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ISSN 2378-7090

International Journal of Dentistry and Oral Health

Research Article | Volume: 3.5 | Open Access

Evaluation of Restorative Procedures in Children following Dental Rehabilitation in Jeddah City

Omar A El Meligy[1]* and Abeer M Al-Nowaiser[2]

[1]*Professor of Pediatric Dentistry, Faculty of Dentistry, King Abdulaziz University, Saudi Arabia and Professor of Pediatric Dentistry, Faculty of Dentistry, Alexandria University, Egypt*

[2]*Associate Professor of Pediatric Dentistry, Faculty of Dentistry, King Abdulaziz University and Chairman of Internship Program at King Abdulaziz University, Saudi Arabia*

***Corresponding author:** Omar Abd El Sadek El Meligy, Professor of Pediatric Dentistry, Department of Pediatric Dentistry, Faculty of Dentistry, King Abdulaziz University, P.O.Box: 80209, Jeddah 21589, Kingdom of Saudi Arabia, Tel: 0122871660, 00966557521584; Fax: 0126403316; **E-mail:** omeligy@kau.edu.sa

Received date: 09 Oct 2017; **Accepted date:** 27 Oct 2017; **Published date:** 30 Oct 2017.

Citation: El Meligy OA, Al-Nowaiser AM (2017) Evaluation of Restorative Procedures in Children following Dental Rehabilitation in Jeddah City. Int J Dent Oral Health 3(5): doi http://dx.doi.org/10.16966/2378-7090.245

Abstract

Objective: To measure the treatment outcomes of the restorative procedures for children undergoing dental rehabilitation performed by dental intern and residents (MSc, PhD and Saudi Board) at King Abdulaziz University Faculty of Dentistry (KAUFD), Jeddah, Saudi Arabia.

Materials and methods: Sixty-one dental digital records of healthy patients undergoing comprehensive dental treatment were viewed by a single examiner. These patients were treated by dental interns, and residents (MSc, PhD and Saudi Board) at KAUFD, Jeddah, Saudi Arabia between 2015 and 2016. Only records of patients who returned for follow-up at least 6 months after their rehabilitations were evaluated.

Results: Compared to stainless steel crowns (SSCs) failure rates, preventive resin restorations (PRRs) failure rates were higher, but not statistically significant (P=0.559). Compared to the failure rates of SSC restorations, failure rates in composite restorations were significantly higher (p<0.0001).

Conclusions: SSCs are the most reliable restorations for carious teeth after six months recalls.

Keywords: Restorative procedures; Children; Dental rehabilitation; Stainless steel crowns

Introduction

Many treatment modalities exist for managing young children in need of comprehensive restorative or surgical dental treatment [1]. Treatment is performed usually under local anesthesia, but for patients who are very young, uncooperative or with special health care needs (SHCN), extensive treatment is usually performed under general anesthesia (GA) [2].

There are many advanced treatment modalities such as stainless steel crowns (SSCs) and strip crowns, in addition to composite resin, amalgam, glass ionomer, fissure sealants and preventive resin restorations (PRR).

According to many studies, SSCs are the most reliable restorations, including anterior deciduous teeth, surpassing amalgam, while composite restorations and strip crowns are the least durable for patients under general anesthesia [2].

Many researchers reported that preformed crowns achieve a better success rate than multi-surfaced amalgam restorations in studies of dental records from private pediatric dental practices, a hospital, and a university dental clinic [3,4].

Clinicians should be aware of the longevity and likely reasons for the failure of direct posterior restorations. In a long-term, randomized clinical trial, the authors concluded that amalgam restorations performed better than composite restorations. The difference in performance was accentuated in large restorations and in those with more than three surfaces involved [5].

Concerning glass ionomer fillings, especially high viscosity type, the current evidence suggests that high-viscosity glass-ionomer cements (HVGIC) are not inferior to amalgam as restorative materials for permanent posterior teeth. A wider range of clinical benefits for both patient and care provider, beyond appropriate restoration longevity for placing HVGIC based restorations, may apply [6,7].

There are two types of fissure sealants: resin based and glass ionomer based. According to Kumaran [8], the retention of the resin-based sealants is superior to that of glass ionomer cements, but the real efficacy of glass ionomer sealants still remains open and needs more studies [9].

Regarding PRRs, a study was performed to examine the 9-year success of the composite resin sealant restoration, which provides "sealing for prevention" of fissure caries rather than "cavity extension for prevention". Forty-three restorations (54%) had completely retained sealants, 20 (25%) had sustained partial loss, and 16 (20%) of the restorations had lost all sealant. Dental caries occurred in 19 (25%) of the restorations that had sealant loss. An additional 16 teeth had proximal caries unrelated to the occlusal restoration [10].

A review of the literature shows a wide variety of approaches to the study of success rate and longevity of restorations. However, few studies have compared the performance of all types of restorations placed by dental interns and residents.

Objective

The aim of the present study was to measure the treatment outcomes of the restorative procedures for children undergoing dental rehabilitation performed by dental interns and residents (MSc, PhD and Saudi Board) at King Abdulaziz University Faculty of Dentistry (KAUFD), Jeddah, Saudi Arabia.

Materials and Methods

One hundred dental digital records of healthy patients undergoing comprehensive dental treatment at KAUFD were viewed by a single examiner. These patients were treated by dental interns and residents (MSc, PhD and Saudi Board) at KAUFD, Jeddah, Saudi Arabia between 2015 and 2016. Dental interns and residents performed the dental treatment in the Pediatric Dentistry Comprehensive Care Clinics under the direct supervision of attending faculty staff members. Dentists' calibration was conducted in the Faculty of Dentistry clinics to assess the intra-examiner consistency before starting treatment.

Demographic data, medical history, date of the dental rehabilitation and types of procedures performed and their radiographs were obtained from the dental records of the patients.

In the current study, only records of patients who returned for follow-up at least 6 months after their rehabilitations were evaluated. Recalled patients were provided with topical fluoride gel application and oral hygiene instructions and referred to treatment if needed. At the follow up visit, the purpose of the study was explained to the parent/s and informed consent for participation in the study was obtained.

Using modified Ryge USPHS criteria [11], each restoration was assessed for wear, anatomical form, marginal integrity, cavosurface marginal discoloration, recurrent caries, surface texture, maintenance of interproximal contact (approximal restorations only) and post-operative sensitivity (Table 1).

Value 1 indicates a clinically ideal situation. Value 2 (apart from caries) indicates a clinically acceptable situation. Value 3 indicates a clinically unacceptable situation, which usually requires replacement of the restoration. Value 4 indicates a clinically unacceptable situation because of fracture, mobility or loss of the restoration, which makes it necessary to replace the restoration.

The children were examined to determine the fate of restorations previously inserted under local anesthesia. Restoration failure was considered to occur if a restoration needed replacement due to structural breakdown (fracture or dislodgement of the restoration), if there was pulpal or dentoalveolar infection associated with the restored tooth or if there was recurrent decay. Intact restorations without new caries at the time of follow up were considered to be successful.

Failure of SSCs was judged using the following criteria: [12].

(1) Occlusal crown perforation (2) Crown loss as a result of cement wash out (3) Loss of interproximal contact for posterior SSCs.

Failure of dental restorations could have occurred any time after dental rehabilitation completion and the last documented follow-up visit.

Statistical Analysis

All of the data were recorded and evaluated by PSPP Excel statistic program and SPSS statistic program version 16 (SPSS Inc., Chicago, IL, USA). Chi-square tests were used to analyze the failure rates of restorative procedures. Intra-examiner agreement was determined using the Kappa statistic and was considered excellent (K=0.92).

Results

From the entire group of dental records that were reviewed, 61 records satisfied the condition of patient follow-up of at least 6 months after rehabilitation.

The 61 patients were 28 males and 33 females with a mean age at the time of the dental rehabilitation of 8.1 years and a standard deviation of 2.16 (Table 2).

Table 1: Direct clinical evaluation criteria (modified Ryge criteria).

Wear/Anatomic Form
1. Restoration is continuous with existing anatomical form.
2. Restoration is discontinuous with existing anatomical form, but missing material is not sufficient. to expose dentin or base.
3. Sufficient material lost to expose dentin or base.
Marginal Integrity
1. Explorer dose not catch and/or no crevice is visible.
2. Explorer catches and crevice is visible, but no exposure of dentin or base and restoration is not mobile.
3. Explorer penetrates crevice, defect extends dentino-enamel junction.
4. Restoration is fractured, mobile or missing (in part or in toto).
Cavosurface Marginal Discoloration
1. No visual evidence of marginal discoloration.
2. Marginal discoloration has not penetrated in pulpal direction.
3. Marginal discoloration has penetrated in pulpal direction.
Recurrent Caries
1. No caries present.
2. Caries present associated with restoration.
Surface Texture
1. Surface texture similar to polished enamel.
2. Surface texture gritty (similar to white stone).
3. Coarse surface pitting.
Maintenance of Interproximal Contact
1. Proximal contact is present.
2. Proximal contact is light but present.
3. No proximal contact.
4. No adjacent proximal surface.
Post-operative Sensitivity
1. No known sensitivity to hot, cold and biting stimuli.
2. Moderate sensitivity to hot, cold and biting stimuli; no replacement of restoration required.
3. Severe sensitivity: replacement of restoration required.

Table 2: Descriptive analysis of patients' ages in years.

Variable	N	Mean	Minimum	Maximum
Age	61	8.1	4	12

Figure 1 shows the number of survived and failed restorations in the sample.

Figures 2 and 3 show the distribution of survived/failed restorations and the different restoration types in relation to the patients' ages. Notice the aggregation of almost all types between ages 6-8 years.

Table 3 shows a comparison of success and failure rates in different restorative procedures. Among the different types of restorations inserted, the highest survival rate after six months' recall was for SSCs (98.7%) followed by PRRs (97.9%) and fissure sealants (96.2%). The sample included only 5 strip crowns which were not enough to compare it with the other restorations.

Table 4 shows a pair wise comparison between failure rates in different restorative procedures. Compared to SSCs failure rates, PRRs failure rates were higher, but not statistically significant (P=0.559). Compared to the failure rates of SSC restorations, failure rates in composite restorations were significantly higher ($p<0.0001$).

Discussion

The purpose of the present study was to measure the treatment outcomes of the restorative procedures for children undergoing dental rehabilitation performed by dental interns and residents (MSc, PhD and Saudi Board) at KAUFD, Jeddah, Saudi Arabia.

Table 3: Comparison of success and failure rates in different restorative procedures.

Types of restorations	Number of inserted restorations	Survived: N (%)	Failed: N (%)	Statistical Tests
Strip crowns	5	5 (100%)	0	
SSCs	154	152 (98.7%)	2 (1.3%)	
Composite	237	205 (86.5%)	32 (13.5%)**	$X^2 = 28.5$
Amalgam	0	0	0	
Glass ionomer	0	0	0	P<0.0001*
Fissure sealant	159	153 (96.2%)	6 (3.7%)	
PRR	48	47 (97.9%)	1 (2%)	
Total	**603**	**562 (93.2%)**	**41 (6.8%)**	

*: statistically significant.
**: Assuming the composite failure rate is approximately the same for all restorations, including those of patients who did not return after 6 months, the actual rate may be closer to 8%.

Table 4: Pair wise comparison between failure rates in different restorative procedures*.

Restorative Procedure	Compared To	P Value
Composite	PRR	0.024**
	SSC	0.0001**
PRR	SSC	0.559 NS

*: Compared to SSCs failure rates, PRRs failure rates were higher, but not statistically significant (P=0.559). Compared to the failure rates of SSC restorations, failure rates in composite restorations were significantly higher(p<0.0001).
**: statistically significant.
NS: Not statistically significant.

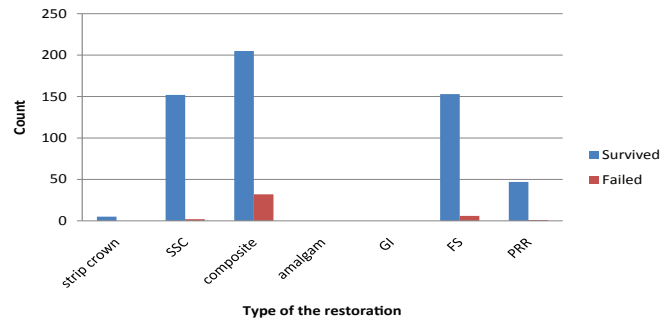

Figure 1: Bar chart showing the number of survived and failed restorations in the sample. Also indicates that no amalgam or glass ionomer restorations were placed.

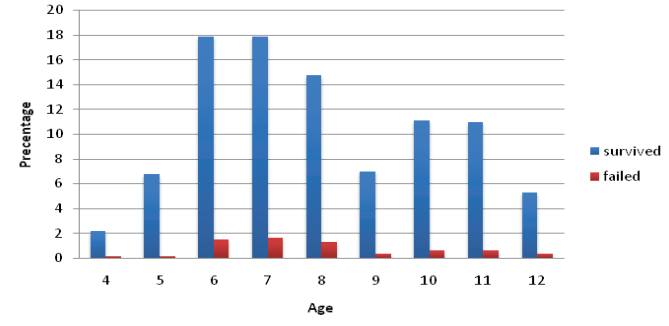

Figure 2: Bar chart showing the age relation to the survived/failed restorations percentage.

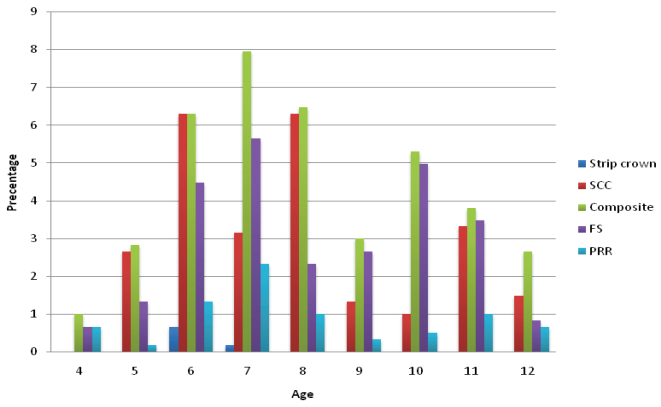

Figure 3: Bar chart showing different restoration types in relation to the patients' ages.

The study involved data from records and clinical examinations of 61 healthy patients receiving oral rehabilitation students at KAUFD.

There was a significant aggregation of survived restorations in age between 6 and 7 years but this result is inconclusive because the mean age of the sample is in that range.

Our results are in agreement with most of the literature in that full coverage was a highly successful procedure, and that restorations dependent on the integrity of dental enamel, such as amalgam, composite and glass ionomer materials, had higher failure rates [12].

Among the different types of restorations inserted, the highest percentage of survived restorations was for the strip crown (100%). The total number of strip crowns were only 5, too few for statistical comparison.

SSCs have the second highest ratio of survived restorations (98.7%). This result is supported by many studies, making SSCs the most reliable restorations [2].

On the other hand, the study showed that most of the restorations inserted were composite resin. The sample did not include amalgam or glass ionomer restorations. Composite resin is preferred because of its excellent physical properties, which allows conserving tooth structure.

This study showed that failed restorations formed 6.8% of all restorations previously inserted (Table 3). This is not in agreement with other studies that showed a 20-30% rate of failed restorations in primary teeth [13,14]. The low failure rate in our study was because of the relatively short follow up period (6 months) after their rehabilitations.

Low return rates for follow-up after dental rehabilitation have been reported in the present study. This is consistent with other studies that reported lower rates of return for follow-up care after dental rehabilitation [2,15]. Only 61% of the patients returned for follow-up in this study, whereas 75% of patients in O'Sullivan's study [16] returned for follow-up. The lower rates of return may be attributed to the patient satisfaction with the treatment provided. In addition, many of the patients may not have returned for follow-up because they did not perceive a need for re-treatment.

Appreciation of the multifactorial nature of dental caries is important when developing a treatment plan. Child, parent and dentist all influence the outcomes of treatment. A child will not voluntarily alter his/her diet or improve his/her oral hygiene habits. The responsibility for these changes rest with the caregiver. It may be of value to actively pursue these caregivers and promote a preventive agenda emphasizing termination of snacks, use

of fluoride, increased tooth brushing by parents and regular professional dental recalls. Furthermore, SSCs have been shown to be more durable suggesting that these restorations may be a more cost-effective treatment choice for children with rampant caries and who require comprehensive dental treatment [2,16].

Limitations of the Study

The limitations of the study are: (1) the small sample size and short follow-up period; (2) lack of data for those patients who did not return after 6 months; (3) insufficient funding for longer-term follow-up.

Conclusions

The restorations provided by the dental interns and residences compare favorably in this study to pediatric dentists in private practice. SSCs are the most reliable restorations for carious teeth after six months recalls. Further investigation over longer periods of time is necessary to determine the long-term success and failure rates for different restorative procedures.

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