective, multicentric studies have been developed to address these questions; over 20,000 infants were recorded during one night in a sleep laboratory and among these, 40 infants eventually died of SIDS. In this review, the following methods were employed: sleep recordings and analysis, monitoring procedure, data analysis of sleep stages, cardiorespiratory and oxygen saturation, scoring of arousals, spectral analysis of the heart rate and the determination of arousal thresholds, and statistical analysis and the results including sleep apneas, arousals and heart rate and autonomic controls in both future SIDS victims and normal infants were introduced separately. In addition, the physiological effect of prenatal risk factors (maternal smoking during gestation) and postnatal risk factors (administration of sedative drugs, prone sleeping position, ambient temperature, sleeping with the face covered by a bed sheet, pacifiers and breastfeeding) in normal infants were analyzed. In conclusion, the physiological studies undertaken on the basis of epidemiological findings provide some clues about the physiological mechanisms linked with SIDS. Although the description of the mechanisms responsible for SIDS is still far from complete, it appears to involve both arousal responses and cardiac autonomic controls during sleep-wake processes.

Full-text available at: <http://www.sciencedirect.com>

Morren G, Van Huffel S, Helon I. et al. **Effects of non-nutritive sucking on heart rate, respiration and oxygenation: A model-based signal processing approach.** Comp Biochem Physiol Part A, Molecular & Integrative Physiology 2002 May; 132(1): 97-106.

Several studies support the idea that the use of pacifiers can reduce the risk of Sudden Infant Death Syndrome. To investigate the effect of non-nutritive sucking (NNS), we measured heart rate, abdominal respiration, EMG and arterial oxygen saturation of 20 neonates. Also, in 10 of these neonates, changes in cerebral hemoglobin concentrations were acquired by means of near-infrared spectroscopy. Using a parametric technique to model the heart rate as a sum of exponentially damped sinusoids, two main frequency components were found in the heart rate during NNS: a frequency of approximately 0.08 Hz due to the alternation of sucking bursts and pauses, and a frequency of approximately 0.8 Hz that reflects the influence of the respiration. Our analysis shows that it is the alternation of bursts and pauses itself that causes the increased heart rate variability, and that this is not due to increased effort. This suggests that the neuronal mechanism regulating NNS also stimulates the heart rate. From our measurements, no effect of NNS on cerebral or peripheral oxygenation could be found. Furthermore, we show that our model-based signal processing technique is well suited for the analysis of non-stationary biomedical signals.

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