

Original Article

Evaluation of efficacy of restorative dental treatment provided under general anesthesia at hospitalized pediatric dental patients of Isfahan

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ABSTRACT

Background: General anesthesia (GA) allows dental treatment to be rendered under optimal conditions, theoretically ensuring ideal outcomes. The aim of this study was to determine the efficacy of restorative dental procedures performed under GA.

Materials and Methods: In this cross-sectional retrospective study, 305 pediatric patients who had been treated under GA 6 to 24 months before our survey at Isfahan's hospitalized dentistry center were examined. The examination was performed on dental chair with oral mirror and dental probe. The results were recorded in a special form for each patient for statistical analysis and evaluation of restorations to be successful or failed. Statistical analysis was performed by chi-square and fisher exact tests for comparison between success rates of restorations and Kendall's tau-b test for evaluating the effect of time on success rates of them ($P < 0.05$).

Results: Stainless steel crown restorations had significantly better results vs class I and class II amalgam and class I and class II tooth color restorations. All types of posterior tooth color restorations had statistically same results with amalgam restorations. Anterior composite resin build-up represented significantly low success rates. The failure rates of stainless steel crown and anterior composite resin build-up restorations did not correlate with the time of follow-up ($P = 0.344$ and $P = 0.091$, respectively).

Conclusion: Stainless steel crown restorations had significantly better results vs other posterior restorations. The failure rates of stainless steel crown and anterior composite resin build-up restorations did not correlate with the time of follow-up in comparison of other restorations.

Key Words: Clinical performance, dental restorations, general anesthesia

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INTRODUCTION

The ability to treat children in the hospital environment in order to provide comprehensive dental care using general anesthesia (GA) is a valuable option to the pediatric dentist, despite some degree of risk to the patient.^[1] GA allow dental treatment to be rendered under optimal conditions theoretically ensuring ideal outcomes.^[2]

The number of GA procedures performed on dental patients in non-traditional settings such as office or outpatient facilities has risen over the last few years. The needs for GA have increased, reimbursement levels for in-hospital procedures have decreased, and safety and effectiveness of drugs and monitors have improved significantly.^[3]

GA has advantages which include the provision of treatment that is safe, efficient, and convenient; extensive high-quality treatment are performed in a single visit, with minimal discomfort to the patient; less physical and mental stress for both the patient and the dentist.^[4-7]

The outcomes of the various treatment modalities and the general health of the child need to be seriously considered prior to the provision of GA. Restorative

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procedures with relatively higher success rates should be selected.

Dental treatment under general anesthesia

In the planning of dental treatment under GA, the current concept is to encourage more radical treatment so as to reduce the need for future repeated general anesthetic administration.^[8] This is similar to the postulate that extractions should be planned symmetrically and that simple restorative procedures be adopted for those teeth known to have a doubtful prognosis.^[9] Most studies confirm that restorative procedures and simple extractions are the most common types of treatment modality in children.^[9-14] Pulp therapy only constitutes a small proportion of all treatment procedures and when used, vital pulpotomy is more frequently employed than pulpectomy. However, pulpotomy is not recommended for those patients with cardiac problems.^[15] Only a few studies have reportedly included pulpectomy in their treatment options.^[10,16-18] Some authors think that extraction is preferred for those teeth with pulp exposures.^[19,20] It is indicated that no attempt should be made to preserve either anterior or posterior teeth with necrotic pulps but extraction should be done.^[13] By contrast, others have found that the preservation of incisors by pulp therapy in children aged three years or younger, even though abscessed or non-vital, has proved to be a highly successful procedure.^[16,18]

Clinical outcomes of restorative treatment under general anesthesia

Definitive, durable, comfortable, and functional restorations with a minimum amount of time spent in the dental office are in the child's best interest. Ideally, a restoration should last until the primary tooth is naturally lost through exfoliation.^[21] Few studies have reported the treatment outcomes and the frequencies of retreatment after dental GA.^[9,10,13,22,23]

GA allows dental treatment to be rendered under optimal conditions, theoretically ensuring ideal outcomes.^[2] A study by Eidelman *et al.* showed that the quality of restorative treatment performed under GA was better than the quality of treatment performed under conscious sedation. In this study, more than 90% of the restorations placed under GA were rated as successful based on the marginal adaptation and anatomic form. Less than 3% had recurrent caries and 90% of composite strip crowns had good marginal adaptation.^[24]

GA provides optimum conditions for restorative treatment such as maximum contamination control, immobilization of the patient, efficiency and

effectiveness, and elimination of reflexes. In spite of providing optimum conditions for restorative procedures, high restorative failure rates are reported in the literature for treatments provided under GA.^[2]

The placement of a restoration in a massively decayed tooth will often fail largely due to marginal deterioration resulting from highly demineralized and undermined enamel surfaces. Restorations dependent on the integrity of enamel show high failure rates.^[13,21]

An study by O'sullivan and Curzon performed on the success rates of different types of restorations under GA indicated approximately 33% and 2%, respectively, and 29% for amalgam or composite restorations.^[13]

Almedia *et al.*^[25] found that 17% of the patients treated for early childhood caries (ECC) required retreatment under GA within 2 years of the initial full-mouth rehabilitation. Seventy-nine percent of the patients required subsequent restorative treatment or extraction at the recall visits which was similar to Legault *et al.*'s^[10] findings.

Holland *et al.* demonstrated that the average survival time for an amalgam restoration in primary teeth was only 31 months, and that the age of the child at the time of placement was directly related to the longevity of the restoration (the younger the child, the sooner the failure).^[26]

A survey by Forss and Widstrom^[27] indicated that irrespective of the restorative material, the lifetime of restoration in primary and young permanent teeth is shorter than in adults. Primary caries is the predominant reason for placement and replacement of restorations in the primary and the young permanent teeth.^[28,29]

The most frequently used materials for the restoration of teeth in children are amalgam, composite resin, glass ionomer cement, stainless steel crowns, and compomer. It is proposed to review the effectiveness over time of these materials. The aim of this study was to determine the types of dental procedures performed under GA and the status of restorative procedures performed.

MATERIALS AND METHODS

In this cross-sectional retrospective study, 305 pediatric patients who had been treated under GA at least 6 to 24 months before our survey at Isfahan University hospitalized dentistry center were selected.

Parents were informed about the study and informed consent obtained. Reminders were done three times and

no respondents were excluded. Before examinations, two examiners were calibrated. Inter examiner agreement were achieved at the level of Kappa coefficient 0.9. Examiners examined patients with dental probes, oral mirrors, and visual inspection on dental chair.

All treatment had been done for the children assessed to be successful or failed. It was considered as failure of treatment if the restorations (SSC, amalgam, and tooth color restorations) or root canal treatments (pulpotomy and pulpectomy) needed replacement.

Data were recorded on data collection sheets. Restorative clinical performance data were tabled in a special form for each patient for statistical analysis.

Statistical analysis was performed by chi-square and fisher exact test for comparison between success rates of restorations and Kendall's tau-b test for evaluation of time effect on success rates of them, using SPSS software and *P* value was adjusted to <0.05.

RESULTS

A total of 305 children with ages ranging from 24 to 108 months (Response rate = 81.3) were called for this study. 287 patients (94%) had ECC or rampant caries. Type of treatment, failure rate, success rates [Table 1], and date of treatment for all patients were recorded. Overall success rates are presented in Table 2. 94, 77, 52, and 82 patients were examined at least 6, 12, 18, and 24 months after hospitalization, respectively. Correlation between success rates of different restoration and follow-up period are presented in Table 3.

Statistical correlations

Statistical analysis revealed that SSC restorations had significantly better results vs CI I and CI 11 amalgam restorations ($P = 0.031$ and $P < 0.0005$, respectively).

In GI and CR posterior restorations, CI I and V restorations represented no significant difference in comparison with SSC restorations ($P = 0.201$) but CI 11 restorations had significantly worse results ($P = 0.007$). All types of GI and CR restorations had statistically same results with amalgam restorations ($P = 0.573$).

One or two surface anterior CR and GI restorations vs anterior buildup restorations represented significantly low success rates ($P < 0.0005$). The failure rates of SSC and anterior CR build up restorations did not correlate with the time of follow-up ($P = 0.344$ and $P = 0.091$, respectively); however, the failure rates of other restorations increase in correlation with the time of follow-up ($P = 0.0007$ for amalgam, $P = 0.015$ for

posterior GI and CR, $P < 0.0005$ for anterior GI and CR except build-up restorations).

It is not possible to evaluate the correlation of root canal treatment success rates with the time of follow-up because of its low failure rate in the period of our survey.

DISCUSSION

Type and number of treatments in this study were the same as previous studies except in extraction and tooth color restorations.^[2,13] Preference of restorations, especially in anterior teeth, instead of their extraction may be the result of this difference. Performance of amalgam restorations in this study was similar to O'Sullivan and Curzon's study^[13] but higher than Tate and Needleman's study.^[2] Therefore, in this study, SSC preferred to multi-surface amalgam restorations.

O'Sullivan and Curzon (1991)^[13] found that SSC and

Table 1: Type of treatment, failure rate, and success rates for all patients were recorded

Type of treatment	Failure rate	Success rate	Total
Amalgam			
CI I	11 (4.3)	246 (95.7)	257 (100)
CIII	21 (13.7)	132 (86.3)	153 (100)
Post GI			
CI 1 and V	0 (0)	36 (100)	36 (100)
CIII	6 (16.6)	30 (83.4)	36 (100)
Post CR			
CI I and V	5 (4.7)	102 (95.3)	107 (100)
CIII	5 (7.9)	58 (92.1)	63 (100)
Ant G	9 (6.3)	133 (93.7)	142 (100)
Ant C	41 (12.9)	275 (87.1)	316 (100)
Ant CR (build up)	48 (19.2)	202 (80.8)	250 (100)
SSC	16 (1.9)	826 (98.1)	842 (100)
Ext	0 (0)	793 (100)	793 (100)
Pulpotomy	5 (1.2)	418 (98.8)	423 (100)
Pulpectomy	1 (0.2)	423 (99.8)	424 (100)

CI: Class of restoration, Ant: Anterior, Post: Posterior, GI: Glass Ionomer, CR: Composite resin, SSC: Stainless steel crown, Ext: Extraction; Figures in parenthesis are in percentage

Table 2: Overall failure or success rate of different restorations

Type of treatment	Failure rate	Success rate	Total
Amalgam	32 (7.8)	378 (92.2)	410 (100)
Post GI and CR	16 (6.6)	226 (93.4)	242 (100)
Ant GI and CR	98 (13.8)	610 (86.2)	708 (100)
SSC	16 (1.9)	826 (98.1)	842 (100)
Total	162 (7.3)	2040 (92.7)	2202 (100)

Ant: Anterior, Post: Posterior, GI: Glass Ionomer, CR: Composite resin, SSC: Stainless steel crown; Figures in parenthesis are in percentage

Table 3: Correlation between success rates of different restoration and follow-up period

Minimum follow-up period(month)	Failure rate				Success rate			
	6	12	18	24	6	12	18	24
Amalgam	5 (4.2)	6 (6)	5 (5.9)	16 (15.1)	115 (95.8)	94 (94)	79 (94.1)	90 (84.9)
SSC	4 (1.5)	4 (1.6)	3 (2.4)	5 (2.6)	272 (98.5)	245 (98.4)	120 (97.6)	189 (97.4)
Post GI and CR	4 (3.5)	4 (4)	4 (20)	4 (44.4)	109 (96.5)	96 (96)	16 (80)	5 (55.6)
Ant GI and CR (except build up)	9 (4.9)	7 (4.6)	12 (24)	22 (28.2)	163 (95.1)	142 (95.4)	38 (76)	56 (71.8)
Ant GI and CR (build up)	7 (14.6)	8 (12.1)	10 (29.4)	23 (22.5)	41 (85.4)	58 (87.9)	24 (70.6)	79 (77.5)

Ant: Anterior, Post: Posterior, GI: Glass Ionomer, CR: Composite resin, SSC: Stainless steel crown; Figures in parenthesis are in percentage

vital pulpotomies showed low failure rate of 3% and 2%, respectively, and 29% for amalgam or composite restorations. SSC restoration in our study represented lowest failure rates (1.9%) in comparison with other treatments, except extractions (0%), and this results confirmed previous studies.^[30-32] Amalgam filling in our study showed high overall failure rate (7.8%) which was lower than results of O'Sullivan and Curzon's study^[13] and Tate and Needleman's.^[2] This may be due to use of SSC instead of multi-surface amalgam restorations in our study and most of the amalgam fillings were class I restorations. This fact suggested that SSC can provide the best results if used instead of multi-surface complex amalgam restorations. Our result reported failure rate of 1.9% for SSC restorations that is same with previous studies (3 and 4.5%)^[13,21] but lower than Tate and Needleman's study (8%).^[2]

Levering and Messer^[33] indicated that the minimal periods of success for class I and II amalgam restorations were 48 and 55 months for children less than 4 years of age, respectively. By contrast, the median survival time of CR was inferior to amalgam restorations.^[34] Although the literature extol the clinical efficacy of composite resins for restoring primary teeth, most of these results have indicated that the proximal restorations had a higher failure rate than one-surface restorations. In addition, secondary caries was the other common mode of failures in composite restorations.^[35,36] Studies have indicated that the failure rates of glass ionomer cement restorations have varied between 25% and 60%.^[28,35,37-39] The median survival rate of glass ionomer cement was 25.5 months.^[40] Only 5% restorations survived after 4 years in one study.^[34] Our findings agree with the previous results. The overall failure rate of GI and CR was 12% while amalgam was 7.8%. This failure rates was low in comparison with any other study. The restorative materials showed a failure rate lower than findings of a recent literature review.^[41] This may be due to the use of

SSC rather multi-surface restorations. Unexpectedly, the failure rate of anterior build-up restorations in our study did not correlate with the time of follow-up; this may be the result of inter-canal retention of these restorations.

CONCLUSIONS

According to our results:

1. SSC restorations had significantly better results vs posterior amalgam and GI or CR restorations.
2. Glass ionomer and composite resin restorations had similar results with amalgam restorations.
3. Anterior build-up restorations represented significantly low success rates in comparison with other restorations.
4. The failure rates of SSC and anterior build-up restorations did not correlate with the time of follow-up in comparison with other restorations.

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