

# Failure rates of restorative procedures following dental rehabilitation under general anesthesia

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## Abstract

**Purpose:** The failure rates of restorative procedures for children undergoing dental rehabilitation under general anesthesia, performed by pediatric dental residents in advanced educational programs, were evaluated in order to determine treatment outcomes and best practices.

**Methods:** Retrospective review of 504 dental records of children receiving comprehensive dental treatment under general anesthesia at children's hospitals in Boston between 1990-1992 and in Washington, DC, between 1994-1998, were undertaken. Data regarding restoration outcomes were evaluated using chi square tests with correction for continuity. Only records of patients who returned for follow-up at least six months after their rehabilitations were evaluated. T-tests were performed on parametric data.

**Results:** Two-hundred and forty-one (48%) of the records were evaluated. Stainless steel crowns (SSCs) had significantly lower failure rates than amalgams ( $P < 0.001$ ,  $\chi^2 = 63$ ). The highest failure rates were seen in composites ( $P < 0.001$ ,  $\chi^2 = 112$ ) and composite strip crowns ( $P < 0.001$ ,  $\chi^2 = 121$ ).

**Conclusions:** SSCs are the most reliable restorations while composite restorations are the least durable. Failure of restorations appears to be related to follow-up length. (*Pediatr Dent* 24:69-71, 2002)

**KEYWORDS:** RESTORATIONS, GENERAL ANESTHESIA

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Early childhood caries (ECC) is a relatively new term used to describe rampant caries in infants and toddlers.<sup>1</sup> This condition typically affects the primary maxillary anterior teeth leading to involvement of primary molars.

Many treatment modalities exist for managing young children in need of comprehensive restorative and surgical dental treatment. Treatment must often be performed under general anesthesia in the operating room for the patient who is either very young or has special needs. The decision to perform dental treatment under general anesthesia is based upon age, ability to cooperate in a normal setting, medical status, and extent of treatment required.<sup>2</sup>

Very few studies have investigated the outcomes of treatment rendered during dental rehabilitation under general anesthesia. Stainless steel crown restorations have been reported to be significantly more successful than amalgam or composite restorations for patients who were treated under

general anesthesia.<sup>3</sup> Eidelman, reporting on restorative results from 34 patients treated under general anesthesia, found that the quality of treatment performed under general anesthesia was better than the quality of treatment performed under conscious sedation.<sup>4</sup>

Recently, a study reported that a group of children with ECC who were treated under general anesthesia demonstrated significantly higher subsequent caries rates than a control group who were initially caries-free.<sup>5</sup> The authors concluded that a more aggressive approach may be warranted for children with ECC who require treatment under general anesthesia.

General anesthesia allows treatment to be rendered under optimal conditions, theoretically ensuring ideal outcomes. However, general anesthesia cost is a significant consideration that adds between \$1,000 to \$6,000 to the cost of dental care.<sup>6</sup> Outcomes for these children are of particular interest because the increased risk of incremental

**Table 1. Patients Who Returned for Follow-Up: A Comparison of the Failure Rates of Restorative Procedures Compared to the Failure Rate of Stainless Steel Crowns**

Procedures	Patients n	% failure
Extraction	731	*
Amalgam	669	21†
Stainless steel crown	862	8†
Pulpotomy	230	*
Composite	367	30†
Composite strip crown	63	51†

\*Failure rates calculated only for restorative procedures; †  $P < 0.001$

decay has been confirmed to exist in children with high initial rates of decay.<sup>7</sup> Yet, despite the high risk for new and recurrent decay in children following dental treatment under general anesthesia, few children return for follow-up after treatment.<sup>3,4,8</sup>

The aim of this retrospective study was to assess the failure rates of restorative procedures, performed by pediatric dental residents, in children who have undergone dental rehabilitation under general anesthesia.

### Methods

Five hundred and four dental records of patients undergoing comprehensive dental treatment under general anesthesia at Children's Hospital in Boston, MA, and at Children's National Medical Center in Washington, DC, were reviewed by a single individual. The Boston patients had dental rehabilitations between 1990 and 1992. The DC patients had dental rehabilitations between 1994 and 1998. In both Boston and DC, pediatric dental residents in advanced educational programs performed the dental treatment in the operating room while under the direct supervision of an attending faculty member. In both studies, only records of patients who returned for follow-up at least six months after their rehabilitations were evaluated.

Demographic data were collected from the dental records of both the Boston and DC patients. In addition, information on each patient's medical history, the date of the dental rehabilitation and the types of procedures performed were recorded. For each patient included in the study, information regarding restoration failures was recorded. Failure was defined as a restoration identified by a dental resident or attending faculty as needing to be replaced due to structural breakdown (fracture or dislodgment of the restoration), pulpal or dentoalveolar infection associated with the restored tooth, or recurrent decay. Post-operative dental radiographs were not obtainable for all patients returning for follow-up. Failure could have occurred any time between the date of the dental rehabilitation and the last documented return visit. Intact restorations without new caries at the time of follow-up were considered to be successful.

All of the data were recorded and evaluated using SAS JMP statistics program (SAS Institute, North Carolina). Chi-square tests with correction for continuity were used to analyze the failure rates of restorative procedures. T-tests were performed on parametric data.

### Results

From the entire group of dental records that were reviewed, 241 records satisfied the condition of patient follow-up of at least six months after rehabilitation. This comprised 48% of the records (N=504).

Fifty-seven percent of the patients who returned for follow-up were male. Mean age at the time of the dental rehabilitation was 51 months with a range from 17 months to 274 months.

Table 1 presents the procedures performed and their failure rates for the combined groups. Compared to SSC failure rates, amalgam restoration failure rates were significantly higher ( $P < 0.001$ ,  $\chi^2 = 63$ ). Compared to the failure rates of SSC restorations, the highest failure rates were found in the composite restorations ( $P < 0.001$ ,  $\chi^2 = 112$ ) and composite strip crown restorations ( $P < 0.001$ ,  $\chi^2 = 121$ ).

### Discussion

In this study, stainless steel crown restorations were found to have the lowest failure rates when compared to amalgam and composite restorations. Composite restorations and composite strip crowns had the highest failure rates. O'Sullivan, in his investigation of restorations placed under general anesthesia, also found that amalgam and composite restorations had much higher failure rates than SSCs.<sup>4</sup> Only 3% of SSCs failed in O'Sullivan's study, while 29% of amalgam and composite restorations failed. Other studies reporting on outcomes of procedures performed in the routine dental setting have supported the superior durability of SSC restorations.<sup>9-12</sup>

In this study, SSCs were performed more often than any other restorations. In fact, more SSC restorations were performed than extractions. A mean of 2.6 SSCs per patient was found in O'Sullivan's study, while 3.2 SSCs per patient was found in this study. Patients in this study may have presented with greater caries severity that required a more aggressive treatment approach.

Low return rates for follow-up after dental rehabilitation have been reported in the literature.<sup>8</sup> The higher failure rates of restorative procedures compared to O'Sullivan's study may also be due to this study's lower rates of return for follow-up care after dental rehabilitation. Only 48% of the patients returned for follow-up in this study, whereas 75% of patients in O'Sullivan's study returned for follow-up. The lower rates of return may have resulted in a bias in this sample population, such that parents were more likely to bring their children in for follow-up if they recognized that a restoration had failed. In addition, many of the patients

may not have returned for follow-up because they did not perceive a need for re-treatment.

Although general anesthesia theoretically allows for optimal conditions under which dental treatment can be performed, the high failure rates of amalgam and composite restorations indicate that other factors were involved in contributing to treatment failures. Patients with early childhood caries have a greater propensity for developing new and recurrent caries.<sup>7</sup> Recently, Almeida et al reported that a group of children with ECC who were treated under general anesthesia demonstrated significantly higher subsequent caries rates than a control group who were initially caries-free. They concluded that a more aggressive approach may be warranted for children with ECC who require treatment under general anesthesia.

Many patients in this study who required general anesthesia had significant medical histories or developmental disabilities. Often these patients are on high caloric diets rich in fermentable carbohydrates that may result in an increased risk for caries development. Limitations in the ability to perform oral hygiene may also contribute to an increased caries risk. The fact that SSC restorations have been shown to be more durable suggests that these restorations may be a more cost-effective treatment choice for young children with gross caries and who require general anesthesia as an adjunct to treatment.<sup>3,5,9</sup>

### Conclusions

1. Stainless steel crowns are the most reliable restorations, surpassing amalgam, while composite restorations are the least durable for patients treated under general anesthesia.
2. Restorative failures are not uncommon after comprehensive dental treatment under general anesthesia. Therefore, dental professionals should educate parents of all children who receive dental treatment under general anesthesia of the risk for restorative treatment failure.

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