Scientific Article

The Effectiveness of a Novel Infant Tooth Wipe in High Caries-risk Babies 8 to 15 Months Old

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Abstract: ***Purpose:*** *The purpose of this study was to assess baby and parental satisfaction and plaque-removal efficacy of a novel infant tooth wipe (Spiffies) in high caries-risk babies.* ***Methods:*** *Thirty-five healthy and caries-free infants were selected. Babies had never had their teeth cleaned and no primary molars were yet present. Subjects were identified with the risk factor of nightly feeding behaviors. Pre- and postcleaning oral hygiene plaque measurements were recorded and then analyzed by a blinded examiner. A manual toothbrush (Ultra Kids) was used as the control method. Infants' caregivers used their randomly assigned cleaning method without instruction. Babies returned to the clinic after a 48- to 72-hour washout period, and the procedures were repeated before and after use of the alternate method. Parental satisfaction and baby-perceived acceptance were evaluated by a questionnaire and were analyzed at the time of the visit and at bedtime.* ***Results:*** *Both the infant tooth wipe and conventional brushing significantly reduced plaque levels (P<.001). Parents were more satisfied with the wipes when compared to toothbrushing, particularly after nightly feeding habits (P<.001). Similarly, infant's acceptance was higher with the wipes at daytime and significantly higher at night-time (P=.002).* ***Conclusions:*** *The Novel novel Infant infant Tooth tooth Wipe wipe provides an effective method of plaque removal before the eruption of primary molars. (Pediatr Dent 2007;29:337-42)*

KEYWORDS: ORAL HYGIENE METHODS, BABY TOOTH WIPE, HIGH CARIES-RISK, INFANT, PREVENTION

The "window of infectivity," defined as the time of initial colonization of the infant's oral environment with the cariogenic bacteria *mutans streptococci* (MS) is of clinical importance. Earlier the colonization of a young child's mouth, the greater their increases the caries risk.[1,2] Although early studies reported that the "window of infectivity" for MS occurs at a mean age of 27 months,[3] a more recent investigation showed that over 30% of infants are already infected with MS before 6 months of age.[4] A significantly higher percentage of children with Early early Childhood childhood Caries caries (ECC) have has a history of early colonization by MS coupled with a frequent bottle habit or nocturnal bottle and breast-feeding practices.[5] Lack of enamel maturation may also increase the caries risk in young children.[5] Defects such as enamel hypoplasia enhance plaque retention and increased MS colonization.[6] The caries potential of children by 6 months of age may be significantly affected by an additional 1 or 2 cariogenic challenges per day, as most children have begun solid foods by that age.

According to Ismail,[7] there are 3 general approaches used to prevent ECC: (1) educating mothers about the disease; (2) examination and preventive measures in dental clinics; and (3) development of appropriate feeding/dietary and self-care habits at home.

Unfortunately, parental knowledge alone is often not sufficient to influence a change in unhealthy behaviors. One study found that 40% of mothers of ECC babies admitted knowing about the potential harmful effects that may result from putting infants to bed with a bottle containing milk, yet they continued the habit.[8] One of the factors influencing this behavior in mothers could be their concern that a sudden interruption of this habit might cause a disruption of the infant's sleep.

Regarding early dental examination and application of preventive measures, the problem for most children continues to be a lack of access to care. Both the American Academy of Pediatrics (AAP) and the American Academy of Pediatric Dentistry (AAPD) recommend that children have a dental home established by 1 year of age. A program in the state of Washington entitled Access Baby and Children's Dentistry (ABCD) has succeeded in increasing the number of children

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under 2 years of age who have seen a dentist from 6% to 13%. This means that at least 87% of young children in Washington state do not have a dental home by 1 year of age, a statistic that is generally reflective of the United States as a whole.[9,10]

This means that the most realistically attainable ECC prevention strategy is for all health care providers of young children to encourage and counsel parents regarding appropriate home feeding, dietary, and self-care habits. According to the AAP, "exclusive breast-feeding" is advocated for "approximately the first 6 months after birth" and continuation of breast-feeding is recommended "for at least 12 months and thereafter for as long as mutually desired."[11] While the AAPD does not dispute the benefits of breast-feeding, it recommends that nightly breast-feeding practices should be avoided after the eruption of the first primary tooth.[12] The cariogenicity of human breast milk (HBM) vs milk formula is complex and has not been thoroughly investigated. At least one in vitro study, however, suggests that HBM is less cariogenic than bovine milk, but this benefit is negated when sucrose is added to the HBM.[13] Thus, it would appear that the presence of fermentable carbohydrates in the diet of the breast-fed infant through snacking or cereal-feeding practices in the evening becomes an important consideration.

Current evidence reasonably supports the contention that human breast milk or formulas may become highly cariogenic when given at bed time and associated with "unfavorable" oral hygiene patterns.[16] Regardless of feeding practices, preventive approaches to minimize the risk for the development of ECC in all children must address an efficient plaque removal technique. In addition to its efficacy, the cleaning method should also be safe and effective for the mother and be readily accepted by the baby. The majority of earlier investigations focused on plaque removal efficiency of oral hygiene techniques in older children.[17,18] Only a few studies describing the effectiveness of oral hygiene methods, however, have been performed on infants.[19,20]

The purpose of this study was to assess baby and parental satisfaction and plaque-removal efficacy of a novel infant tooth wipe (Spiffies Baby Tooth Wipes, DR Products, Tucson, Ariz) in high caries-risk babies 8 to 15 months old.

Methods

The patients identified for this study were recruited from the "Babysmile Project," Center for Children's Assistance of the Districts Health Department, a hospital affiliated with the Pediatrics Department of the Federal University of Ceará (UFC), Fortaleza, Brazil. A randomized and crossover clinical study was performed following institutional approval by the Ethics Committee of the UFC. Informed consent was obtained from each child's parent or legal guardian.

All babies included in this study had unremarkable medical histories. In addition, all babies selected were identified with the potential caries risk factor of routine bedtime "go-to-sleep" feeding behaviors. Infants were put to sleep with a bottle containing milk. The bottle, however, was removed from the bed after the baby fell asleep. The habit was considered deleterious, since oral hygiene was not performed after bottle-feeding. The reduced salivary flow during sleep diminishes oral clearance of the sugars and increases the contact time between plaque and substrate, thus raising the substrate's cariogenicity. The authors hypothesized that the baby tooth wipes would be adequate for the cleaning of smooth enamel surfaces. Therefore, a final selection criterion was to study only babies who had erupted at least 2 anterior teeth (upper or lower).

The principal investigator assessed the infant's high-risk behaviors and gave instructions for use of the dental cleaning technique. We ensured that all babies had never had their teeth cleaned nor had the parents received any oral hygiene instructions in the past. It was our intention to assess the infant's first experience in tooth cleaning. Since the first contact teething infants commonly have is with nondental health care providers, we wanted to analyze the plaque removal efficacy of the infants' caregivers without the instructions of a pediatric dentist.

Caregivers were told to try to clean their infant's teeth as thoroughly as they could, even if the baby cried, regardless of the time of day.

None of the children had any filled surfaces or active carious lesions. In addition, babies diagnosed with any kind of oral lesions were not considered for the study.
Thirty-five healthy and caries-free babies were selected. The subjects ranged in age from 8 to 15 months (mean age=12 months). The group consisted of 21 males and 14 females.

Spiffies Baby Tooth Wipes were utilized as the experimental dental cleaning technique. The individually packaged tooth wipes are made of a polycarbonate and rayon nonwoven compressed fiber towellete (approximately 12.5x7 cm in size) which is saturated with a highly palatable aqueous solution of 25% xylitol and 10% sorbitol. Each wipe is machine cut and folded, and inserted along with 1.8 mL. of the solution into a foil packet that is then hygienically sealed.

Tooth-brushing (Ultra Escovas Dentais K120, Boqueirão, Curitiba, Brazil) was used as the control dental cleaning technique. This method was selected as the control, because we believe that tooth-brushing is the most effective form of plaque removal, and it should be introduced with eruption of the first primary teeth. A toothbrush was given to the parent along with a tube of commercial children's toothpaste which contained 500 ppm of sodium fluoride. The toothpaste used in this study was the children's "Colgate-Barney" (Colgate-Palmolive, SB Campo, São Paulo, Brazil).

Efficacy of plaque removal. The parent and a single pediatric

dentist were placed in a knee-to-knee position and a clinical examination of the infant's dentition and oral soft tissues was performed. A few droplets of a disclosing agent were applied directly to all tooth surfaces to disclose the plaque. Then, the excess of disclosing solution was carefully removed from the mouth with a sterile gauze pad moistened with a few drops of water. The excess water of the moistened gauze was squeezed close to the disclosed tooth. We performed this step carefully to ensure that the gauze would not touch the tooth surface and remove any dental plaque that would be later used for assessment.

A "before-cleaning method" digital photograph of the teeth was then taken by the principal investigator. All photographs were saved to a computer and given code numbers known only to the principal investigator. The parent was then randomly assigned a dental cleaning method. They were told to step outside of the clinic and wait for 5 to 10 minutes for the baby to calm down, since the majority of the babies cried for the clinical examination and plaque registration. To clean the baby's teeth, the parent was instructed to sit on a chair/sofa with their child's head placed in a comfortable position on the parent's lap. At that time, they performed the cleaning technique. Parents were simply instructed to: (1) tear open the baby tooth wipe packet; (2) remove and unfold the wet wipe; and (3) wrap it around the finger prior to use.
The only other instruction that the parents received was to rub the wipe over the baby's teeth.

For the tooth-brushing cleaning method, parents received a single instruction to put an amount of toothpaste "much smaller" than a pea-sized shape onto the toothbrush, which corresponds to approximately 0.2 mg of toothpaste. Half of the sample initiated the clinical study with the tooth wipe experimental technique and the other half started with the toothbrush control technique. After performing the dental cleaning, the parent and child immediately returned to the clinic where an "after-cleaning method" digital photograph of the teeth was again recorded and stored. After the baseline visit, the subjects were asked to refrain from tooth cleaning for the next 48 to 72 hours. An exception was one bedtime dental cleaning, which allowed parents to complete a satisfaction survey regarding the 2 cleaning techniques.

After infants were put to sleep with a bottle containing milk, the randomly assigned cleansingcleaning method was performed. The caregivers were told not to perform dental cleaning (except once, at bedtime during day 1) in between assessment visits to allow for dental plaque build-up. The subjects then returned for the second visit, and all the clinical procedures previously described were repeated before and after use of the alternate cleaning method. Dental plaque index scores were analyzed utilizing the Turesky modification of the Quigley and Hein index (PI).[21,18] The scoring utilized was as follows: 0=no plaque; 1=separate flecks of plaque at the cervical margin; 2=a thin band of plaque at the cervical margin; 3=a band of plaque wider than 1 mm but covering less than one third of the crown; 4=plaque covering at least one third but less than two thirds of the crown; 5=plaque covering more than two thirds of the crown.

Digital photography was performed with a NIKON D70 digital camera and a 105 mm F 2.8 EX Macro Sigma lens. A high-resolution monitor (Samsung SyncMaster 172B, Samsung, Seremban, Malaysia) was used for the analyses of the PI scores and was performed by a single examiner (co-investigator, who was blinded to the treatment sequence) and calibrated with another examiner.

Assessment of baby and parental satisfaction. Parents/guardians of the infants were also asked to score 2 parameters: parental satisfaction and baby-perceived acceptance of the baby regarding the use of the cleaning method. These parameters were evaluated by a questionnaire. Each of the 2 criteria was scored using the following scale: 1=very dissatisfied; 2=dissatisfied; 3=neutral satisfied; 4=satisfied; 5=very satisfied.[22]

The satisfaction questionnaire was recorded by all parents based on: (1) their own and their infant's dental cleaning experience at the clinic visit; and (2) a single bedtime dental cleaning at home, during which the parents were asked to clean their babies' teeth after the last feeding prior to the longest sleeping time.

Statistical analysis. Paired *t* tests (Mann-Whitney test) were performed using a .05 significance level to determine if significant differences existed between the 2 techniques. Descriptive statistics were generated for the data from the 2 techniques and used to interpret the data.

Results

Two hundred forty-five teeth were analyzed for plaque index scores. Before and afterdental plaque indices for each dental cleaning method are described in Table 1. Both the Infant Tooth Wipe and conventional brushing significantly reduced plaque levels from anterior primary teeth (both $P<.001$). Nevertheless, it is important to note that the initial plaque index scores before the performance of both cleaning methods were not significant ($P=.160$), nor was the "after" comparison of the plaque removing capabilities of the methods ($P=.147$).

Assessment of parental and perceived baby satisfaction. Tables 2 and 3 illustrate, respectively, the mean scores of the 2 parameters of parental satisfaction and perceived baby acceptance regarding the use of the cleaning method. Overall, parents were equally satisfied with the tooth wipes when compared to conventional brushing during the daytime, but more satisfied with the wipes at night-time. Parents dem-

Table 1. EFFICACY OF PLAQUE REMOVAL

ASSIGNED CLEANING METHOD	PLAQUE SCORES (BEFORE) MEAN±(SD)	PLAQUE SCORES (AFTER) MEAN±(SD)	MANN-WHITNEY TEST *P*-VALUE
Baby tooth wipe	3.6±1.2	2.4±1.3	<.001*
Conventional brushing	3.2±1.3	2.0±1.4	<.001*

* Both assigned cleaning methods significantly reduced plaque levels from anterior primary teeth.

Table 2. PARENTAL SATISFACTION

BABY'S CLEANING METHOD	SCORES MEAN±(SD)	MANN-WHITNEY TEST *P*-VALUE
Daytime		
Baby tooth wipe	4.45±0.7	.607*
Conventional brushing	4.37±0.8	
Night-time		
Baby tooth wipe	4.71±0.8	<.001†
Conventional brushing	3.91±1.2	

* Parents were equally satisfied with the tooth wipes when compared to conventional brushing during daytime.

† Parents were significantly more satisfied with the tooth wipe after night-time-feeding habit.

Table 3. PERCEIVED BABY ACCEPTANCE

BABY'S CLEANING METHOD	SCORES MEAN±(SD)	MANN-WHITNEY TEST *P*-VALUE
Daytime		
Baby tooth wipe	4.05±1.9	.534*
Conventional brushing	3.85±1.3	
Night-time		
Baby tooth wipe	4.31±1.2	.002†
Conventional brushing	3.22±1.6	

* Both methods were well accepted during the day. The difference was not statistically significant.

† The tooth wipes were statistically more accepted by the infant at night in comparison to the toothbrush.

onstrated a mean satisfaction rating of 4.45±0.74 SD using the tooth wipe during the daytime, as compared to a mean rating of 4.37±0.77 SD utilizing conventional brushing. Importantly, parents were significantly more satisfied with the tooth wipe after a night-time feeding when they were asked to clean their infant's teeth prior to the longest sleeping time ($P<.001$). The parents mean satisfaction rating of was 4.71±0.78 SD using the tooth wipe at night-time, and was 3.91±1.22 SD for conventional brushing.

The perceived babies' acceptance of their parent's use of a tooth wipe during the daytime resulted in a mean score of 4.05±1.18 SD. Conventional brushing, on the other hand, demonstrated a mean scoring of 3.85±1.28 SD. Although both methods were well accepted during the day, the tooth wipes were statistically more accepted by the infant at night compared to the toothbrush ($P=.002$). In this scenario, the use of the tooth wipe resulted in a mean score of 4.31±1.20 SD when compared to conventional brushing, which had a mean score of 3.22±1.57 SD.

Discussion

This study's results suggest that the Infant Tooth Wipe provides an effective method of plaque removal before the eruption of primary molars. It is important to note that this study investigated only the efficacy of plaque removal with the use of tooth wipes in primary anterior teeth. It should not be extrapolated to children with primary molars, since the wipes likely do not effectively clean pit and fissure surfaces. Both the tooth wipe and conventional brushing significantly reduced plaque levels from anterior primary teeth. This confirms findings of Goval et al (2005), in which an adult novel tooth wipe significantly reduced plaque levels from smooth surfaces.[23] Surprisingly, in addition to the primary finding of effective plaque removal, it is interesting to note that the dental cleaning interventions for infants reduced plaque indices equally. This is in contrast to the results of Goval et al (2005),[23] in which the toothbrush reduced significantly greater plaque than the adult tooth wipe on facial and lingual surfaces. This fact is of clinical importance to children's caregivers.

Control of the colonization by MS may play a major role in the prevention of ECC.[24] MS are found in dental plaque, and mechanical removal theoretically reduces MS levels and further dental caries susceptibility. According to a recent study of by Seow there was a 25% reduction in MS infection in young children after a single dental health education session and tooth-brushing instruc-

tion.[25] Furthermore, optimal preventive measures, including antimicrobial regimens, have also been effective in reducing bacterial counts. Although not tested in the present study, the fact that the Baby Tooth Wipes contain xylitol may be an important feature.

According to numerous studies, the regular use of xylitol was associated with decreased MS levels in saliva and plaque and subsequent decrease in dental caries.[26,27] The appreciable reduction of MS counts is due to the apparent ability of xylitol to decrease the interaction between cariogenic bacteria and the acquired pellicle, which is essential for the promotion of bacterial adhesion to teeth[28] xylitol and sorbitol, components of the wipes, are members of the polyol family. They are the most commonly used sugar substitutes. Sorbitol is metabolized at a slower rate than sucrose, and not at all by most microorganisms. It can, however, be fermented at a slow rate by all MS, including *Streptococcus mutans*, while xylitol is considered to be nonacidogenic.[29,30] Among other benefits of the polyols are their noncariogenicity effects. Regular consumption does not promote tooth decay.[29,31] The major side effect associated with most polyol consumption is osmotic diarrhea. For xylitol, osmotic diarrhea only occurs when it is consumed in large quantities, typically 4 to 5 times that needed for the prevention of dental caries.[31,32]

Many infants and young children experience difficulties in accepting regular tooth-brushing habits. A recent investigation evaluated children's perceived acceptance and parent satisfaction of specialized infant toothbrushes in children 7 to 23 months of age.[20] The assessment of parental satisfaction and perceived baby acceptance of oral hygiene practices after nightly feeding habits in infants, however, has never been reported. The current study attempted to evaluate daytime and night-time parental satisfaction and perceived baby acceptance regarding the use of the novel infant tooth wipe vs a conventional children's toothbrush.

This investigation's findings demonstrated that parents were equally satisfied with the tooth wipes and conventional brushing during the daytime, but significantly more satisfied with the wipes after nightly feedings. This observation might be due to the fact that a number of mothers spontaneously reported that the infant's sleep was not disrupted with the use of the tooth wipes. We were surprised to note that some caregivers reported being more concerned with disrupting their infant's sleep via an oral hygiene practice than with the increased caries risk of habitually putting their baby to sleep with a bottle-/breast-feeding without a post feeding oral cleaning. From this finding, we suggest that a further study is needed to accurately analyze the oral hygiene behaviors of infant's caregivers. Mothers are the primary promoters of oral hygiene practices, and health care providers must address the introduction of accessible oral hygiene methods while infants are still in nightly feeding practices.[33]

Similarly, the infants' perceived acceptance was significantly higher with the tooth wipes at night-time. The fact that the wipes allow the mother to provide smoother and more soothing oral sensory movements in the infant's mouth might have influenced this result. Anticipatory guidance to provide early dental intervention has been proposed by Nowak and Casamassimo.[34] Based on these this datastudy, the introduction of the infant tooth wipe cleansingcleaning method in high caries-risk babies 8 to 15 months of age was considered effective and supports the benefits of anticipatory guidance to address the individual's risk factors for ECC earlier and provide the necessary appropriate intervention.

We believe, however, that the wipes are not a replacement for the toothbrush. They should be used in conjunction with tooth-brushing and any other effective cleaning method, most importantly before the infant's longest sleeping time. Few studies show that 6-month-old infants in the predental stage are already infected by *S mutans*.[4,25] Because of this, perhaps the use of the wipes can be also considered as a first step to oral cleaning, before the eruption of primary teeth. Thus, the xylitol wipes might be very useful during this initial phase of colonization. To this end, primary medical care providers must play a major role in introducing concepts of early childhood preventive dental care to the child's parents as part of their overall well child care and anticipatory guidance. Infants in the first year of life make their first health care visits to medical offices rather than dental offices.[35] This investigation clearly demonstrates that the novel baby tooth wipe can be appropriately recommended by physicians and other nondental health care providers as an effective dental cleaning intervention for teething infants. In addition, the wipes may be especially useful for infants that milk feed at night.

Conclusions

Based on this study's results, the following conclusions can be made:

1. Tooth wipes provide an effective method of plaque removal before the eruption of primary molars.
2. Tooth wipes are highly accepted by infants and their caregivers, especially after nightly feeding practices.

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