

The Impact of Prolonged Pacifier Use on Speech Articulation: A Preliminary Investigation

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Newborns' instinctive nature to suck is a reflexive behavior that facilitates nourishment. Prenatal imaging has demonstrated that babies suck their thumb or fingers before birth (Baby Center, n.d). Additionally, sucking is a comforting behavior that may help to calm and settle restless babies (American Academy of Pediatrics, 2000; Baby Center, n.d.). Substituting a pacifier for the mother's breast or the baby bottle for the

purpose of comforting and settling the newborn is common (i.e., 75 to 85% of infants) in western countries (Victoria, Behague, Barros, Olinto, & Weiderpass, 1997). Pacifiers allow babies to suck without ingesting nourishment (i.e., nonnutritive sucking [NNS]). The optimal age for discontinuation of pacifier use is the subject of debate, in part, because of the potential impact of sustained NNS on the development of oral structure and function, which in turn is critical for speech production.

A recent study of dental malocclusions from approximately 15,000 children from one orthodontic clinic concluded that a sucking habit resulted in 60% of the dental malocclusions that were seen in those patients (Van Norman, 2001). The American Dental Association (2003) reported that pacifier use in 3- to 5-year-old children led to anterior open bite, posterior crossbite, mean overjet, and smaller intercanine distance of the upper arch. Boshart (2001) suggested that dental problems associated with prolonged pacifier sucking could lead to speech articulation problems such as distortion of the fricative and alveolar phonemes. In addition to speech articulation problems, it is plausible that NNS might negatively impact speech development in children in other ways. With the oral cavity partially obstructed by the pacifier, babbling and imitation of sounds and words may be limited. In addition, it is conceivable that vocalizations made around the pacifier may be distorted, or the child may not attempt to speak at all (Van Norman, 2001). Finally, the World Health Organization (1989) reported a positive correlation between pacifier use and increased incidence of otitis media. The

ABSTRACT: This investigation was designed to study the impact of prolonged pacifier use on speech articulation. Three groups of children representing varying degrees of pacifier use ranging from little or none to 55 months were formed. Group 1 consisted of 30 children who had no or minimal history of pacifier use. Group 2 consisted of 16 children who had a history of pacifier use for up to 15 months. Group 3 consisted of 22 children who had a history of pacifier use that ranged from 18 to 55 months. Each child was administered the Goldman-Fristoe Test of Articulation—Second Edition (GFTA-2; R. Goldman & M. Fristoe, 2000). For purposes of this investigation, mean standard scores for each group were statistically compared. A one-way analysis of variance did not suggest that there were significant differences among the 3 groups. Implications for future study include more rigorous quantification of the style and brand of pacifier used, the extent of pacifier use, the inclusion of other forms of nonnutritive sucking, and the instrument and protocol for measuring speech articulation errors.

KEY WORDS: pacifier, speech, articulation, disorder, dentition

impact of otitis media on speech and language development is well documented (Niemela, Pihakari, Pokka, Uhari, & Uhari, 2000).

The purpose of this investigation was to study the impact of prolonged pacifier use on speech articulation. Specifically, this investigation examined and compared the speech production abilities of children with minimal (i.e., less than 1 month) or no history of pacifier use, children with a history of typical pacifier use, and children with a history of prolonged pacifier use. For purposes of this investigation, typical pacifier use was defined as routine pacifier use between the ages of birth to 15 months, and prolonged pacifier use was defined as routine pacifier use beyond 18 months of age.

METHOD

Participants for this investigation were 68 children, 34 females and 34 males, between the ages of 24 and 79 months, with an average age of 45 months ($SD = 12$ months). Participants had no reported family history of speech disorders or cognitive disabilities. All participants had normal hearing sensitivity and normal vision. The duration of pacifier use for participants ranged from zero to 56 months, with a mean duration of 11 months. Participants were assigned to 1 of 3 groups depending on the extent or duration of their pacifier use. Group 1 consisted of 30 children who had never used a pacifier or whose use of a pacifier was deemed minimal (i.e., less than 1 month). The mean age of Group 1 was 44 months ($SD = 11$ months). Group 2 consisted of 16 children who routinely used a pacifier from birth to 15 months. The mean age of Group 2 was 48 months ($SD = 13$ months). Group 3 consisted of 22 children who had routinely used a pacifier beyond the age of 18 months. The mean age of Group 3 was 46 months ($SD = 12$ months). Table 1 provides descriptive statistics for the 3 groups' ages.

A Levene statistical test for homogeneity of variance among the 3 groups did not suggest that the variances among the 3 groups were significantly different (Levene statistic = 0.103, $df = 2$ and 65, $p = 0.902$; Levene, 1960). Because the assumption of homogeneity of variance was therefore met, a one-way analysis of variance (ANOVA) was used to assess for differences among the ages of the 3 groups. The ANOVA among the mean ages for the 3 groups is shown in Table 2, and did not reveal that any of the

means were significantly different from one another ($F = .876$, $df = 2$, $p = .421$). The male gender composition of the 3 groups was 15, 8, and 11, respectively.

The test material used in this study to assess speech articulation development was the Goldman-Fristoe Test of Articulation—Second Edition (GFTA-2; Goldman & Fristoe, 2000). Data regarding the participants' articulation abilities were obtained through the Sounds-in-Words section of the GFTA-2, which uses 53 target words on 34 picture plates to elicit articulation of 61 consonant sounds in the initial, medial, and/or final position as well as 16 consonant clusters in the initial position. Results from the GFTA-2 were in the form of standard scores. Data were analyzed with an ANOVA.

RESULTS

Table 3 shows the descriptive statistics for the 3 groups' performances on the GFTA-2. Group 1's average standard score for the GFTA-2 was 100.47 ($SD = 16.65$, range = 73 points). Group 2's average standard score was 103.31 ($SD = 12.39$, range = 52). Group 3's average standard score was 105.59 ($SD = 13.53$, range = 59).

A Levene statistical test for homogeneity of variance among the 3 groups did not suggest that the variances among the 3 groups were significantly different (Levene statistic = .970, $df = 2$ and 2, $p = .384$). Because the assumption of homogeneity of variance was therefore met, a one-way ANOVA was used to test for differences among the 3 group means. The ANOVA among the means for the 3 groups is shown in Table 4, and did not suggest that any of the means were significantly different from one another ($F = .776$, $df = 2$, $p = .464$).

DISCUSSION

The results of this study found no significant differences among the articulation skills (as measured by the GFTA-2) of the 3 groups of participants. Despite this finding, questions still remain regarding the impact of prolonged pacifier use on speech articulation. First, the use of commercially available pacifiers is but one of several forms of NNS. The current study made no attempt to include participants who engaged in other forms of NNS such as

Table 1. Descriptive statistics for the 3 groups' ages.

Group	N	Mean	SD	SE	95% confidence interval for mean		Minimum	Maximum
					Lower bound	Upper bound		
1	30	43.57	10.988	2.006	39.46	47.67	24	60
2	16	48.13	12.940	3.235	41.23	55.02	32	79
3	22	46.36	11.640	2.482	41.20	51.52	24	60
Total	68	45.54	11.652	1.413	42.72	48.36	24	79

Table 2. Group results ANOVA table for the one-way analysis. The independent grouping variable is groups (1, 2, and 3), representing the extent of pacifier use. The dependent variable is age in months.

Source	SS	df	MS	F	Probability
Between group	238.660	2	119.330	.876	.421
Within groups	8858.208	65	136.280		
Total	9096.867	67			

thumb sucking. Future research should take into account any and all forms of NNS.

As with other forms of NNS, no attempt was made in the current study to identify and/or factor in the type or brand of pacifier used. Although there are commercially available pacifiers that are marketed as being designed to fit the physiological and orthodontic contour of the oral cavity, no attempt was made in the current study to introduce type, style, or brand as an experimental variable. Future research may wish to take into account the actual style, type, or brand of pacifier that was used most frequently by each study participant.

No routine information is available to quantify the exact amount of time that participants engaged in pacifier use during a typical day. Instead, participants were grouped on the basis of mother's reported information regarding the duration of pacifier use in months. Additional information regarding typical daily use of the pacifier as well as the use to facilitate falling asleep might have been variables that could have influenced the current findings. Obtaining valid data regarding the actual amount of time that a pacifier was used during a typical day from the mother's recollection is problematic. Until some reliable metric can be devised to quantify the amount of time the pacifier was actually in the mouth, the accuracy of the mother's estimate needs to be verified.

Examining speech articulation and, specifically, articulation errors associated with the developing dentition in young children in a more natural context may prove to be more beneficial in future studies designed to explore the impact of pacifier use on articulatory development. The GFTA-2 does not analyze speech sound production beyond sounds and words in isolation for the ages used in this study. It is conceivable that articulation errors might have emerged had connected discourse been analyzed. Finally,

Table 3. Descriptive statistics for the 3 groups' performances on the Goldman-Fristoe Test of Articulation—Second Edition (GFTA-2; Goldman & Fristoe, 2000).

Group	N	Mean	SD	SE	95% confidence interval for mean		Minimum	Maximum
					Lower bound	Upper bound		
1	30	100.47	16.650	3.040	94.25	106.68	55	128
2	16	103.31	12.392	3.098	96.71	109.92	67	119
3	22	105.59	13.528	2.884	99.59	111.59	67	126
Total	68	102.79	14.724	1.786	99.23	106.36	55	128

Table 4. Group results ANOVA table for the one-way analysis. The independent grouping variable is groups (1, 2, and 3), representing the extent of pacifier use. The dependent variable is the result from the GFTA-2.

Source	SS	df	MS	F	Probability
Between group	338.895	2	169.448	.776	.464
Within groups	14186.222	65	218.250		
Total	14525.118	67			

the number of participants available for study in this investigation may not have been sufficient to bring true and significant findings to light.

CONCLUSION

There remains a link between NNS and dental development. Likewise, there is a similar link between poor dental development and the production (i.e., articulation) of certain speech sounds such as linguodentals and labiodentals. However, the current investigation did not show a statistically significant relationship between prolonged pacifier use and speech articulation.

Several factors might account for the current study's inability to show a relationship between prolonged pacifier use and speech articulation. Among these factors are the failure to quantify the amount of daily pacifier use and the style and brand of pacifier used. For this study, the only form of NNS included was the use of pacifiers. No attempt was made to include participants who engaged in thumb sucking, garment sucking, blanket sucking, or any other form of object sucking. The GFTA-2, the instrument used in this investigation to assess speech sound articulation, examined the production of speech sounds in single words and therefore may not have been sensitive to misarticulations that might have occurred during connected speech or conversation.

REFERENCES

- American Academy of Pediatrics. (2000). *Thumb sucking and pacifiers*. Retrieved July 14, 2003, from <http://www.aap.org/healthtopics/stages.cfm#early>.

- American Dental Association.** (2003). *Dental effects persist regardless of type of pacifier used: Study, 2003* [Data file]. Retrieved July 14, 2003, from <http://www.ada.org>.
- Baby Center.** (n.d.). *Fetal development 14 weeks*. Retrieved July 14, 2003, from <http://www.babycenter.com/mybabycenter/114.html>.
- Boshart, B. A.** (2001). *The pacifier: Making the decision*. Temecula, CA: Speech Dynamics.
- Goldman, R., & Fristoe, M.** (2000). *Goldman-Fristoe Test of Articulation—Second edition: Manual*. Circle Pines, MN: AGS.
- Levene, H.** (1960). Robust tests for equality of variances. In I. Olkin (Ed.), *Contributions to probability and statistics* (pp. 278–292). Palo Alto, CA: Stanford University Press.
- Niemela, M., Pihakari, O., Pokka, T., Uhari, M., & Uhari, M.** (2000). Pacifier as a risk factor for acute otitis media: A randomized, controlled trial of parental counseling. *Pediatrics, 106*, 483–488.
- Van Norman, R.** (2001). Why we can't afford to ignore prolonged digit sucking. *Contemporary Pediatrics, 18*, 61–81.
- Victoria, C., Behague, D., Barros, F., Olinto, M., & Weiderpass, E.** (1997). Pacifier use and short breastfeeding duration: Cause, consequence, or coincidence? *Pediatrics, 99*, 445–453.
- World Health Organization.** (1989). *Protecting, promoting, and supporting breastfeeding: The special role of maternity services*. Geneva, Switzerland: Author.
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