

Association between Composite Restoration in Anterior Teeth and Secondary Caries

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Abstract

Composite resin is one of the most commonly used restorative material during the past decade as it provides desirable esthetics, easy to manipulate and minimal cavity preparation required. Despite numerous benefits provided by composites, several clinical studies have reported short longevity and higher rate of failure in composite restoration. One of the main reasons for failure was due to recurrent or secondary caries. The aim of this study was to evaluate the association between composite restoration in anterior teeth and secondary caries. This study included patients above 18 years with composite restoration filled anterior teeth who reported to dental hospital from June 2019 to March 2020. Patients below 18 years, medically compromised patients and patients without anterior composite restorations were excluded from the study. A total of around 86000 patient records were reviewed and analysed for the inclusion criteria and the following parameters were extracted; (i) Patient's gender, (ii) teeth involved, (iii) presence of secondary caries and (iv) types of restoration. Data was recorded into Microsoft Office Excel (2013) and analysed using SPSS software Version 26.0. Chi-square test was done to find out correlation of presence of secondary caries between variables such as patient's gender, teeth involved and types of restoration. Significant test level was set at $p < 0.05$. A total of 1062 teeth presented with composite restoration in anterior teeth. 17.6% of composite filled anteriors presented with secondary caries. Class III restoration had the highest prevalence of secondary caries (61%) and was found to be statistically significant ($p < 0.05$). Females (18.3%) had higher incidence of secondary caries than compared to males (16.6%). Maxillary central incisors had the highest presence of secondary caries (64.2%). Within the limits of this study, it was observed that less number of composite filled anterior teeth had secondary caries and females presented with more number of anterior composite restoration with secondary caries compared to males. Class III restorations demonstrated higher presence of secondary caries than other types of restoration.

Keywords: Anterior restoration, class III restoration, composite restoration, recurrent caries, secondary caries

Introduction

Composite restoration is a tooth coloured restorative material commonly used to restore mild to moderately

decayed teeth and has the benefit of improved esthetics as compared to other restorative materials in the market. Composite is known to be one of the most commonly used restorative material during the past decade^{1,2}. Composite restoration not only provides desirable esthetics but is also easy to manipulate and requires minimally invasive preparation technique and has replaced amalgams which have been the standard restorative material for the past 100 years as amalgam restorations have been associated with environmental pollution^{3,4} and has a negative effect on health as it releases mercury^{5,6}. Moreover, composites are known to have good bonding potential to the tooth, good mechanical property and lower cost

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compared to other indirect restoration and have also replaced other types of restoration in a wide variety of clinical situations such as situations in which previously could only be treated by indirect prosthetic restoration. Composite restoration is not only used to restore traumatized or decayed teeth, but also used for direct and indirect restoration to improve esthetics.

However, despite the numerous benefits provided by composites, several clinical studies have reported short longevity and higher rate of failure in composite restorations than amalgam restorations^{2,7-10}. Previous studies reported that one of the main reasons for failure was due to recurrent or secondary caries⁸⁻¹⁰. The term secondary caries or recurrent caries signify both new caries around a restoration and residual remaining caries¹¹. Secondary caries is also one of the main reasons for replacement of restorative material¹². Secondary caries cannot be avoided completely regardless of the material used for filling. Secondary caries may occur due to crack formation after filling or inadequate removal of caries. However, the relationship between gap and secondary caries is controversial as some studies found poor correlation^{13,14} while a few studies found positive correlation^{15,16}. There has not been any conclusive evidence for association between gaps and secondary caries adjacent to restoration. Nevertheless, studies have reported presence of secondary caries in complete restorations^{14,17}.

One of the disadvantages of composite filling material is the inadequate sealing ability which allows the formation of micro-gaps at the composite-tooth interface followed by microleakage of bacteria and their metabolites and other oral fluids which have long been considered as an etiology of secondary caries¹⁸. Polymerization shrinkage is also one of the inherent shortcomings of composites, which greatly affects the sealing ability¹⁹. Surface roughness of composites also play a role in development of secondary caries as studies have shown that composites have greater bacterial adhesion and accumulate more plaque compared to other restorative materials^{20,21}. The most common method used for detection of secondary caries around restorations is intraoral radiography²¹. In some cases, secondary caries can be detected with visual and tactile inspection for brown or black staining of margins around the composite which can be easily observed around tooth coloured restoration and marginal debonding²¹. Good operator skill is fundamental to improve clinical success of composite restorations since the application

of composite materials are generally known to be very technique sensitive²².

Over the past 5 years, innumerable clinical trials²³⁻²⁸, in-vitro studies²⁹⁻³⁴ and article reviews³⁵⁻³⁷ had previously been conducted by our team. Currently we are focusing on analysing the prevalence of secondary caries in composite restored anterior teeth. The aim of this study was to evaluate the association between composite restoration in anterior teeth and secondary caries. This allows us to gain knowledge on the prevalence of recurrent caries in composite restorations and to understand the need to take necessary measures to improve clinical success of composite restorations.

Materials and Methods

The case control study involved adults of 18 years and above who had reported to dental hospital between June 2019 to March 2020. Both male and female adults were selected for this study. The study was conducted as a university based. This allowed flexible data retrieval, automated data collection, cost effective as well as time saving. However, the setting allowed a limited population to be covered and is subjected to researcher's personal bias. Retrieval of patient's data received approval from the Ethical Committee Board of dental hospital and will be covered by the following ethical approval number. SDC/SIHEC/2020/DIASDATA/0619-0320. Patient's informed consent was obtained from patients prior to clinical examination.

A total of 86000 patient records between June 2019 to March 2020 were reviewed and analysed for presence of composite restoration in anterior teeth and information was verified through intraoral photographs of patients uploaded into the system. Data was collected by a single calibrated examiner. The inclusion criteria was patients above 18 years with anterior composite restoration. Exclusion criteria includes patients below 18 years, medically compromised patients and patients without anterior composite restorations. The following parameters were observed and recorded: (i) Patient's gender, (ii) teeth involved, (iii) types of restoration and (iv) presence of secondary caries.

Statistical Analysis

All the data were entered into Microsoft Office Excel (2013) and analysed using SPSS software Version 26.0. Descriptive statistics were used to report distribution of gender, tooth involved, types of restoration and

presence of secondary caries. Chi-square test was further conducted to assess the association between variable factors such as gender, presence of secondary caries and types of restoration. Significant level test was set at $p < 0.05$.

Results and Discussion

A total of 1062 anterior teeth was diagnosed with composite restoration. Out of which 628 were females and 434 males. 3% of anterior teeth had class V restoration, 5% had class I restoration, 45.1% had class IV restoration and 54.1% had class III restoration (Figure 1). As for the type of teeth involved, the distribution was 60% maxillary central incisors, 25% maxillary lateral incisors, 9% maxillary canine, 1.9% mandibular central incisors, 2.3% mandibular lateral incisors and 1.9% mandibular canines (Figure 2). Out of 1062 teeth with composite restoration, 187 (17.6%) of teeth were observed with secondary caries while remaining 875 (82.4%) had no sign of secondary caries (Figure 3).

Based on gender, prevalence of secondary caries was found to be higher in females (18.3%) compared to males (16.6%) (Figure 4). However, no statistically significant difference was found in presence of secondary caries between males and females ($p > 0.05$) (Figure 4).

Maxillary central incisors demonstrated the highest presence of secondary caries (64.2%) (Figure 5) but this finding was not statistically significant ($p > 0.05$) (Figure 5). Based on type of restoration, the presence of secondary caries was found to be higher in class III restorations compared to other types of restoration (Figure 6). Significant association was found in presence of secondary caries between types of restoration ($p < 0.05$) (Figure 6).

The prevalence and incidence of secondary caries in composite restoration in the general population has not been thoroughly investigated despite secondary caries being recognized as a major issue related to composite restoration. Many studies have reported the incidence of secondary caries were used to study the longevity of composite restoration. However, there are very few

studies available that deal exclusively with its incidence and prevalence in composite restoration.

Our present study found that 17.6% of composite filled anteriors were observed to have secondary caries. Hewlett et al. studied the radiographic secondary caries prevalence in teeth with restorations and reported that 14% of the restored teeth had secondary caries¹⁷. Previous study by Rezwani et al. Also had similar findings in which he reported that 13% of restorations exhibited secondary caries¹⁴. These studies confirmed the finding of the present study.

Our studies observed that secondary caries was found to be more common in class III restoration (61%) compared to other types of restoration. There is a statistically significant difference in the presence of secondary caries between different types of restoration. In agreement with our current finding was a study by Asghar et al who found that class III composite restoration had the highest prevalence of secondary caries³⁸. This adds to the consensus of our finding and is to be included in clinical practice.

In a previous study done by Asghar et al reported the prevalence of secondary caries was higher in males than compared to females³⁸. This study contradicted our current finding of females having a higher prevalence of secondary caries. However, this finding was not statistically significant ($p > 0.05$). The possible reason may be due to difference in geographic location, oral hygiene practice and age of dental restoration.

Our current study was done to associate secondary caries with composite restoration. However, factors involved are only limited to the patient's gender, tooth involved and types of restoration. Other factors such as location of secondary caries, age of restoration and the intactness of restoration may also contribute to association of secondary caries. Many factors can contribute to secondary caries in composite restored teeth. Extensive research is needed to find out possible contributing factors which associates secondary caries to composite restoration and on a large population scale.



Figure 1. Bar chart depicts the number of anterior teeth with composite restoration and type of restoration. X-axis represents type of restoration and Y-axis represents the number of anterior teeth with composite restoration. Class III restoration was more common in anterior teeth compared to other types of restoration.

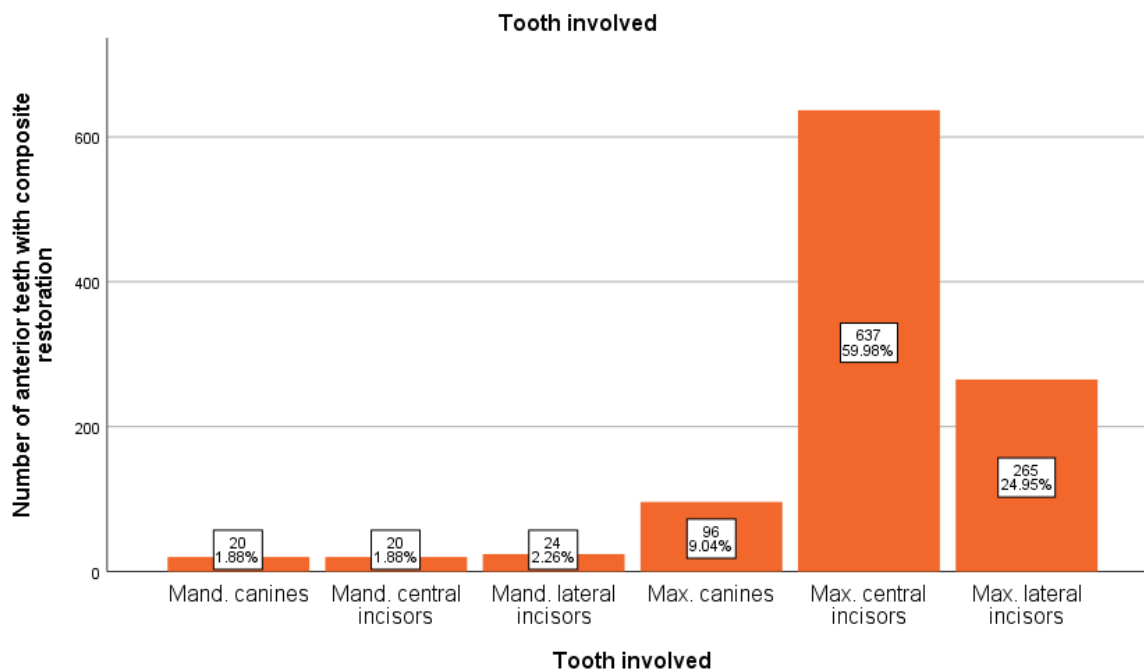


Figure 2. Bar chart depicts the number of anterior teeth with composite restoration and tooth involved. X-axis represents the tooth involved and Y-axis represents the number of anterior teeth with composite restoration. Composite restoration was more in maxillary central incisors compared to other teeth involved.

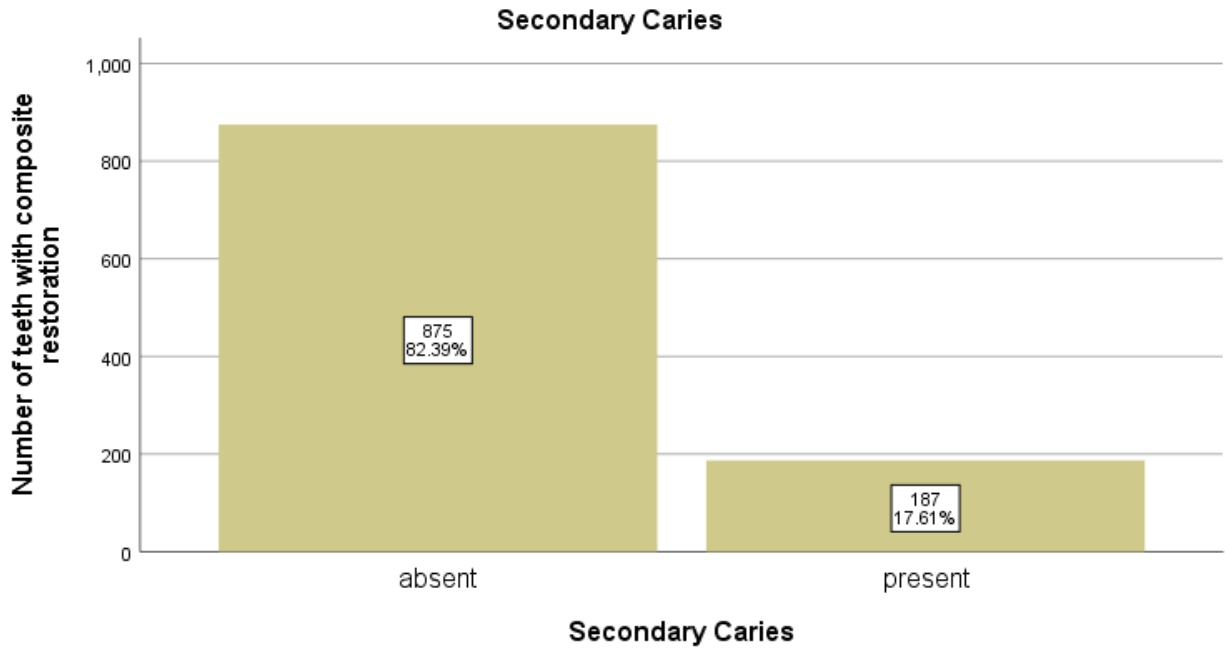


Figure 3. Bar chart depicts the number of anterior teeth with composite restoration and presence of secondary caries. X-axis represents presence of secondary caries and Y-axis represents the number of anterior teeth with composite restoration. The number of cases with secondary caries is comparatively low.

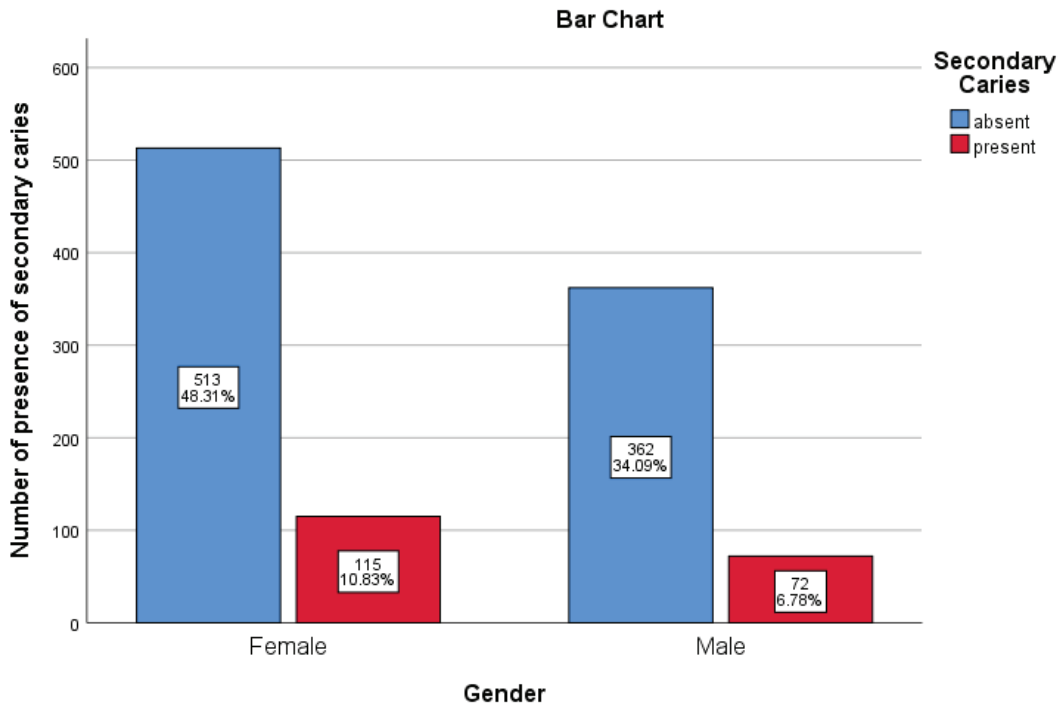


Figure 4. Bar chart depicts the association between the presence of secondary caries and gender. X-axis represents gender and Y-axis represents the presence of secondary caries (presence- red, absence- blue). Out of 187 teeth with secondary caries, 115 were females and 72 were males. Pearson chi-square value- 0.525, p value- 0.469 ($p > 0.05$), hence, not significant. Secondary caries were observed more in females compared to males but the results were statistically not significant.

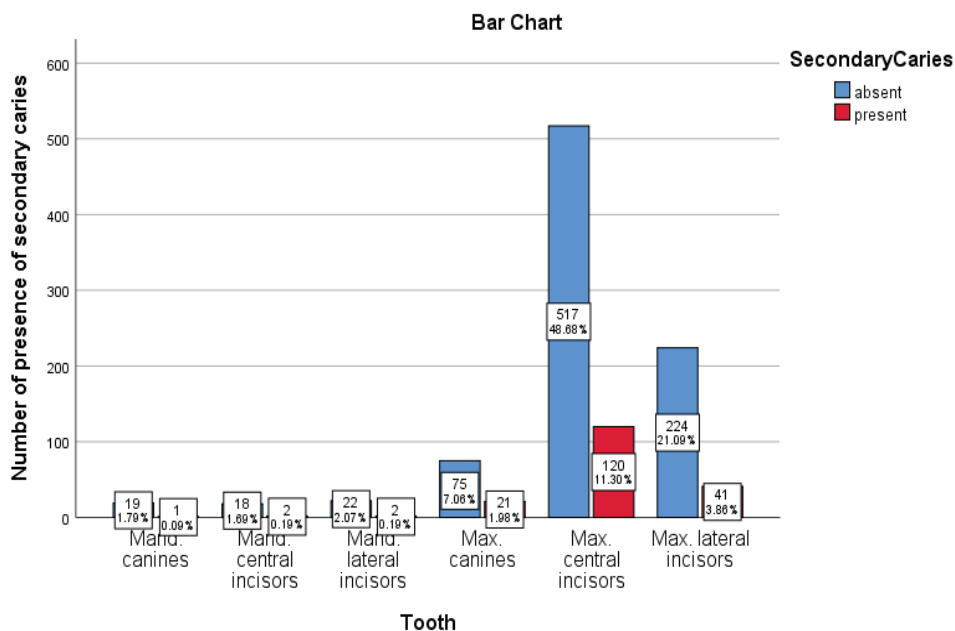


Figure 5. Bar chart depicts the association between the presence of secondary caries and tooth involvement. X-axis represents the tooth involved and Y-axis represents the presence of secondary caries (presence- red, absence- blue). Presence of secondary caries were more common in maxillary central incisors. Pearson chi-square value- 7.115 , p value-0.212 ($p > 0.05$), hence, not significant. Maxillary central incisors demonstrated the highest presence of secondary caries but the results were statistically not significant

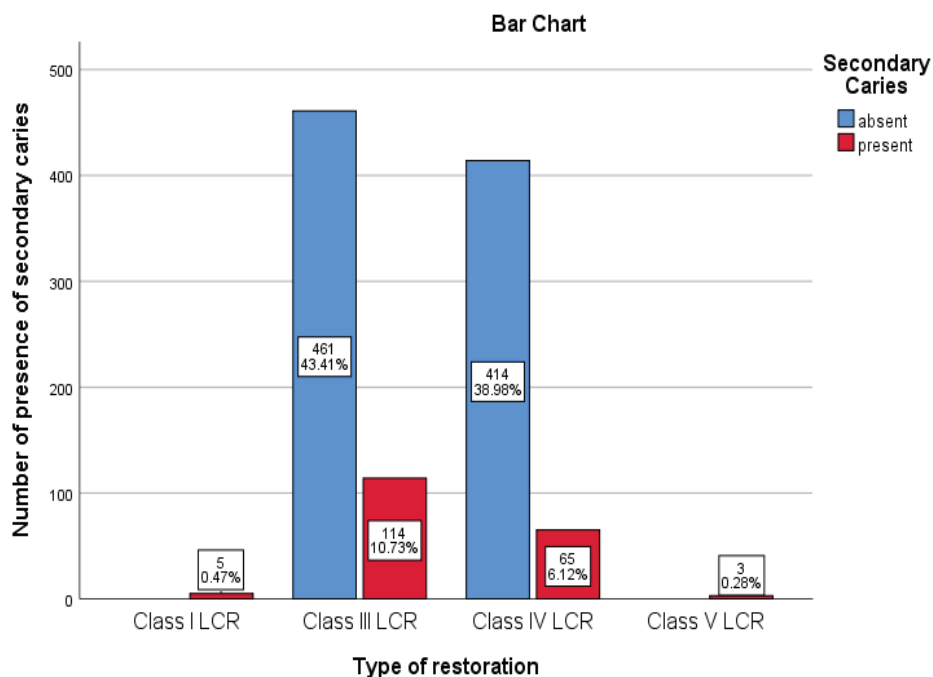


Figure 6. Bar chart depicts the association between the presence of secondary caries and type of restoration. X-axis represents the type of restoration and Y-axis represents the presence of secondary caries (presence- red, absence- blue). Presence of secondary caries were more in class III restorations followed by class IV, class I and class V restorations. Pearson chi-square , p value- 0.000 ($p < 0.05$), hence, statistically significant. Class III restorations demonstrated higher presence of secondary caries than other types of restoration and the results were statistically significant.

Conclusion

Within the limits of this study, it was observed that less number of composite filled anterior teeth had secondary caries and females presented with more number of anterior composite restoration with secondary caries compared to males. Class III restorations demonstrated higher presence of secondary caries than other types of restoration.

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