

An analysis of malocclusion in children with otitis media

Scot Watase, DMD Arthur P. Mourino, DDS, MSD Gary A. Tipton, MD, FAAP

Abstract

Purpose: The purpose of this study was to examine the occlusion of children younger than 6 years with a diagnosis of otitis media.

Methods: The study consisted of 112 children diagnosed with otitis media by their pediatrician. Parents were surveyed regarding their child's history of pacifier use, thumb/finger-sucking habit, mouthbreathing habit, method of feeding, day care attendance, snoring, allergies, asthma, upper respiratory infections, otitis media in the family, and the number of people who smoke in the home. The children's occlusions were examined.

Results: In this study, 52% of the population presented with some type of malocclusion, with anterior open bite (17%) and an overbite measuring greater than 70% (17%) being the most prominent. This study showed that the following factors were common in children with otitis media: bottle feeding, smoking in the home, day care attendance, upper respiratory infection, history of otitis media with a sibling, pacifier habit, snoring, and mouthbreathing habit.

Conclusion: A logistic regression analysis showed no significant association between malocclusion and factors related to otitis media. (*Pediatr Dent* 20:5 327-330, 1998)

Otitis media is a common childhood infectious disease, second only to the common cold, characterized by inflammation of the middle ear.^{1,2} It is a recurrent disease that, if untreated, can progress from the acute stage, lasting up to 3 weeks, to the subacute stage, which lasts between 3 weeks and 3 months, and the chronic stage, which lasts for more than 3 months.¹ Otitis media can be accompanied by an effusion, a collection of fluid present in the middle ear space accompanying the inflammation. The effusion can be purulent, mucoid, or serous and can occur in all three stages of otitis media.^{1,2} A perforation of the tympanic membrane may occur, causing a discharge of fluid from the ear. This condition is known as chronic suppurative otitis media.

Risk factors for otitis media include: male gender, Caucasian, occurrence before the age of 3, frequent upper respiratory infections, day care attendance, pa-

rental smoking, family history of otitis media, history of allergy, supine bottle feeding, and lack of breast feeding.²⁻⁶ Although the pathogenesis of otitis media in children is multifactorial, eustachian tube malfunction is the most common etiology.^{2,3}

Niemela et al.³ tested 944 5-year-old children with a history of otitis media as well as the risk factors of pacifier use, thumb sucking, mouth breathing, atopic eczema, open bite, posterior cross-bite, history of snoring, allergic rhinitis, asthma, and an overjet > 2.5 mm, as well as maxillary and mandibular crowding. A significant association with otitis media was found in children who used a pacifier, were mouth breathers, or had an anterior open bite. He also concluded that allergic rhinitis, asthma, and snoring were common in children with otitis media, but thumb-sucking habits and atopic eczema were not associated. Although the sucking action used with pacifiers has less of an effect on the growth of the nasopharyngeal bony frame than the thumb-sucking action, the pacifier habit was a greater risk factor for otitis media than thumb sucking in this study.

A follow up study by Neimela et al.⁴ examined the occurrence of otitis media and the use of a pacifier in 845 children attending selected day care centers. Other variables examined included the frequency of thumb sucking, type of nursing, history of parental smoking, and social class. The 845-child sample was divided into:

1. Children younger than 2 years
2. Children from 2 to 3 years
3. Children from 3 to 4 years
4. Children 4 and older.

In all four groups, pacifier usage increased the risk of otitis media. Neimela concluded that the use of a pacifier was responsible for 25% of cases of otitis media in children younger than 3 years but had no influence on the incidence of otitis media in children 4 years of age or older.⁴ The authors recommend that a pacifier be used only in the first 10 months of life when the need for sucking is strongest and otitis media is uncommon.

The pacifier habit has also been known to cause a high prevalence of malocclusion in children. Adair et al.⁷ studied the effects of pacifier use on malocclusion

in 218 children between the ages of 24 to 59 months. Results of this study showed a higher prevalence of anterior openbites, posterior crossbites, increased overjet, and Class II canines and molars in children who used pacifiers.

Although these studies have shown that pacifier use is a risk factor for otitis media and malocclusion, the reasons for this are unknown. A possible explanation for an increase in cases of otitis media with pacifier use is that the pacifier could elevate the soft palate and impair the normal functions of the eustachian tube.³ An abnormally patent eustachian tube could result in a reflux of nasopharyngeal secretions into the tube, enhancing development of otitis media. Also microorganisms could be spread by the pacifiers when used in small, close contact areas like day care centers.

The purpose of this study was to examine the occlusion of children younger than 6 with a diagnosis of otitis media, as it relates to sucking habits via the pacifier or thumb/finger, mouthbreathing, snoring, allergies, asthma, history of upper respiratory infections, history of breast feeding, history of bottle feeding, and family history of otitis media.

Methods

As the parents presented to the pediatric dental clinic at the Medical College of Virginia/ Virginia Commonwealth University (MCV/VCU) or the MCV/VCU private pediatrician's office, they were asked the age of the child as well as if their child was ever diagnosed with otitis media. If the child met the requirements for this study, they were asked to participate. After informed consent was obtained, a six-question survey was presented to 113 parents of patients younger than the age of 6 with a diagnosis of otitis media. One parent refused to participate in the study. The study consisted of two groups totaling 112 patients gathered in a 5-month time frame. One group of 61 patients was seen at the MCV/VCU pediatric dental clinic and the other group of 51 patients was seen at a MCV/VCU private practice pediatrician's office. The child's age, gender, and race was ascertained. The questionnaire asked about a history of pacifier habits, as well as other related subjects such as a history of thumb/finger-sucking habits, mouthbreathing habits, snoring, smoking in the home, allergies, asthma, upper respiratory infections, day care attendance, family history of otitis media, history of bottle feeding, and a history of breast feeding. The patients were examined and the type of occlusion present was recorded. In this study, malocclusion was defined as having one or more of the following:

1. Class II or III relationships for the primary canines on the right and left sides
2. Distal step relationship
3. Overbite > 70%
4. Overjet > 5 mm

5. Presence of an anterior openbite

6. Presence of an anterior crossbite

7. Presence of a posterior crossbite.

Descriptive statistics were used to review and present the results. In addition, logistic regression was used to test the association between the response variable, malocclusion, and the explanatory variables of pacifier-sucking habit, thumb/finger-sucking habit, mouthbreathing habit, snoring, allergies, asthma, upper respiratory infections, history of breast feeding, history of bottle feeding, and a history of otitis media in the family.

Results

This study examined 64 males and 44 females diagnosed with otitis media from the pediatric dental clinic and the pediatrician's office. From the 112 children who were examined, there were four children whose parents did not give the child's gender when completing this survey, leaving 108 children in this category. There were no significant differences between the pediatric dental clinic group and the group that was seen at the pediatrician's office. These two groups were combined for this study. From these numbers, 36 (56%) males and 20 (46%) females or a combined 56 out of 108 (54%) children had a malocclusion. Out of the 112 children examined in this study, 58 (52%) had some type of malocclusion.

There were 36 Caucasians and 67 Afro-Americans in the study. There were six children whose nationalities differed from Caucasian or African-American and three children whose parents did not give the race. Malocclusion was present in 25 (69%) Caucasians and 29 (43%) African-Americans.

Table 1 lists the frequencies and percentages for the types of occlusion present in this study. Class I canines and mesial step molar relationships were the primary types of occlusion present. There were 82 (73%) Class I canines on the right and 78 (70%) Class I canines on the left. The mesial step molar relationships accounted for 70 (63%) on the right and 68 (61%) on the left.

The two most prominent types of malocclusion were anterior open bites (17%) and overbites > 70% (17%). These two types of malocclusion accounted for 66% (38/58) of all malocclusions present in this study. There were 13 of 19 (68%) patients examined with an anterior open bite who had a history of pacifier use. More anterior crossbites (10%) than posterior crossbites (7%) were found. Class III canine relationships occurred more than Class II canine relationships and flush terminal plane relationships occurred more often than distal step relationships.

Table 2 lists the explanatory variables used in this study. These variables were compared to malocclusion to see if there was an association between them. Although no association was found in this study, 44%

TABLE 1. FREQUENCY AND PERCENTAGE OF OCCLUSION

<i>Malocclusion</i>	<i>Frequency (%)</i>
Right canine Class I	82 (73%)
Left canine Class I	78 (70%)
Right canine Class II	4 (4%)
Left canine Class II	5 (5%)
Right canine Class III	7 (6%)
Left canine Class III	8 (7%)
Right mesial step	70 (63%)
Left mesial step	68 (61%)
Right distal step	4 (4%)
Left distal step	4 (4%)
Right flush terminal plane	11 (10%)
Left flush terminal plane	12 (11%)
Overbite > 70 %	19 (17%)
Overjet > 5 mm	9 (8%)
Anterior open bite	19 (17%)
Anterior crossbite	11 (10%)
Posterior crossbite	8 (7%)

of the children diagnosed with otitis media used a pacifier while 21% had a mouthbreathing habit. Only 9% had a history of thumb/finger-sucking habit. Other notable factors associated with otitis media are bottle feeding, which occurred in 94% of the children, smoking in the home (55%), day care attendance (55%), upper respiratory infection (51%), history of otitis media with a sibling occurring (46%), and snoring (42%).

The statistical analysis showed no association at the .05 significance level between the response variable (malocclusion) and the explanatory variables (pacifier-sucking habit, thumb/finger-sucking habit, history of breast feeding, history of bottle feeding, mouthbreathing habit, snoring, allergies, asthma, upper respiratory infections, and family history of otitis media).

Discussion

There are approximately 4000 children who present to the pediatric department at the MCV with otitis media per year. This represents 20% of the annual pediatric population. In this study, 64 males and 44 females of those diagnosed with otitis media were selected. In four children, the parents neglected to give the gender of the child. Bluestone et al.² reported a higher prevalence of otitis media occurring in males. This study found a similar trend.

Multiple factors play a role in otitis media. In this study, factors associated with otitis media and how they

relate to malocclusion were evaluated. Although this study found no association between malocclusion and the risk factors for otitis media, studies done by Niemela et al.³ found a significant relationship between otitis media and anterior open bite, mouthbreathing habit, and pacifier use. In that study, 14% of the children had a mouthbreathing habit, 24% had an anterior open bite, and 73% used a pacifier. In comparison, our study found a higher percentage of mouthbreathers (21%) but a lower percentage of anterior open bites (17%) and pacifier use (44%). The study by Adair et al.⁷ found a strong association between pacifier use and anterior open bite. In Adair's study, 17% of the children who used a pacifier had an anterior open bite compared to 3% of the children who did not use a pacifier.⁷ In comparison, our study found that 68% of children who presented with an anterior open bite also had a history of pacifier use. From the Niemela and Adair studies, there may be some correlation between pacifier use causing not only anterior open bites but otitis media as well. The studies done by Niemela et al. and Adair et al. were comprised of larger data sets. Our data set consisted of only 112 children.

In a study by Jones et al.,⁸ 493 African-American children between the ages of 3 and 4 years were evaluated for the types of molar occlusion present, the frequencies of anterior and posterior crossbites, and the frequencies of anterior openbites. They found 90% of the children had a mesial step molar relationship, 8% had a flush terminal plane relationship, and 2% had a

TABLE 2. FACTORS ASSOCIATED WITH OTITIS MEDIA

<i>Factors associated with otitis media</i>	<i>Frequency (%)</i>
Pacifier habit	49 (44%)
Thumb/finger sucking habit	10 (9%)
Mouthbreathing habit	23 (21%)
Snoring	47 (42%)
Allergies	18 (16%)
Asthma	19 (17%)
Upper respiratory infections	57 (51%)
History of otitis media with the mother	22 (20%)
History of otitis media with the father	9 (8%)
History of otitis media with a sibling	51 (46%)
Breast feeding	7 (6%)
Bottle feeding	105 (94%)
Smoking in the home	62 (55%)
Day care attendance	61 (55%)

distal step molar relationship. In this study with a mixed population, Class I canines and mesial step molar relationships were the most prominent occlusions present. Mesial step molar relationships occurred in 62% of the children while 10% had a flush terminal plane relationship and 4% had a distal step molar relationship.

Jones et al.⁸ found that posterior crossbites occurred in 7% of the children, while anterior crossbites occurred in 5% of their sample size.⁸ Our study showed posterior crossbites in 7% of the children with anterior crossbites in 10% of the children. Jones et al.⁸ found 8% of the children had an anterior open bite. By comparison, our study showed 17% of the children with an anterior open bite.

The factors of smoking in the home and day care attendance were items that were not incorporated into the logistic regression. The survey included these factors because they are associated with otitis media. Smoking in the home and day care attendance are common factors in approximately 55% of the children in this study.

There were 105 (94%) children who have a history of bottle feeding and 7 (6%) children who have a history of breast feeding (Table 2). In this study, children who were bottle fed as opposed to breast fed had a higher tendency toward acquiring otitis media. In a study by Sheard et al., it was concluded that breast feeding for the first 4 to 6 months of life may protect against the occurrence of otitis media in the first year of life.¹¹ Some of the suggested reasons why breast feeding is protective against otitis media are that breast-fed infants are positioned in an upright manner as opposed to the supine position when bottle fed. Because the eustachian tube of the child is anatomically shorter and lies in a more horizontal direction, children bottle fed in the supine position enable any reflux or liquid present in the area of the nasopharynx to enter the tube with the possibility of causing an otitis media.^{2,6} A second reason is that breast milk contains immunologic components such as secretory IgA, which prevents bacteria from spreading to the eustachian tube, thus limiting the chance for otitis media to occur.^{2, 11}

The main cause of otitis media is eustachian tube dysfunction.^{2, 3} The eustachian tube is part of a continuous system where there is communication between the surrounding organs such as the nasopharynx, nasal, and oral cavities. Normally the eustachian tube leading into the nasopharynx is closed to prevent a reflux of fluid from entering the tube. However, during such actions as swallowing and sucking, the tensor veli palatini muscle contracts, allowing the tube to become patent.² Therefore, a child sucking on a pacifier with an upper respiratory infection is more susceptible to otitis media. The Niemela study coincides with the present study in that thumb sucking did not seem to be a factor for otitis media.³

The anatomic features of the child's eustachian tube, as well as the features of supine bottle feeding, smoking in the home, day care attendance, upper respiratory infection, history of otitis media with a sibling, pacifier habit, snoring, mouthbreathing habit, history of allergy, and lack of breast feeding are all factors related to otitis media.^{2-6, 11} Although these factors are related to otitis media, this study showed that they were not associated with malocclusion.

Conclusion

1. The following factors were common in children with otitis media: bottle feeding, smoking in the home, day care attendance, upper respiratory infection, history of otitis media with a sibling, pacifier habit, snoring, and mouthbreathing habit.
2. Malocclusion was present in 52% of the children examined in this study.
3. The most prominent malocclusions are anterior open bite (17%) and overbite > 70% (17%).
4. There is no association between the factors of otitis media and malocclusion.

Dr. Watase is in private practice in Montebello, California and was formerly an advanced education student in pediatric dentistry, Dr. Mourino is director, advanced education program in Pediatric Dentistry, School of Dentistry, and Dr. Tipton is associate professor, Division of General Pediatrics and Emergency Care, School of Medicine, at of the Medical College of Virginia-Virginia Commonwealth University, Richmond, Virginia.

References

1. Lisby-Sutch SM, Nemec-Dwyer MA, Deeter RG, Gaur SM: Therapy of otitis media. *Clin Pharm* 9:15-34, 1990.
2. Bluestone C, Klein J: *Otitis Media in Infants and Children*, 2nd Ed. Philadelphia: WB Saunders, 1995.
3. Niemela M, Uhari M, Hannuksela A: Pacifiers and dental structure as risk factors for otitis media. *Int J Pediatr Otorhinolaryngol* 29:121-27, 1994.
4. Niemela M, Uhari M, Mottonen M: A pacifier increases the risk of recurrent acute otitis media in children in day care centers. *Pediatrics* 96:884-88, 1995.
5. Sassen ML, Brand R, Grote JJ: Breast-feeding and acute otitis media. *Am J Otolaryngol* 15:351-57, 1994.
6. Tully SB, Bar-Haim Y, Bradley RL: Abnormal tympanography after supine bottle feeding. *J Pediatr* 126:105-111, 1995.
7. Adair SM, Milano M, Lorenzo I, Russell C: Effects of current and former pacifier use on the dentition on 24- to 59 month old children. *Pediatr Dent* 17:437-44, 1995.
8. Jones ML, Mourino AP, Bowden TA: Evaluation of occlusion, trauma, and dental anomalies in African-American children of metropolitan Headstart programs. *J Clin Pediatr Dent* 18:51-54, 1993.
9. Peterson JE Jr, Schneider PE: Oral habits. A behavioral approach. *Pediatr Clin North Am* 38:1289-1307, 1991.
10. Hannuksela A: The effect of atopy on the dentition. *Eur J Orthod* 5:279-85, 1983.
11. Sheard NF: Breast-feeding protects against otitis media. *Nutr Rev* 51:275-77, 1993.