ORIGINAL ARTICLE

Outcomes of Class II composite restorations placed by dental students: An observational study

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Abstract

Introduction: Main objectives of restoring the teeth is to remove the caries and replace the tooth structure to restore form and function. This radiographic study aimed to determine the defective Class II composite restorations in permanent teeth placed by the undergraduate dental students in a private dental school.

Materials and Methods: A retrospective analysis of bitewing radiographs of Class II composite restorations placed by the clinical dental students of 2017–2018 year was assessed to determine the defective restorations. Bitewing radiographs were examined to record voids, open contact, residual caries, open margin, defective restoration, and acceptable composite Class II restorations.

Results: A total of 1514 permanent teeth filled with composite Class II restorations were assessed using bitewing radiographs. Almost 935 teeth showed signs of failure of Class II restorations. Reasons for the failure of most of the Class II composite restoration were due overhang 197 (13.01%), followed by voids 184 (12.15%), open contact 167 (11%), poor contour 165 (10.88%), open margin 135 (8.91%), and residual caries 87 (5.75%). A significant difference between male and female students was observed with regard to voids ($P = 0.026$), overhang ($P = 0.016$), and open margins ($P = 0.001$) of the Class II composite restorations.

Conclusion: Overhang was the most common, and residual caries was the least common defects observed in the bitewings. Male dental students placed higher defective composite Class II restorations compared to the female dental students.

Key words: Bitewing radiographs, Class II composite restorations, dental students, failure, overhang, voids

Introduction

The major objective behind dental restorations is to completely remove the carious lesion and replace the missing tooth structure in order to rehabilitate the normal function. However, there are chances of failure associated with the skills as well as the improper use of materials. The word “quality” is being used when describing the state of any dental restoration. Competent skills and clinical experience play an important role in determining the quality and longevity of dental restorations.[1]

Alongside the factors mentioned above, the type of restoration and material used are also pivotal in determining the success or failure of the dental restoration. Several studies have been conducted to analyze the various techniques of restoring missing tooth structure alongside the various types of materials being used. Proximal contacts have been noted to have...
experienced a higher rate of marginal leakage leading to recurrent caries. Therefore, the advent and utilization of different materials and techniques may reduce the chances of failure.\[2\]

There are multiple reasons behind the failure of composite restorations, which include secondary caries, marginal defects, and fracture. Quality of isolation and clinician skills plays an important role in determining the longevity of dental restorations. Observation of several studies has resulted in the inference that failure rates may go up to 45% in some cases.\[3\] However, several investigations have also associated the presence of caries as the sole factor in leading a restoration to failure. They completely excluded the above-mentioned factors related to clinician’s skills and quality of restoration.\[4\]

Apart from the factors mentioned in the above-stated investigations, there is another important reason behind the restoration failure. This refers to the patients’ compliance to dentists’ instructions, especially when restored by composite material.\[5\] Moreover, chances of failure among composite restorations are higher when used in Class II cavities.\[6\] Amalgam as well as composites have been used for a long time, yet the failure of dental restorations have not been avoided. One of the major reasons behind the failure is recurrent caries, which is the result of marginal leakage following a lack of clinical competency. Survival rate of restorative materials varies and change with time, with composite having slightly better life than amalgam.\[7,8\] On the other hand, there are a few morphological factors associated with the failure of restorations. This is highly common in the proximal surface restorations, where dealing with concavities is quite difficult and may require interventions in wedges in order to avoid failure of dental restoration.\[9\]

Regarding the above-mentioned proximal restoration failure, it is important to understand that the chances of failure are higher in composite restorations. However, amalgam restorations are able to adapt to the proximal concavities to a better extent.\[10\] This information was clinically verified when Bernardo et al. compared the failure rates of amalgam and composite, which resulted in a conclusion that amalgam has better chance of avoiding secondary caries.\[11\]

On the contrary, recent advancements in dental materials have seen better performance of composite materials to be used in posterior teeth. This achievement has overcome the failures of previously used composites.\[12\] Hence, this radiographic study aimed to determine the defective Class II composite restorations in permanent teeth placed by the undergraduate students.

**Materials and Methods**

**Ethical clearance**

This study proposal submitted to the Research Center of Riyadh Elm University and ethical approval obtained (FIRP/2018/85).

**Study design**

This was a retrospective analysis of the student’s Class II composite restorations obtained from the patient’s E-files (Dentoplus) for the academic year 2017–2018. Trained and calibrated examiners (four) with adequate interexaminer and intraexaminer reliability examined digital bitewing radiographs for Class II restorations placed by the students. The inclusion and exclusion criteria for examining the radiographs were as follows:

**Inclusion criteria**

1. Class II
2. Composite restoration
3. Postoperative radiograph (bitewing)
4. Permanent teeth.

**Exclusion criteria**

1. Restorative material other than composite (amalgam, GIC, IRM, etc.)
2. Primary teeth
3. No postoperative radiograph
4. Anterior teeth
5. Occlusal, cusp, and cervical caries only.

**Data collection**

A total of 1514 files were selected based on convenience sampling methodology and examined for the Class II composite restorations.

A special form consisting of case number, file number, tooth number, gender, nationality, voids, open contact, residual caries, open margin, defective restoration, and acceptable restorations was prepared to collect the data.

**Statistical analysis**

All the data obtained from the digital bitewing examination were entered into the Excel sheet and then transferred to the Statistical Package for the Social Sciences (version 25, IBM Corp., Armonk, NY, USA) for further analysis. Descriptive statistics of frequency distribution and percentages were calculated for each of the variables. Chi-square test was applied to assess the outcomes of Class II composite restorations placed by dental students. $P < 0.05$ was considered statistically significant.
Results

A total of 1514 permanent teeth filled with composite Class II restorations having postoperative digital bitewing radiographs were evaluated for the outcomes. Almost 935 teeth showed signs of failure of Class II restorations. Characteristics of the teeth with Class II composite restorations are displayed in Table 1.

Reasons for the failure of most of the Class II composite restoration were due overhang (197 [13.01%]), followed by voids (184 [12.15%]), open contact (167 [11%]), poor contour (165 [10.88%]), open margin (135 [8.91%]), and residual caries (87 [5.75%]), as shown in Figure 1.

Comparison of frequency of defective composite Class II restorations between male and female students showed statistically significant difference for voids ($P = 0.026$), overhang ($P = 0.016$), and open margins ($P = 0.001$), as shown in Table 2.

Discussion

This study aimed to determine the number of defects in composite Class II restorations done by the undergraduate dental students in the female campus of Riyadh Elm University. Thorough examinations of patients’ files using the radiographs were conducted by four examiners. Different types of defects in the composite restorations were observed and noted down. The highest frequency of defects in our study was found to be overhang and voids. These findings were similar to the ones investigated by Overton and Sullivan, who reported these defects to be most common among the cases treated by dental students of Texas, USA.[13]

Another study conducted by Moura et al. in Pelotas Brazil on the patients treated by undergraduate students revealed that the most common cause of composite Class II restoration failure was open contact and open margins which is similar to the findings observed in our study.[14] It is important to note that they conducted the study to evaluate the restorations over the course of 3-year period, whereas this study was conducted in a single academic year, which may affect the comparisons between two studies.

According to our study findings, marginal defects comprise one of the least common causes of composite failure. This was the case with a study conducted by Kopperud et al., which revealed that the marginal defects constituted the least number of failures of composite restorations.[15] Interestingly, caries has been reported to be the least common cause of restoration failure. Although this has not been

| Characteristics | n (%) |
|-----------------|-------|
| Section         |       |
| Male students   | 1028 (67.9) |
| Female students | 486 (32.1)  |
| Tooth numbers   |       |
| 14              | 119 (7.9) |
| 15              | 154 (10.2) |
| 16              | 119 (7.9) |
| 17              | 28 (1.8)  |
| 18              | 3 (0.2)   |
| 24              | 154 (10.2) |
| 25              | 158 (10.4) |
| 26              | 101 (6.7)  |
| 27              | 27 (1.8)   |
| 28              | 5 (0.3)    |
| 34              | 80 (5.3)   |
| 35              | 133 (8.8)  |
| 36              | 68 (4.5)   |
| 37              | 34 (2.2)   |
| 38              | 3 (0.2)    |
| 44              | 74 (4.9)   |
| 45              | 127 (8.4)  |
| 46              | 81 (5.4)   |
| 47              | 44 (2.9)   |
| 48              | 2 (0.1)    |
| Gender          |       |
| Male patient file | 1028 (67.9) |
| Female patient file | 486 (32.1) |
| Nationality     |       |
| Saudi           | 762 (50.3) |
| Non-Saudi       | 752 (49.7) |
| Conditions of composite Class II restorations | |
| Defective       | 935 (61.75) |
| Not defective   | 579 (38.25) |

Table 2: Defects noticed in the radiographs of patient

| Reason for failure | Females, n | Males, n | P     |
|--------------------|------------|----------|-------|
| Voids              | 78         | 106      | 0.026 |
| Open contact       | 79         | 88       | 0.483 |
| Overhang           | 82         | 115      | 0.016 |
| Residual caries     | 37         | 50       | 0.196 |
| Open margin        | 46         | 89       | 0.001 |
| Poor contour       | 74         | 91       | 0.287 |

Figure 1: Reasons for composite Class II failure
the case in multiple studies, the most common reason of composite failure was secondary caries.\[^{16,17}\] 

Failure of dental restorations can be a result of inadequate clinical competency, which is possible among the undergraduate dental students. The findings can be compared on the basis of seniority and clinical experience of dental students. However, there have been studies which have shown that contrary to popular perception, restorations placed by students are often superior to those placed by clinical practitioners.\[^\text{16}\] 

The results of this study should be viewed keeping in mind certain limitations. The retrospective design of the current study meant that it was not possible to match the restorations to the individual practitioner or their experience level. Furthermore, the restorations were followed up over a period of only 1 year. Despite these limitations, this study offers a good insight into the outcomes of composite restorations placed by dental students.

**Conclusion**

Overhang was the most common, and residual caries was the least common defects found in the Class II composite restorations placed by the students. Defective restorations were found more commonly in Class II composite restorations placed by the male dental students.

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**Conflicts of interest**
There are no conflicts of interest.

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