



ORIGINAL ARTICLE

Factors associated with the risk of caries development after comprehensive dental rehabilitation under general anesthesia



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Abstract *Background/purpose:* The aims of this cross-sectional study were to determine the possible risk factors of caries development in children with early childhood caries (ECC) and to perform a caries risk assessment using Cariogram over a 12-month period. There is no report in examining caries risk assessment under 6 years old children in Taiwan.

Materials and methods: Seventy-nine children (mean age 48.80 ± 10.71 months) with ECC indicated for comprehensive dental reconstruction under general anesthesia were selected. A questionnaire was completed by the parents to assess the possible caries-related factors at a 12-month follow-up. Data were collected for caries index, plaque index, *Streptococcus mutans* (SM) and *Lactobacillus* (LB) counts, and salivary buffering capacity at the initial examination and at the 12-month follow-up. Children were divided into two groups: caries-free (decayed, extracted, and filled teeth = 0) and caries-recurrent (decayed, extracted, and filled teeth > 0). The children's caries risk was assessed using the Cariogram software program.

Results: At the 12-month follow-up, 79.7% of the children had developed new caries. No significant differences were found in parents' education levels, child's oral health practices, or parental knowledge and attitudes toward oral health ($P > 0.05$) between the caries-free group and the caries-recurrent group. The SM count ($P = 0.001$) and caries risk assessment (CRA) score ($P < 0.001$) were found to be significantly associated with new caries development. *Conclusion:* This study has shown that SM count and CRA score were associated with new caries development in ECC children who needed to be treated under general anesthesia. The modified Cariogram used in this study is another significant tool for predicting new carries development in this particular population.

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Introduction

Early childhood caries (ECC) is a term used to describe rampant caries in infants and toddlers.¹ This type of caries generally affects the deciduous maxillary anterior teeth initially, followed by the involvement of deciduous posterior teeth. In view of the destructive characteristics of this condition, immediate and comprehensive treatment has been recommended to prevent further dental caries and to ensure the child's overall general health.² Most of these patients receive dental care in a conventional office environment even when immobilization is necessary. However, patients resistant to treatment, of young age, or requiring significant restorative treatment usually need general anesthesia.³ Comprehensive dental treatment under general anesthesia for ECC can provide an immediate enhancement in the patients' oral health and quality of life.^{4,5}

There have been relatively few studies that have investigated the outcomes after full mouth dental rehabilitation under general anesthesia. In spite of aggressive dental rehabilitation and preventive efforts in these patients, they still frequently experience recurrence of caries.^{6–10} A retrospective study in 292 children treated under general anesthesia showed that of the 95% who returned for treatment, 55% had developed new caries within 2–4 years.⁷ Almeida et al¹⁰ found that 79% of 42 ECC children had detectable recurrent caries within 2 years compared with 29% of 31 caries-free controls. In order to achieve a further decrease in dental caries, it is important to identify cases with a higher risk for developing caries. A number of risk factors for caries development have been examined and include previous caries experience, diet, parents' education level, behaviors related to dental health, and socioeconomic status.^{11,12} Köhler and Holst¹³ investigated the dental health of 4-year-old children in Southern Sweden and found that their dental health was significantly associated with factors including infrequent between-meal eating, tooth brushing frequency, intake of fluoride tablets, and regular dental appointments.

There are no current literature reports examining caries risk assessment in children under the age of 6 years treated under general anesthesia and residing in Taiwan. We used a risk assessment model called Cariogram to evaluate several possible caries risk factors.^{14,15} This model allowed us to simultaneously assess the relative importance of different factors allowing a more accurate determination of the caries risk than a single-factor model. The aim of the present study was to determine the possible risk factors of caries development in ECC children in Taiwan 12 months after treatment under general anesthesia. We used the Cariogram to analyze the risk of caries development by comparing caries-free with caries-recurrent children over a 12-month period.

Materials and methods

The study was approved by the Institutional Review Board of Chang Gung Memorial Hospital (IRB no: 100-3088A3). A total of 79 children with early childhood caries requiring full mouth dental rehabilitation under general anesthesia were

recruited from the Children's Dental Clinic of Kaohsiung Chang Gung Memorial Hospital. The study group was comprised of 40 boys and 39 girls aged 27–71 (48.80 ± 10.71) months. The parents of the children were invited to participate in the study and signed a consent form.

Study design

Immediately after the participant had been anesthetized, dental examinations were conducted by two pediatric dentists (Lin JYT and Lin YT) using on-site dental chairs, mirrors, and explorers under focused flashlights. Caries were assessed using decayed, extracted, and filled teeth (deft) and decayed, extracted, and filled surfaces (defs) indices according to the World Health Organization diagnostic criteria (WHO, 1997).¹⁶ The oral hygiene status was evaluated using the Silness–Löe Plaque Index and was based on an average of six assigned teeth (A, D, I, K, N, and S).¹⁷ All teeth were isolated with a rubber dam and treated with operative restoration, pulpotomy with crown, pulpectomy with crown, or extraction according to the severity of the carious lesions.

The caries and plaque index examinations were repeated in the clinic 12 months after the initial treatment. Physical restraint with parent's permission was sometimes necessary when the child was uncooperative during the examinations. We divided the participants into caries-free (deft = 0) and caries-recurrent (deft > 0) groups according to the caries status at the 12-month follow-up. A questionnaire was completed by the parents or caregivers at this time to assess the possible caries-related factors including: (1) the child's demographic background (gender and age); (2) parents' education levels; (3) child's oral health practices; and (4) parental knowledge and attitudes toward oral health.

In addition, three biological parameters were measured in participants at the 12-month follow-up: salivary buffering capacity, *Streptococcus mutans* (SM) count, and *Lactobacillus* (LB) count. The Dentocult-buffer Strip, Dentocult-SM, and Dentocult-LB test kits (Orion Diagnostica, Espoo, Finland) were used to determine the salivary buffering capacity, SM count, and LB count respectively. Each participant was instructed not swallow their saliva for 1 minute of chewing paraffin pellets prior to SM collection using the Dentocult-SM kit. The participant was then instructed to continuously spit out all saliva into a plastic cup for the next 4 minutes. Immediately after collection, the saliva samples were poured into a Dentocult-LB tube. The Dentocult-SM and LB tubes were stored in an incubator at 37°C for 2 days and 4 days, respectively. The SM and LB salivary counts were obtained by comparing the colony density on the test strips against a standard chart provided by the manufacturer (Table 1). The buffering capacity test (Dentobuff, Orion Diagnostica) was performed by applying 1 drop of stimulated saliva to a test strip; the reading was taken 5 minutes after initiation of the stabilized chemical reaction.

Caries risk assessment (CRA) using Cariogram

Children's caries risk was assessed by using a multifactorial computational program called Cariogram.^{14,15} We modified

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