

QUALITY ASSESSMENT OF COMPOSITE RESTORATIONS PERFORMED BY THE DENTAL STUDENTS: A RETROSPECTIVE STUDY

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ABSTRACT

The main characteristics of the failure of composite fillings include; fracture, wear and postoperative sensitivity, secondary caries, and Marginal deficiencies. Many of these defects can be controlled, but at the same time, a patient also has to take a lot of precautions for the long-term preservation of any restoration. This is a retrospective study done using the patients' files and examination of post-operative radiographs (bitewings). Convenient sampling was done, and 341 patients' files were selected from Muneseya clinics after seeking approval from the Research center and clinic director. The presence of faulty restorations was of concern; the prevalence was found to be 35%. Anatomic form criteria to assess the quality showed that 63% of restorations were continuous with the existing anatomic form, 29% were discontinuous with the existing anatomic form, and 8% showed sufficient material being lost to expose dentin or base. The overall quality of the restorations done by the students was not satisfactory.

Key words: Composite restorations, Dental students, Quality assessment, Retrospective.

Introduction

The grand purpose of restoring a decayed tooth is to remove the carious portion and to improve its form and functions. However, along with successful recovery, there are also chances of failure due to improper use of materials. Skills and experiences play a vital role in determining the quality and durability of dental restorations. Along with these factors, the quality of a dental restoration also depends upon the kinds of materials and the type of restoration. However, with the introduction of new technology and materials, the chances of failure have been reduced [1].

The main characteristics of failure of composite fillings include; fracture, wear and postoperative sensitivity, secondary caries, and Marginal deficiencies. Many of these defects can be controlled, but at the same time, a patient also has to take many precautions for the long-term preservation of any restoration [2, 3].

Three main factors are responsible for the success of a composite filling. One of which is to choose a good quality composite, the correct use of a proper bonding system, and the proper use of a curing system.

The demerits of composite fillings are

1. The danger of microleakage and secondary caries.
2. Lower fracture toughness.
3. Sensitive technique.

4. The necessity of oral hygiene.

5. It takes much time to replace as compared to amalgam and many other restorative materials.

In case of failed restoration, a tooth can suffer recurrent caries and need further restoration [4].

These days, modern fillings are created with tooth-colored material. It not only improves the look of teeth but also reduces the chances of restoration failures associated with previously used amalgam. For a natural look, composite is the best option; in that case, the filling will remain unnoticeable [5, 6].

Massano *et al.* (2019) conducted the study to determine the composite of the Anterior Teeth in the direct method [7]. The study's main aim was to evaluate the longevity of restoration classes performed with various Nano filled resin composites. Fifty-three patients visited the Department of Operative Dentistry to receive treatment for fractures and caries. The results showed that 93 restorations were evaluated at the visits of the follow-up given to them after their first recall. After 60 months, parameters are affected by the fracture and weak restorations regarding the matching color, and no critical differences were found until 96 months. The rate of annual failure was 2.4% [8].

The outcomes of dental-student-performed composite restorations of the Class II order have been looked at by

AlOtaibi *et al.* (2020) [9]. The radiographic study performed by dental students aimed to analyze the inferior Class II composite restorations the dental students have placed. Bitewing radiographs were analyzed to assess the voids, residual caries, open margin, open contact, and defective Class II restorations. Bitewing radiographs indicated 1514 permanent teeth were filed with Class II composite restoration. There were almost 925 teeth that showed the failure of restorations of Class II, while the cause of the failure of most of the composite restorations of Class II includes; overhanging 197 (13.01%), followed by 184 (12.15%) voids, the poor contour with 165 (10.88%), 135 (8.91%) open margin and 87 (5.75%) residual caries.

Study rationale

The study aims to discern Class II composite restoration quality performed by undergraduate dental students to enable the instructors to improve the students' clinical skills if needed.

Study hypotheses

The quality of composite restorations among the patients visiting REU clinics is satisfactory.

Aims of the study

- To determine the quality of composite restorations among the patients visiting REU clinics.
- To list down the major reasons behind low-quality restorations.

Materials and Methods

Study design & sample

This is a retrospective study using the patients' files and examining post-operative radiographs (bitewings). Convenient sampling was done, and 341 patients' files were selected from Muneseya clinics after seeking approval from the Research center and clinic director.

Sample size calculation:

Confidence level: 95%

Population Size: 3000

Margin of Error: 5%

Sample size: 341

Inclusion criteria

Fillings done by level 9 to 12 students, x-rays without any artifact

Exclusion criteria

Fillings done by level 8, interns or post-graduate students, x-rays with artifact

Data collection

Bitewing radiographs were examined for any faulty composite restorations. Each radiograph was examined by at least two students (researchers), and inter-examiner reliability was measured. Chronbach's coefficient alpha

(intra –examiner reliability) value was 0.812. Inter-examiner reliability was 0.798. Prevalence and reasons for any faulty restoration were noted down.

Data confidentiality

Data collected from the patients' files (name, contact information, and file number) were kept confidential.

Statistical analysis

Collected data was analyzed using SPSS version 22, where descriptive and inferential statistics were conducted. A Chi-square test was done to compare the findings based on dentistry level and type of restoration.

Results and Discussion

A total of 334 patients' files were used in this study, which was treated by students from various levels of dentistry. 16% of students were from level 9, 22% were from levels 10 and 11, and 40% were from level 12 (**Figure 1**). Regarding the restoration types observed, 28% were class I, 56% were class II, 11% were class III, 4% were class IV, and merely 1% were class V (**Figure 2**). Regarding the presence of faulty restorations, the prevalence was found to be 35% (**Figure 3**). Anatomic form criteria to assess the quality showed that 63% of restorations were continuous with the existing anatomic form, 29% were discontinuous with the existing anatomic form, and 8% showed sufficient material being lost to expose dentin or base (**Figure 4**). Finally, secondary caries criteria were also used to evaluate the quality of restorations, which showed that only 1% showed the prevalence (**Figure 5**).

Table 1 shows the comparison of our study findings based on student level, which revealed no statistically significant comparisons as all p-values were higher than 0.05. **Table 2** shows the comparison of our study findings on the basis of restoration type, which revealed statistically significant differences in the anatomic form criteria, where class I showed the highest restoration quality (p-value: .000). However, the secondary caries criteria did not show any significant difference.

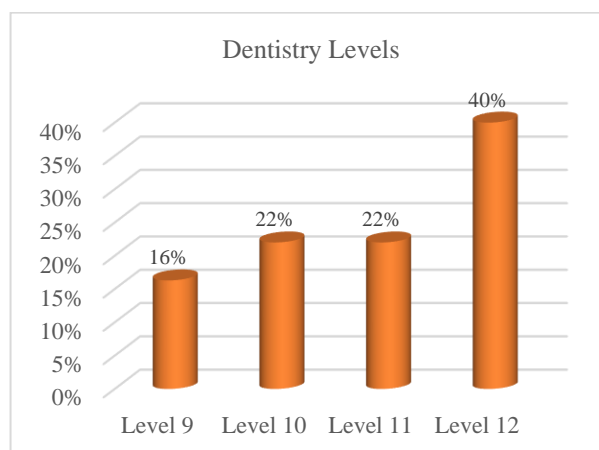


Figure 1. Dentistry levels of students whose cases were included.

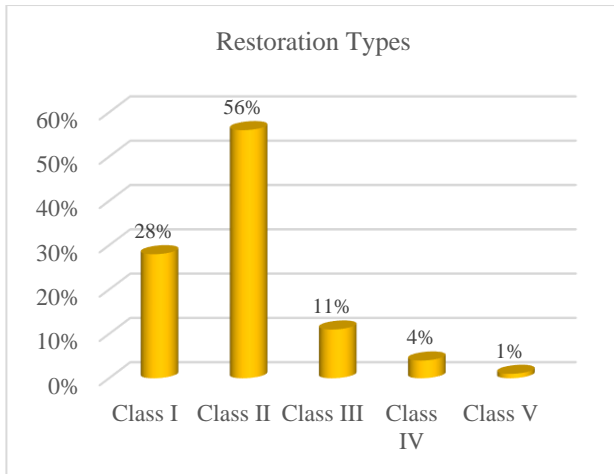


Figure 2. Types of restorations and their frequencies screened in this study.

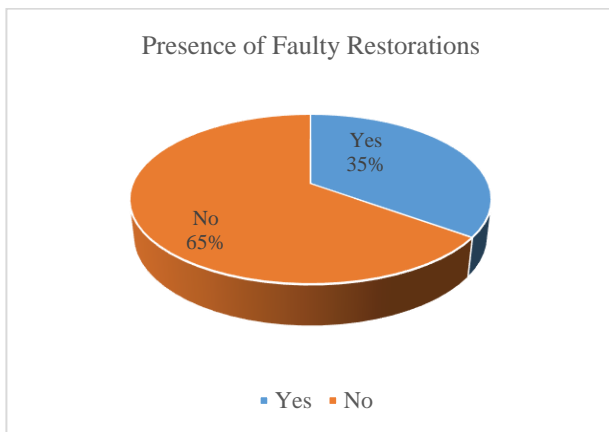


Figure 3. Prevalence of faulty restorations in the files of selected cases.

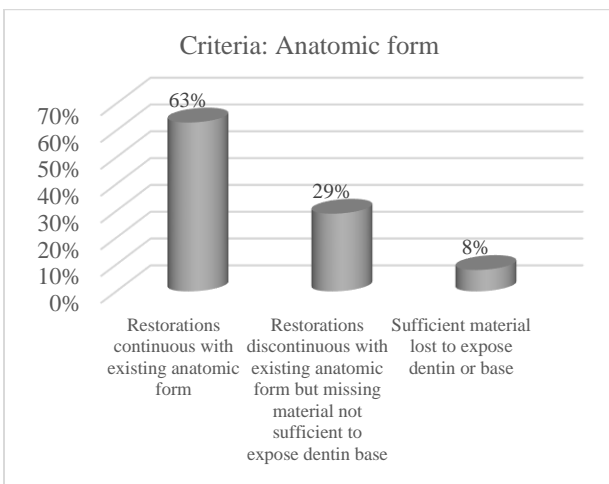


Figure 4. Anatomic form criteria used to determine the

quality of restoration.

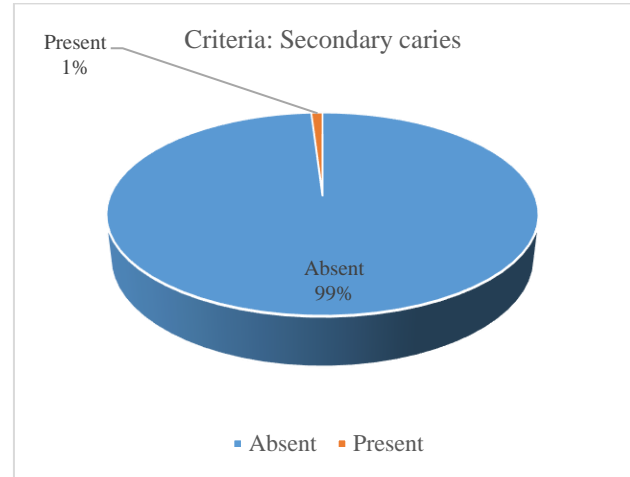


Figure 5. Secondary caries criteria used to determine the quality of restoration.

Table 1. Comparison of study findings based on student level.

	Frequencies	P-value
Anatomic form criteria	Level 9: A:48% B:41% C:11%	.119
	Level 10: A:65% B:25% C: 10%	
	Level 11: A:65% B:25% C: 10%	
	Level 12: A:68% B:29% C:4%	
Secondary caries criteria	Level 9: Absent: 100% Present: 0%	.455
	Level 10: Absent: 99% Present: 1%	
	Level 11: Absent: 99% Present: 1%	
	Level 12: Absent: 100% Present: 0%	

A: Restorations continuous with existing anatomic form
 B: Restorations discontinuous with existing anatomic form but missing material not sufficient to expose dentin base
 C: Sufficient material lost to expose dentin or base

Table 2. Comparison of study findings based on restoration type.

	Frequencies	P-value
Anatomic form criteria	Class I: A: 93% B: 7% C: 0%	.000*
	Class II: A: 55% B:34% C: 11%	
	Class III: A: 46% B: 46% C: 8%	
	Class IV: A: 25% B: 58% C: 17%	
	Class V: A: 0% B: 100% C: 00%	
Secondary caries criteria	Class I: Absent: 100% Present: 0%	.905
	Class II: Absent: 99% Present: 1%	
	Class III: Absent: 100% Present: 0%	
	Class IV: Absent: 100% Present: 0%	
	Class V: Absent: 100% Present: 0%	

A: Restorations continuous with existing anatomic form
 B: Restorations discontinuous with existing anatomic form but missing material not sufficient to expose dentin base
 C: Sufficient material lost to expose dentin or base

This study aimed to determine the outcomes of various types of restorations done by undergraduate dental students [10]. It was revealed from the findings that 35% of the restorations had some kind of fault. A 3-year Brazilian study looked into the clinical performance of undergraduate dental students and the causes of the failure of composite restorations in the anterior and posterior that they placed. Fifteen percent of the restorations were deemed unsatisfactory after three years. These failures were prevalent mainly in Class II and class IV restorations. The failures were caused by restoration loss and deficient marginal adaptation. Secondary caries was not an attributing factor to these losses. After long-term evaluation, most of the dental restorations by students were viewed as satisfactory [11]. When comparing these results with our findings, the successful restorations percentage by our students was 65%, which is lower than the study mentioned above. One similar comparison was the highest failure rate of class II and class IV restorations, which is similar in both studies.

A 3-year study on Kuwait University's dental students investigated the survival rate of posterior resin composite restorations they placed. The rate was 95.1%, giving a low annual failure rate of 1.7%. Most of the failures were caused by recurrent caries (71.4%). This factor was affected by the patients' Oral hygiene, gender, and age [12]. Our study did not reveal more than 1% of restorations affected by secondary caries, which is substantially lower than the above-mentioned study. Moreover, we did not use and compare the factors such as oral hygiene, gender, and age, which is the case in the Kuwaiti study.

Another similar investigation carried out in the Netherlands investigated the quality of posterior resin composite restorations placed by students. Ninety-four out of 703 restorations had failed. Restoration fracture, endodontic treatment, caries, defective margin, and lack of proximal contact were some of the causes of the high failure in restorations [13]. The overall failure rate was lower as compared to our study. Moreover, they only focused on the posterior teeth, whereas our sample included all types of teeth and restorations.

A retrospective analysis was done in a Saudi study of the student's composite restorations of the Class II order using patient's E-files (Dentoplus). (four) competent and standardized examiners with adequate inter- and intra-examiner reliability examined the student-placed Class II restorations using digital bitewing radiographs. The most common defect seen in the bitewings was the overhang, whereas residual caries was the least. The female dental students placed more acceptable Class II composite restorations than their male counterparts [7]. Our study also showed similar findings, as the most common cause of failure was overhang (Restorations discontinuous with existing anatomic form). However, we did not compare the outcomes on the basis of gender.

Study limitations

- Factors such as oral hygiene, gender, and age were not included in our study, which may be helpful in further improving the accuracy of the results.
- The time factor was not included in our study, as we included all cases regardless of the age of the restorations (3 or 5 years).

Conclusion

The overall quality of the restorations done by the students was not satisfactory. There is a need to improve the restorative skills of students. Class II and class IV showed the highest rate of failure. Secondary caries was not prevalent in the cases used in the study.

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Ethics statement: This study fulfills the ethical requirements of Riyadh Elm University.

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