

## Clinical and Radiographic Evaluation of Composite Restorations by Dental Students

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**Abstract:** The purpose of the study was to evaluate composite resin restorations placed by students of King Abdulaziz University Faculty of dentistry clinically and radiographically. Patients who received comprehensive treatment were called for evaluation. By using modified USPHS criteria, composite restorations were evaluated clinically. Radiographic examinations were conducted if the restoration had a proximal extension with tight contact. Almost 43 % of 105 restorations were clinically deemed failed with causes as follows: non matching shade (anterior teeth) (25.45%), weak or open contact (23.64%), lost restoration (21.82%), compromised esthetic (anterior teeth) (12.73%), recurrent caries (7.2%), tooth loss due to caries (3.64%), restoration fracture (3.64%), and marginal staining (1.82%). Radiographical failure represented 19% of restoration failure and reasons were: lost restoration (60%), recurrent caries (30%), and tooth loss due to caries (10%). Clinical evaluation of direct composite restoration placed by students of KAUFU demonstrated high percent of clinical failure (42.9%) compared to different published studies. Nonmatching shade, light or open contact, and loss of restoration retention were the most common causes of failure.

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### 1. Introduction

Although amalgam restorations are still in use<sup>[1]</sup> and provide excellent results, direct composite restorations have widely replaced them. The longevity of composite restorations has been investigated and their properties have been improved. However, composite restoration placement is technique sensitive and failure is not uncommon.<sup>[2]</sup> Understanding of its complexity by dental students and how to perform the techniques correctly to get the best results is a must.<sup>[3]</sup> Therefore, in this study we clinically and radiographically evaluated the longevity of direct composite restorations placed by dental students at King Abdulaziz University, Faculty of Dentistry (KAUFU), in Jeddah, Saudi Arabia

### 2. Materials and Methods:

Manual review of all cases treated in 2004/2005 and 2009/2010 by 6<sup>th</sup> year dental students was performed and only cases that received comprehensive treatment were considered. Patients recalled for follow-up, but only 13 patients showed-up with 90 restored teeth and 106 restoration placed.

Teeth were examined clinically and radiographically by one examiner to reduce the variability among examiners. Each restoration was evaluated by using specific criteria.

#### General Information of the Patient:

Personal information collected included: age, gender, socioeconomic status (SES), tooth number and position and class of restoration.

#### General Health of the Patient:

General health was categorized into insignificant (healthy) if the patient had no systemic disease that may affect his/her oral health, or significant if such disease or condition existed.

#### Oral Hygiene Practice Evaluation:

Patient oral hygiene was evaluated into acceptable or unacceptable. For that purpose a special protocol was followed to evaluate the oral hygiene by asking questions: have you learned how to maintain good oral hygiene? Do you brush your teeth? How many times? Also the patient was asked about the use of dental floss, mouthwash, xylitol gum. Then plaque index of the patient was measured using simplified oral hygiene index.

#### Clinical Evaluation:

The targeted restoration was evaluated by checking if it is present, lost, replaced or repaired. Then its retention was evaluated to see if it is fixed, movable, completely or partially lost. After that, contour of the restoration was evaluated (correct, over- or under contoured). Proximal tightness of all restorations was then evaluated except for class I and V, by using dental floss to check if the restoration had positive, light or open contact. Then, the restoration was examined for presence of recurrent decay. After that, marginal

integrity, marginal staining and anatomic form of the restoration were evaluated and marked either A, B, C, or D according to modified criteria (mUSPHS).<sup>[2]</sup> Then, presence of restoration bulk fracture, tooth fracture, pain or sensitivity of the tooth were evaluated. After that, the esthetic appearance of the anterior restoration was examined to check if it is compromised. Finally, shade of the anterior restoration was examined to check if it is a match to existing dentition.

#### Radiographic Evaluation:

After finishing the clinical examination, Bitewing or periapical radiograph was examined to check for recurrent caries, overhanging restoration, periapical or peri-radicular radiolucency or violation of biological width.

#### Statistical Analysis :

Non-parametric chi-squared ( $\chi^2$ ) and Fisher exact tests were used to analyze a possible association among the variables with a 5% significance level.

### 3. Results:

Patients who received a comprehensive dental treatment were recalled for evaluation of their dental composite restorations. Patients whom we were unable to contact, had incomplete records, or incomplete dental treatment were excluded. Only 13 patients with 105 restorations fit the criteria and were eligible for evaluation.

Restorations placed in year (2009-10) represented 63.2 %, and the remaining 36.8 % of the restorations were placed in year (2004-05). 76.4 % of placed restorations were in male patients while the other 23.6 % in female patients. The specific distribution for class of the restorations was class I (31.1%), class II (26.4%), class III (21.7%), class IV (7.5%), class V (12.3%) and finally class VI (0.9%). Anterior restorations represented 42.5 % and while 57.5 % of the restorations were placed in posterior teeth.

**Table 1. Percentage of failure of different classes of restorations.**

Restoration type	Class III	Class II	Class V	Class IV	Class I	Class VI
Percentage of failure	65.22	59.26	46.15	37.5	15.15	0

**Table 2. Causes of clinical failure.**

Causes of failure	Frequency	Percent
Nonmatching Shade ( Anterior Teeth)	14	25.45
Weak or Open Contact	13	23.64
Completely Lost Restoration	12	21.82
Compromised Esthetic (Anterior Teeth)	7	12.73
Recurrent Caries	4	7.2
Tooth Loss Due To Caries	2	3.64
Restoration Bulk Fracture	2	3.64
Marginal Staining	1	1.82
Total	55	100

**Table 3. Causes of radiographic failure.**

Causes of failure	Frequency	Percent
Completely Lost Restoration	12	60
Recurrent Caries	6	30
Tooth Loss Due To Caries	2	10
Total	20	100

Table 1 shows the percentage of failure of different classes of restorations. Class III showed the highest percent of clinical failure (65.22%), while class VI was only one restoration with 0% of clinical failure.

Clinical and radiographical evaluation showed that 42.9 % of 105 restorations were unacceptable clinically and 19 % of 105 restorations were unacceptable radiographically. Oral hygiene (OH) practice were unacceptable in 94.3 % of the patients.

Table 2 shows causes of clinical failures. Shade matching, improper proximal contact, and loss of restorations were the most common causes of clinical failures. Table 3 shows causes of radiographic failure. Complete loss of restoration accounted for 60 % of causes.

### 4. Discussion:

In this study the number of restorations evaluated were 106. Clinical and radiographical failures of restorations were 42.9% and 19% respectively. The most common cause of failure regarding anterior teeth clinically was nonmatching shade which accounted for 25.45% of clinical restorations failure. Several factors can contribute to such failure. Color change may be related to dentists' experience or composite color stability. Regarding experience, shade selection should be taken in clean moist environment. The process of shade selection can yield different shade if not followed properly. For example, taking the shade after placing the rubber dam (teeth will be brighter in color

because of dehydration)<sup>[3]</sup> or using a shade guide system different than the composite resin type.<sup>[3-6]</sup> According to Bayindir *et al.*<sup>[5]</sup> study, coverage errors (CEs) of three shade guides were compared based on the color of 359 anterior teeth. VITA Toothguide 3D-Master® (Vita North America, Ca) (3DM) showed the lowest CEs compared with Vitapan Classical and Chromascop; therefore, 3DM was recommended as the clinically relevant guide; while, King Abdulaziz University students use 3M ESPE system (St. Paul, MN).

Weak or open contacts accounted for 23.64% of clinical restorations failure which is considered the most common cause of failure related to anterior and posterior teeth combined. Achieving tight contact is considered one of the major difficulties of the composite resin<sup>[7]</sup> because traditional composite materials do not 'push out' a matrix in the same way as is achieved with amalgam.<sup>[8]</sup> Class II composite restorations showed significantly higher failure rate in achieving adequate proximal contact than amalgam.<sup>[9]</sup> Another factor is the mal adaptation of the matrix band<sup>[10]</sup> or improper wedge selection or placement.<sup>[10]</sup> Matrix type may also affect the tightness of the proximal contact. According to Wirsching *et al.*<sup>[11]</sup>, use of sectional matrix system in two-surface Class II cavities resulted in statistically significant tighter proximal contacts compared to circumferential matrix system which is extensively used in the school (Tofflemeyer type). Polymerization shrinkage might affect the tightness of the contact as the shrinkage will be greater with a higher volume of composite and it will be towards bounded surface of the restoration<sup>[12-14]</sup>. All these factors may decrease the proximal contacts tightness.

The second cause of clinical failure of anterior and posterior teeth combined was complete loss of restorations which accounted for 21.82% of clinical restorations failure. This may be due to different factors: inadequate preparation form, contamination of prepared cavity, poor bonding technique or, intermingling of bonding materials from different systems.<sup>[15]</sup> Also Moura *et al.* mentioned that loss of restoration happens due to limited adhesiveness and lack of experience of the operators with adhesive technique.<sup>[16]</sup> Experience of operators appears to be a critical role in the outcome of bond strength<sup>[17]</sup> which indicates that students are not as experienced as graduate doctors who may have better failure rates.

For anterior teeth, unesthetic appearance of the restoration accounted for 12.73%. Unesthetic appearance refers to discoloration or improper anatomic form of the restoration. Lack of experience with placing anterior restorations and lack a good understanding of the behaviour of the material can lead to faulty restorations and unesthetic look.<sup>[18]</sup>

Recurrent caries and tooth loss due to caries accounted for 7.2% and 3.64% of clinical restoration failure. This is most probably related to microleakage following polymerization shrinkage of the composite restoration.<sup>[19]</sup> It may lead to staining at the margins of the restoration, acceleration of the breakdown at the margins, recurrent caries at the tooth-restoration interface, hypersensitivity of the restored teeth, and the development of pulpal pathology<sup>[19,20]</sup>. Caries development may be a reflection of several factors like the presence of local factors (plaque and microorganisms), dietary habits, or salivary problems. These factors were not measured in the current study so the recurrent decay measured may very well not be student-related.

Restoration bulk fracture accounted for 3.64% of clinical restoration failure. It is one of the complications that could happen to composite restorations according to studies<sup>[21-24]</sup> which showed composite fracture ranges from 9.2% to 20% of participants. However, due to high frequency of lost restoration in our study that might decrease the percentage of bulk fracture in our results. The least common cause of clinical failure was marginal staining which accounted for 1.82% of clinical restoration failure.

After finishing the clinical examination, teeth were examined radiographically. To avoid unnecessary patient exposure to radiographs, the decision to take radiographs was based on clinical decision after examining the patient.<sup>[22]</sup> Only patients who had a proximal restoration with tight contact were examined radiographically, otherwise, patients would be examined clinically only. The bitwing is a well-documented diagnostic aid for detecting proximal caries.<sup>[23]</sup> In this study, the causes of radiographical failure were three. First was complete loss of restoration which was accounted for 60% followed by recurrent caries(30%), and tooth loss due to caries (10%).

## 5. Conclusion:

Clinical evaluation of direct composite restoration placed by students of KAUFU demonstrated high percent of clinical failure (42.9%) compared to different published studies. Nonmatching shade, light or open contact, and loss of restoration retention were the most common causes of failure. Among students of KAUFU, esthetics failure seems to be the most reason of failure. Results of this study will be introduced to Faculty of Restorative Dentistry department to discuss its findings in order to determine reasons for such failures and how to overcome these problems with composite restorations.

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