Effect of full mouth rehabilitation on the amount of Streptococcus mutans in children with Early Childhood Caries

ABSTRACT

**Aim** The purpose of this study is to evaluate the effect of full mouth rehabilitation on the amount of S. mutans in children with Early Childhood Caries.  

**Materials and methods** Thirty-nine children between 2 and 5 years old treated under general anaesthesia participated in this study. Prior to treatment two baselines samples were collected, one of dental plaque and one of saliva. In addition, samples were obtained one week post operatively, and then three months later. In each sampling, the amount and the concentration (cfu/ml) of S. mutans were evaluated.  

**Results** The findings demonstrate that the operative procedures under general anaesthesia, significantly decrease (p<0.01) the concentration (cfu/ml) and the amount of S. mutans for at least three months. After three months, saliva concentrations and plaque colony numbers of S. mutans increased significantly in relation to one week post-operatively (p<0.01). However, none of the saliva or plaque samples collected three months following treatment reached the pretreatment levels of S. mutans in any of our subjects.  

**Conclusions** The data indicates that full mouth rehabilitation under general anaesthesia produces a statistically significant decrease in S. mutans levels for at least three months.

**Key words** S. mutans; Early childhood caries; Full mouth rehabilitation.

Introduction

Early Childhood Caries (ECC) is a specific form of rampant decay of the primary teeth of infants. The decay pattern of ECC is characteristic and pathognomonic of the condition. The four maxillary incisors are most often affected. The lower primary incisors are intact and the primary cuspids can be occasionally affected. In very severe cases the mandibular incisors are also affected. The primary canines most of the times remain unaffected as the disease progression halts prior to the eruption of these teeth [Ripa, 1988; Horowitz, 1998; Wyne, 1999].

ECC has been given a number of different names including nursing bottle caries, nursing bottle syndrome, milk bottle syndrome, baby bottle caries, and baby bottle tooth decay. The term “baby bottle tooth decay” is easily understood by parents/health professionals and therefore is useful in a programme that educates them about this condition. However, children who never use a “bottle” may still develop the disease [Matee et al., 1994]. Early childhood caries (ECC) is a relatively new term that describes rampant caries in infants and toddlers. Johnston and Messer, [1994] classifies ECC into 3 patterns: i) developmental defects; ii) smooth surface lesions; iii) rampant caries.

Veerkamp and Weerheijm [1995] use 4 stages to classify the ECC: initial, damaged, deep and traumatic lesions. According to Wyne [1999] ECC can be divided into 3 stages: Type I (mild to moderate), Type II (moderate to severe) and Type III (severe).

Ismail and Sohn [1999] classify the ECC into 4 patterns according to the site of occurrence, while Drury et al. [1999] recommended the term Severe Early Childhood Caries for those children under 3 years of age with any sign of smooth surface caries.

**S. mutans**

Certain physiological characteristics of the S. mutans favour their position as a prime agent in caries. It synthesizes extracellular polysaccharides, namely glucans and fructans, from sucrose by the enzymatic action of GPTase and fructosyltransferase. These polysaccharides, especially glucans, are considered to be critically important in dental plaque formation and hence in the pathogenesis of dental caries, because they are insoluble and possess a marked ability to promote adherence when synthesized de novo on various solid surfaces. [Wallman and Krasse, 1993]. However, Marchant et al. [2001] investigated the microbiota from children with nursing caries, and showed that the predominant aciduric flora was composed by S. oralis, S. mutans and A. israelii. The most important conclusion was that each species was genotypically heterogeneous and different genotypes were recovered from different carious teeth in the same child. S. mutans, Lactobacillus spp. and Actinomyces sp. Strain B19SC, were the bacterial species in children with early childhood caries according to Corby et al. [2005], while Aas et al. [2008] imply that bacterial species such as Lactobacillus, Bifidobacterium and Actinomyces may play an important role in caries progression.

Infants seem to acquire the S. mutans from their mothers. According to Berkowitzi [2006] acquisition may occur via vertical or horizontal transmission. He supported that S. mutans can colonize the mouth even of pre-dentate infants. Prolonged and night time bottle feeding practices in infants and toddlers provide the carbohydrate source that promotes high acid production by S. mutans. Liquid from the nursing bottle is deleterious, especially at bedtime, because of decreased salivary flow during sleep.
The prolonged night time exposure to milk or juices results in pooling and stagnation around the maxillary incisors, which have an erosive effect on dental tissues.

Plaque and saliva from children with ECC has been found to contain unusually high levels of S. mutans [Tinanoff and O’Sullivan, 1997; Marchant et al., 2001, Tanzer et al., 2001]. S. mutans colonizes primarily the tooth surfaces, and the condition is detected only after the emergence of the teeth into the oral cavity.

Children who develop ECC remain highly susceptible to future caries development [Greenwell et al., 1990; O’Sullivan and Tinanoff, 1996; O’Sullivan and Thibodeau, 1996].

**Full mouth rehabilitation**

Full mouth rehabilitation under general anaesthesia has shown to be an acceptable procedure to eliminate the caries lesion in children with ECC. Treatment usually consists of restoration or surgical removal of carious teeth along with recommendations regarding feeding patterns. Most of the papers showed that dental surgery result in a significant reduction of the amount of S. mutans. However, many questions have been raised regarding the relapse rate of caries disease. Vinckier et al. [2001], Chase et al. [2004], Grave et al. [2004] and Foster et al. [2006] have supported that dental treatment under general anaesthesia is an important service but we have to emphasise the preventive care to the parents and monitor their children closely.

The purpose of the present study is to investigate the effect of full mouth rehabilitation in children with Early Childhood Caries, on the level of S. mutans in plaque and saliva.

**Materials and methods**

Thirty-nine children between the ages of 24 and 48 months participated in this study. All children were referred by the department of Paediatric Dentistry from Tufts University School of Dental Medicine to the New England Medical Center Hospital for dental treatment under general anaesthesia. The clinical examination included recording decayed, missing, filled teeth as well as assessment of teeth that needed to be extracted. Radiographs were taken for the detection of approximal caries lesion in children with ECC. Treatment usually consists of restoration or surgical removal of carious teeth along with recommendations regarding feeding patterns. Most of the papers showed that dental surgery result in a significant reduction of the amount of S. mutans. However, many questions have been raised regarding the relapse rate of caries disease. Vinckier et al. [2001], Chase et al. [2004], Grave et al. [2004] and Foster et al. [2006] have supported that dental treatment under general anaesthesia is an important service but we have to emphasise the preventive care to the parents and monitor their children closely.

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<table>
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<tr>
<th>T-Test</th>
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<th>Maximum</th>
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<th>Std.Dev.</th>
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<td>5.6x10^4</td>
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**TABLE 1** - Descriptive statistics/saliva.

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<th>Std.Dev.</th>
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</table>

**TABLE 2** - Descriptive statistics/plaque.
Three months later the mean concentration of S. mutans in saliva increased to $4.8 \times 10^4$ (+/- $2.9 \times 10^4$) (Table 1).

Treatment produced a statistically significant ($p<0.01$) decrease in S. mutans concentrations in saliva when measured after 1 week and 3 months. A paired t-test was performed to determine if there was a significant difference in the salivary concentration of S. mutans one week versus three months. The results indicated that there was a statistically significant increase ($p<0.01$) from one week to three months (Table 3). However, none of the saliva samples collected three months after the treatment reached the pretreatment value of S. mutans in any of our subjects.

### Effect on the amount of S. mutans in plaque

The mean amount of S. mutans colonies in plaque before treatment was 71.89 (+/- 23.79). One week after the treatment the mean amount of S. mutans in plaque decreased to 8.43 (+/- 4.05). Three months later the mean of S. mutans in plaque amount increased to 20.66 (+/- 6.73) (Table 2). The results indicate that treatment produced a statistically significant ($p<0.01$) decrease in amount of S. mutans in plaque when measured after 1 week and 3 months. A paired t-test was performed (Table 4) to interpret the difference between the numbers of S. mutans in plaque at three months versus one week after the treatment.

### Discussion

The primary question we sought to answer was whether full mouth rehabilitation under general anaesthesia affects the amounts of S. mutans in young children with nursing caries in a period of three months. The data obtained from this study indicated that full mouth rehabilitation caused a significant reduction in the S. mutans populations recoverable from dental plaque and saliva of young children.

However, the levels of S. mutans are significantly higher three months after the dental procedures when compared to levels observed after one week. Nevertheless, these levels are significantly below the values obtained before the full mouth rehabilitation. It is not known whether the reappearance of S. mutans represented the outgrowth of a small number of organisms from the tooth surfaces, or indicates that the teeth had become re-colonised by S. mutans from saliva. This is in line with Vinckier et al. [2001], who had treated 98 children with ECC under general anaesthesia and followed them for 1 year; it was found that caries activity remained a problem in most of the children studied. Amin et al. [2004] recommended povidone iodine as a supplement during the two months recall intervals to keep the amount of S. mutans as low as possible. Zhan et al. [2006] showed that full mouth rehabilitation and prophylaxis by povidone iodine and fluoride application failed to reduce future caries formation over one year, suggesting repeated antibacterial treatment to control high levels of cariogenic bacteria.

Based on our findings, as well as the results of the above studies, in order to achieve a low amount of S. mutans for a long period of time in children with previous history of ECC, a treatment under general anaesthesia and strict follow-up seems mandatory. The recall appointment permits a reevaluation of past treatment and the establishment of a new recall interval.

Almost all the children studied in our research (88.23%) had a history of being put to bed with a bottle containing milk, orange juices or mixed drinks. In order to prevent the re-establishment of disease the focus should be in parental educational program to alter children’s feeding practices and appropriate plaque control. In addition, professional plaque control and fluoride treatment are important aspects of supportive care control programme for these children.

### Conclusion

Elimination and restoration of ECCaries lesions under general anaesthesia is an effective procedure in reducing the number of S. mutans. However, a high degree of parental motivation and close monitoring is necessary to maintain low levels of S. mutans for a long period of time.

### References


International News

Because of lack of space we can not publish the International news in this issue of the European Journal of Paediatric Dentistry. Here is a reminder of the forthcoming meetings published in past issues.

May 20th, Oporto (Portugal): Iberian and SEPO Congress info: http://www.reuniaoibericaodp.com
June 11th, Verona (Italy): IADT congress info: http://www.sitdtraumidentali.com
Save the date: October 14-15th, Beirut (Lebanon), Congress of Mediterranean Societies of Paediatric Dentistry, more information in the June issue 2/2010

More details about these and other 2010 events are available at: http://www.ejpd.eu