

Failure Rate of Dental Procedures Performed under General Anesthesia on Children Presenting to Mofid Pediatric Hospital during 2010-2011

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Abstract

Objective: Extensive dental treatments for young healthy and medically compromised children are performed under general anesthesia in a daily basis. Considering the side effects of sedatives and anesthetic drugs and also the high risk of dental caries in this group of patients, it is especially important to decide the safest and the most cost beneficial treatments. This study aimed at clinical evaluation of the failure rate of various dental procedures performed under general anesthesia on children presenting to Mofid Pediatric Hospital in Tehran during 2010-2011.

Methods: This descriptive cross sectional study was conducted on a total of 104 patients who received dental treatments under general anesthesia in Mofid Pediatric Hospital and a minimum of 6 months had been passed from their treatment. Dental examination was performed on a dental chair using dental mirror and a probe in the out-patient dental clinic of Mofid Pediatric Hospital. Recorded information included all types of treatment failures occurred in patients that were registered in especially prepared forms. Overall difference in failure rates was calculated using Chi square test while multiple logistic regression test was used to investigate the effect of different factors on the failure rate of treatment modalities.

Results: Our study results indicated that stainless steel crown (SSC) was the most successful treatment with the lowest failure rate (1.5%). SSC had a significantly lower failure rate compared to amalgam (7.9%) and posterior composite restorations (9.9%) ($P=0.003$ and $P<0.001$, respectively). Composite buildup of the anterior teeth had the highest failure rate (22.4%) among all types of anterior restorations (11.6%) ($P=0.009$). The failure rates of both pulpectomy and pulpotomy procedures were found to be reasonably low rating at 0.8% and 1.1%, respectively.

Conclusion: The highest failure rate belonged to anterior teeth build-ups. Teeth restored with SSC had the highest success rate indicating it as the treatment of choice for badly carious posterior teeth of children who require dental treatments under general anesthesia.

Key words: Dental treatment, General anesthesia, Treatment failure, Children

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Introduction:

At present, extensive dental treatments for young healthy or medically compromised children are performed in the operating room under general anesthesia. In such treatments, it is especially important to select the safest and the most reliable treatment modality at shortest time

period possible. Patients, who require dental treatments under general anesthesia, usually have a poor oral hygiene. Considering the high cost and potential risks of general anesthesia, it is necessary to minimize the risk of treatment failures in time. Given all the above, evaluation of the treatment failure rate in such patients

seems essential (1). In O'Sullivan and Curzon (1991) study, recurrent caries under composite restorations and failure of glassionomer restorations comprised one third of all failures in patients treated under general anesthesia; whereas, failure rate of SSC was only 3% (2).

Braff (1975) reported the success rate of SSC restorations performed under general anesthesia to be 70% and Dawson (1981) reported this rate to be 88%. O'Sullivan (1991) reported the success rate of SSC restorations performed under general anesthesia as 97% (2,3,4). Tate et al. (2002) announced the success rate of pulpotomy treatments conducted under general anesthesia to be 100%. They reported the failure rate of amalgam restorations, SSC and composite restorations as 21%, 8% and 30%, respectively (5). Al-Eheideb and his colleague in 2003 evaluated the integrity and longevity of restorative and pulpal procedures performed on children's primary teeth under general anesthesia and concluded that posterior teeth SSCs with a success rate of 95.5% are superior to amalgam and composite restorations with a success rate of 50% (6). In the anterior teeth, success rate of crowns was similar to that of class III, class IV and class V composite restorations. Pulpotomies had an extremely high success rate (97.8%). Drummond and coworkers in 2004 clinically evaluated comprehensive dental treatments conducted under general anesthesia and reported success rates of 57.1%, 73.4%, 85.2%, 92.8% and 84.6% for amalgam, composite, compomer, SCC and pulpotomies, respectively. Replaced restorations were mostly because of new carious lesions (7). This study aimed at evaluating the clinical failure rate of dental treatments performed under general anesthesia on children presenting to Mofid Pediatric Hospital during 2010-2011.

Methods:

In this descriptive cross sectional study, all children who received dental treatment under

general anesthesia in Mofid Pediatric Hospital during 2010-2011 and at least 6 months had been passed from their treatment were evaluated. Of these patients, 104 presented again to the hospital for oral and dental examination. Patients were divided into groups of 10 patients each and an appointment was arranged for the patients and their parents via a phone call. Patients were examined on a dental chair using a dental mirror and a probe. Before examining the hard tissue, patient's intra-oral soft tissue was thoroughly examined especially for presence of any swelling, fistula, abscess or redness in relation with the treated teeth. In order to determine oral hygiene status at the time of examination, simplified oral hygiene index was used. On clinical examination, in order to detect carious lesions and cracks or fractures in tooth structure or restorations, each tooth was separately dried and examined under sufficient light. Dental examination was routinely started from the last tooth of the right upper quadrant, continued along the upper teeth toward the front and across to the last tooth back on the top left side followed by the left lower quadrant and ending at the last tooth in the right lower quadrant. If a new carious lesion or a treatment failure was observed, the child would be referred to the Pediatric Department of the Shahid Beheshti University, School of Dentistry for necessary treatments. It should be mentioned that in this research project, permanent teeth were excluded from the study due to their low number and lack of statistical significance. For the teeth that underwent pulp therapy, presence of abscess, pathologic mobility and fistula were considered as treatment failure. For the extracted teeth, presence of any detectable residual root and for teeth that underwent SSC treatment, gingivitis, misplaced crown, and loss or mobility of the crown were defined as a "failure". Also, Ryge's clinical criteria were employed for evaluation of the failure of composite and amalgam restorations. Ryge's criteria evaluate the failure

of a restoration based on the observation of three parameters of marginal adaptation, restoration and preservation of anatomic form and recurrence of caries (8). SPSS version 14 software and Minitab 14 were used for statistical analysis and drawing the required tables. Excel 2010 software was used for drawing the charts. In order to compare the failure rates of different treatments, Chi square test and for evaluation of the effect of various factors on treatment failures, multiple logistic regression test were used.

Results:

In this study 104 patients out of a total of 164 (63.4%) presented for the follow up visit. At the time of undergoing general anesthesia, 65.4% of patients were in the age range of 1.5-4.9 yrs. while 50.9% of them at the time of examination (second visit) were within this range of age. Patients' age at the time of anesthesia or visit had no effect on failure of pulp therapies (pulpotomy and pulpectomy) or extractions ($P=0.12$ and $P=0.26$, respectively). Whereas, failure of restorative treatments was significantly correlated with patient's age at the time of treatment under general anesthesia and the post-op visit ($P=0.006$ and $P=0.001$, respectively). The higher the patient's age at the time of treatment and the second visit, the greater the failure rate of restorations. Of the understudy subjects, 78 were males and 26 were females. Patient's gender was significantly correlated with failure of pulp therapies and extractions and rate of such failures was greater among males ($P=0.045$). Gender also played a significant role in failure of restorative treatments and rate of such failures was higher among males ($P=0.037$). Also, rate of dmfs was estimated as 9.43 ± 4.43 .

Out of 104 subjects, 16 were suffering from a systemic condition (3 had heart disease, 2 had cardiopulmonary disease, 1 had renal cardiac

disease, 3 had Favism, 2 had Autism, and 5 had seizures). Failure of pulpotomy, pulpectomy and extractions had a significant relationship with the underlying systemic condition and rate of failures was higher among those suffering from a systemic condition ($P=0.007$). Failure of restorative treatments had also a significant association with presence of a systemic disease and failure of such treatments was greater in cases with underlying systemic conditions ($P=0.043$). Level of education of most parents was high school diploma (41.8% of fathers and 49.5% of mothers). A small number of fathers had a Bachelor's degree or higher (10.9%). A few of mothers had educational level below diploma (12%). Failure of pulpotomy, pulpectomy or extraction had no significant association with the educational level of fathers ($P=0.25$) or mothers ($P=0.271$). However, failure of restorative treatments was significantly correlated with the educational level of fathers and mothers ($P=0.004$ and $P=0.009$) in a way that the higher the educational level of parents, the lower the failure of restorative treatments performed for their children. The dentist played a significant role in failure of pulpotomy, pulpectomy or extractions. Specialized dentists had a significantly lower rate of failure compared to general dentists ($P=0.02$) but no statistically significant association was observed between failure of restorative treatments and the dentist's educational degree (fellow, instructor, general dentist or resident) ($P=0.552$).

According to OHI-S index at the time of examination, 9.9% of patients had poor oral hygiene, 27.5% had fair and 62.6% had good oral hygiene. No significant association was found between failure of pulpotomy, pulpectomy or extractions and patient's oral hygiene status ($P=0.12$). Failure of restorative treatments had no significant correlation with oral hygiene status either ($P=0.138$). Of the examined patients only 15.3% underwent fluoride therapy and

periodic dental examinations after treatment under general anesthesia. Failure of pulpotomy, pulpectomy and extraction was significantly associated with lack of fluoride therapy and periodic examinations (P=0.045). Rate of such failures was much lower in patients who had undergone fluoride therapy and periodic examinations. Failure of restorative treatments was also correlated with lack of fluoride therapy and periodic examinations (P=0.041) and rate of failures was higher in those who did not undergo fluoride therapy or periodic examinations after treatment under general anesthesia. Evaluation of the confounding factors that play a role in failure or loss of restorations showed that failure or loss of restorations occurred following trauma in 5.8%, as the result of entering foreign bodies like a pencil or toys into the mouth in 1% and due to consumption of foods like candies, drupes or etc. in another 1%. A total of 4.8% of the treated teeth were no longer present in the mouth because they had been exfoliated or extracted. Based on the parents' statements, 4.8% of the teeth treated under general anesthesia required re-treatment and were operated on for the second time. Failure rate of pulpotomy, pulpectomy and extractions was low in our understudy patients (Table 1).

Table 1- Failure rate of pulpotomies, pulpectomies and extractions among our understudy subjects

Type of treatment	Failure	Success	Total
Pulpotomy	3 (1.1%)	272 (98.9%)	275 (100%)
Pulpectomy	1 (0.8%)	119 (99.2%)	120 (100%)
Extraction	1 (0.5%)	208 (99.5%)	209 (100%)

The failure rate of fissure-sealant treatment was 4.3% and no failure was detected in teeth that underwent preventive resin restoration (PRR). The failure rate was 7.9% for amalgam restorations and 1.5% for SSCs. Chi square test showed a significant difference between the failure rates of these treatment modalities (P=0.003). This test also demonstrated that failure rate of posterior composite restorations was significantly higher than that of SSC (P=0.00029)(Figure1). Failure rate was 9.9% for single-surface posterior composite restorations, 9.4% for two-surface and 10.3% for three-surface composite restorations (Figure 1). Frequency of loss of marginal integrity, loss of restoration or preservation of anatomic form and recurrence of caries in amalgam and composite restorations according to Ryge's criteria was also recorded (Table 2).

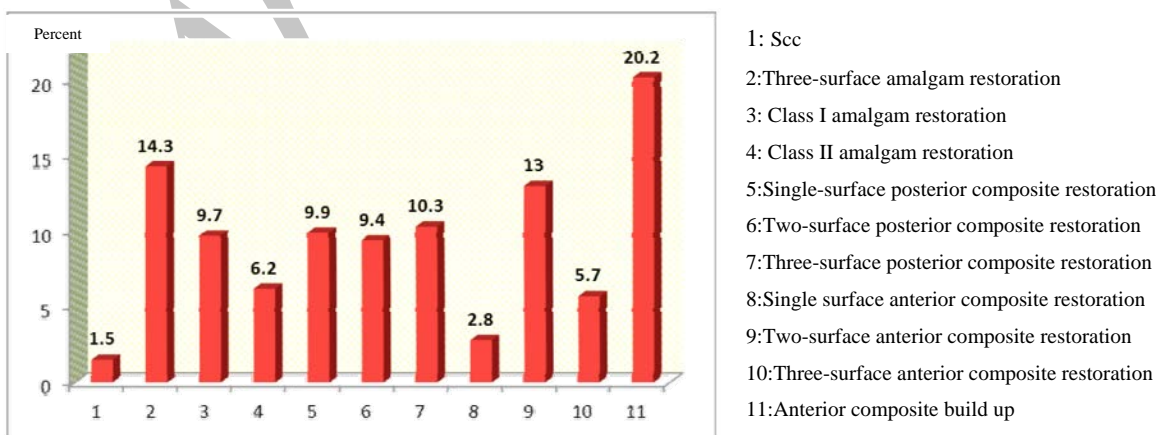


Figure 1- Comparison of the failure rates of various restorative treatment

Table 2-The frequency of marginal integrity, loss of restoration and preservation of anatomic form, and recurrence of caries according to Ryge's criteria in composite and amalgam restorations

Marginal integrity		
	Composite N (%)	Amalgam N (%)
No gap between the tooth structure and the restorative material, dental explorer cannot penetrate	526 (87.5%)	120 (87.5%)
Presence of a gap between the tooth and the restoration, dental explorer cannot penetrate, dentin is not exposed	9 (1.5%)	5 (3.8%)
Presence of a gap between the tooth and the restoration, dental explorer cannot penetrate, dentin is exposed	28 (4.3%)	8 (5.8%)
Presence of a gap between the tooth and the restoration, dental explorer cannot penetrate, dentin is exposed and restoration is fractured.	41 (6.7%)	4 (2.9%)
Loss of restoration or preservation of anatomic form		
	Composite	Amalgam
Loss of restoration or preservation of anatomic form		
Presence of integrity and preservation of anatomic form	532 (88.1%)	124 (0.5%)
Restoration is lost slightly to moderately without dentin exposure	22 (3.6%)	6 (4.4%)
Restoration is extensively lost and dentin is exposed	50 (8.3%)	7 (5.1%)
Recurrence of caries		
	Composite	Amalgam
Recurrence of caries		
No caries at restoration margins	545 (90.3%)	125 (91.3%)
Presence of caries at restoration margins	59 (9.7%)	12 (8.7%)

Discussion:

During the recent years, prevalence of comprehensive dental treatments for children under general anesthesia has greatly increased. Due to high number of children requiring such treatments, it seems necessary to have complete knowledge regarding the success and failure rates of different dental treatments and make the necessary efforts to improve the quality of dental services offered under general anesthesia. According to the present study results, 65.4% of understudy patients were in the age range of 1.5 to 4.9 yrs. in other words, they were mostly

young children. This range is comparable with Jamjoom study in which understudy children were in the age group of 2-4 yrs.(9). In the present study, 63.4% of treated patients showed up for follow up examinations which is similar to the rate reported in O'Sullivan study in 1991 (2). This rate is higher than what was reported in Tate et al, study (2002) in which only 48% of patients showed up for post-op follow up visits (5). In Al-Eheideb study (2003), 10% of patients presented for follow up visits after 27 months (6). Higher rate of patients showing up for follow up visit in our study compared to the

above mentioned studies may be due to the fact that time of follow up visit in our study was a short while after the treatment under general anesthesia. In our study, we called and asked patients to kindly show up for a follow up visit whereas in most other studies only patients' dental records were used. In the latter situation, there is a possibility that parents present for a dental follow up visit only after their children complained of a problem with their teeth and those with no problem presented less frequently for the follow up. That is why reported failure rates are much higher in studies that only use patients' dental records for detection of failures (2,5,6).

Based on the information in Table 3, number of extractions compared to composite restorations for each patient in our study was lower than the rates reported in Tate (2002) and O'Sullivan (1991) studies (2,5).

This finding indicates that in the present study restoring the teeth (especially the anterior teeth) was preferred over extraction. Table 3 also shows that ratio of SSC to amalgam restorations in our study was higher than the same ratio in Tate study (2002) and similar to that reported in O'Sullivan study (1991). Therefore, compared to Tate's study (2002), in our study SSC was preferred over amalgam restoration (2,5). The failure rate of class I and class II amalgam restorations in our study was estimated as 7.9% which is close to the rate reported in a 10-year study by Sherriff and Robert (1990) (10). O'Sullivan and Curzon (1991) reported the failure rate of amalgam restorations in patients treated under general anesthesia to be 16% which is higher than the rate we reported in the present research (2).

Tate et al. (2002) reported the failure rate of 21% for amalgam restorations which is higher than the rate we obtained in this study (5). Al-Eheideb and colleagues (2003) in their study

reported the failure rate of amalgam restorations to be 50% which is higher than that of our study and other similar researches (2,5,6). The reason for such difference may be because in the above mentioned studies the authors could not randomly select the patients' records and only used records of those who presented for follow up visits and there is a high probability that parents of these patients knew that there was a problem with their child's dental restorations and that is why they brought them for follow up dental examination and therefore the reported failure rate is higher than the actual rate (2, 5, 6). In our study, SSC treatment with the failure rate of 1.5% was considered as the most successful treatment. On dental examination, no case of SSC failure due to severe gingival problems or periodontal problems was observed which is in accord with the previous studies' findings (11, 12). In the present study failure of SSCs was mainly due to mobility or crown misplacement.

Sherriff and Roberts (1990) in their 10-year study reported the failure rate of SSCs in primary and permanent teeth as 2%. This rate was 3% in those treated under general anesthesia. Our study results are in accord with findings of these two studies (2). Al-Eheideb et al. (2003) reported the success rate of SSCs in 54 children treated under general anesthesia as 95.5% which is in agreement with our study finding (6). SSC failure rate was 8% in Tate et al. study (2002) which might be due to the fact that only 48% of patients in his study showed up for follow up visits and most of the parents who brought their children knew that there was a problem with their child's dental restorations (5). In another group of researches higher failure rates have been reported for SSCs including Papatthanassiou et al. (1994) study that reported the failure rate of 20% for SSC. They could not differentiate the actual failures from the false ones (failure due to defective restoration or pulp therapy) and probably that is why the failure rate

is higher (13). In a retrospective study by Levering and Messer (1988) failure rate of SSC was 12%. They could not distinguish between actual and false failures either (14). Considering the failure rates of class I amalgam restorations (9.7%), class II (7.4%) and SSC (1.5%), it seems that SSC is a much better treatment modality than amalgam restorations ($P=0.003$). Therefore, based on our study results, it is recommended that SSCs be used instead of amalgam restorations. Our study was able to successfully compare class II amalgam restorations with SSCs while the previous studies had compared amalgam restorations in general with SSCs in patients treated under general anesthesia (2, 5, 6). Since no failure was observed in PRRs, this treatment modality is recommended for cavities with tiny carious lesions. Previous studies have also considered PRR as an optimal treatment modality (15). Based on our study findings, single-surface (2.8%), two-surface (15.1%) and three-surface (6.5%) anterior composite restorations were significantly more successful than anterior composite build ups (22.4%) and had a smaller failure rates ($P=0.009$). In Tate et al, (2002) study results regarding failure rate of anterior and posterior composite restorations were not differentiable and this rate was 30%. O'Sullivan in his study (1991) was not able to distinguish between the failure rate of anterior and posterior composite restorations and he announced an overall failure rate of 29% (2, 5). Considering the failure rate of anterior build ups, in cases where most of the dental structure is lost use of more durable restorations like open faced SSCs or esthetic SSCs is a wiser choice of treatment. In the present study, extractions had the minimum failures which is in accord with the findings of previous studies (2, 5, 6). Our study

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evaluated pulpectomy and pulpotomy treatments separately and considering the high clinical success rate of pulpectomy (99.2%), this treatment is recommended and preferred over high risk pulpotomies for this group of patients. Pulpotomies also had a high success rate in these patients too which is in agreement with the results of previous studies (2, 15, 5-18). However, it is noteworthy that due to the short follow up period and not obtaining an x ray during the follow up visit there is a possibility that the success rate of these treatments has been reported higher than the actual rate.

Conclusion:

In this study, failure rate of pulpotomies, pulpectomies and extractions was 1.1%, 0.8% and 0.5%, respectively. The failure rate of SSC was 1.5%; whereas, this rate was 7.9% for amalgam restorations. Overall, 9.9%, 20.2% and 10.3% failure rates were obtained for posterior composite restorations, composite buildup of anterior teeth with extensive caries and other anterior composite restorations, respectively. Also, failure rate of pulp therapies, extractions and restorative treatments was higher in children suffering from systemic underlying diseases. Educational level of parents also played a significant role in failure of restorative treatments in children.

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