

# Investigating Contemporary Dental Practice In Restorative Dentistry And Dentists-Related Factors In Placing And Replacing Restorations In Kurdistan, Iraq

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## Abstract:

**Aim:** to assess if there is any relationship in dental practice between direct restoration placement or replacement to the dentist's gender and experience. **Method:** a cross-sectional study included two hundred general practitioner dentists whose experiences from 1-20 years were divided into two groups (1-10 and 11-20 years). The participants were instructed to collect data about the number of placed and replaced restorations, the reason for placement, and the type of materials from patients aged 14- > 60. The Pearson Chi-Square test (with continuity correction and Fisher's exact test, if necessary). It was considered that a P-value less than  $\leq 0.05$  was significant. **Results:** Both male and female dentists placed restorations more than they replaced and the difference between placement and replacement was statistically significant ( $P = 0.000$ ). Clinicians with professional experience between 1-10 years performed more restoration replacement than the older group and this difference showed statistical significance ( $P = 0.000$ ). Secondary caries was the most diagnosed reason for replacement by both male and female clinicians. Significant differences between secondary caries and other causes ( $P = 0.000$ ). **Conclusion:** Accuracy is required in diagnosing defects in previously performed fillings and whether they are worth replacing or not, as well as motivating dentists to follow minimally invasive dentistry.

**Keywords:** Practice-Based Research; Restorations; Replacement; Amalgam; Composite.

## 1. Introduction

When considering the replacement of restorations, numerous subjective factors may influence the decision-making process. Some of the factors that contribute to the evaluation of failure in dental restorations include the criterion used, the patient's preferences, and the dentist's approach to the current state of the restoration. The percentage of replacement restorations has increased and continues to represent over half of all restorations placed [1]. Dentists are frequently inclined to replace rather than repair dental restorations. Secondary caries was identified as the primary cause for the majority of instances requiring restoration replacement or repair. The determination to either replace or repair was influenced by various factors relating to the patient, dentist, and restoration [2]. There is a limited number of researches about dentist-related factors in the context of restoration replacement, as evidenced by a limited number of studies. Nevertheless, the extant literature offers valuable guidance for dentists to adhere to in their approach to replacing restorations [3]. Numerous studies have assessed the impact of a dentist's level of experience on the outcomes of restorative procedures. The choices made by dentists were influenced by two factors: the amount of time that had passed since their graduation and the level of specialization they had achieved [4,5]. Secondary caries was diagnosed as a cause of replacement by female dentists compared to their male counterparts [6]. A study determined that a significant proportion of dentists exhibited a lack of conservatism during recall visits when assessing previously placed restorations [2]. Bashi in 2013 [6] found that 64% of class II composite

restorations were replaced due to secondary caries. Perhaps the most important of the disadvantages of composite restorations is that it is technique-sensitive. Factors such as saliva and gingival crevicular fluid make isolation particularly difficult in composite restorations extending to the gingival region. In addition, it has been noted that, especially in deep class II restorations, the inability to see the gingival base after placement of the first layer, lack of polymerization, the inadequacy of adaptation, and void formation, leads to an increased risk of plaque accumulation and formation of secondary lesions in this region [7]. This study aimed to investigate the factors of age and experience of Iraqi dentists in placing and replacing dental restorations.

## **2. Methodology**

### **2.1 Study Design**

The authors contacted general practitioner dentists who worked in their private clinics in Erbil City to ask them about the possibility of participating in collecting data during their daily work in their clinics. Of those clinicians, 200 (100 females and 100 males) dentists were accepted to participate. The research started after getting the approval of the ethics committee at the university (meeting No. 1, decree No. 9 on August 21st, 2023). All experiments of this manuscript were done with the Declaration of Helsinki and all the processes were carried out with adequate understanding and written consent of the subjects.

### **2.2 Study Settings**

This study was practice-based, each participant dentist collected data from his/her patients during routine dental practice. At the beginning of the study, the authors contacted the volunteer dentists and visited them in their dental centers. In the clinics, the authors made presentations about the study plan and the way to collect the data. Each clinician gave case sheets to register the age, gender, tooth number; initially placed or replaced direct restoration, and the reason for placement for each tooth. In addition, the years of experience of the dentists. For standardization and calibration, the clinician provided photographs taken from the internet of teeth with failure fillings, which need replacement for various reasons. The authors answered all the clinicians' questions regarding data collection.

### **2.3 Participants**

The clinicians' number was 200 dentists all were general practitioners. The period for collecting data was two months but it was extended to five months to give more time to the clinicians to collect enough data. The data were collected from 4111 patients. The ages of the patients were 14 – 60 years who had complete permanent dentition. The clinicians' experiences were from 1-20 years divided into two groups 1-10 and 11-20 years of experience.

### **2.4 Data Collection**

The data collected by the clinicians were collected from anterior and posterior vital teeth. The clinicians were instructed to collect all the information about the causes of replacing the restorations such as secondary caries (S.C), marginal discoloration (M.D), bodily discoloration of anterior restoration (B.D.A), bodily discoloration of posterior teeth (B.D.P), marginal fracture (M.F), loss of restoration (L.R), tooth fracture (T.F), anatomic form (A.F), pain/sensitivity (P/S), and material change (M.C).

### **2.5 Statistical Analysis**

The data were collected in Microsoft Excel and SPSS Windows software (SPSS 20.00 Inc., Chicago, IL, USA) software for Windows was used to evaluate the findings. The Pearson Chi-Square test (with continuity correction and Fisher's exact test, if necessary) and cross tabulation were used to assess

reasons for restoration placement and replacement, restorative material selection, teeth groups in which restorations were placed, and factors such as those related to clinician gender and experience and material selection. It was considered that a P-value less than 0.05 was significant.

### 3. Results

#### 3.1 Distribution of Restoration Placement And Replacement According To Gender

The distribution of restorations performed according to clinicians' gender is given in Figure (1). Both male and female dentists placed restorations more than they replaced restorations, and this difference was statistically significant ( $P = 0.000$ ) at ( $P < 0.05$ ). The placement was performed more in male than female dentists (87.8%, and 86.2% respectively). In contrast, replacement was more by females (females 13.8 and males 12.2%). The difference was non-significant in both placement and replacement.



Figure 1: The distribution of restorations performed according to clinicians' gender

#### 3.2 Restoration Replacement According To Clinicians' Gender

Table (1) shows the percentage distribution of the causes of restoration replacement as indicated by male and female clinicians. Secondary caries was the most diagnosed reason for replacement by both male and female clinicians and the rate of diagnosis by male and female clinicians was 31.7% and 33.9%, respectively. This difference was significant for both male and female clinicians compared to other reasons for replacement ( $P = 0.000$ ). Although the general difference between male and female clinicians was statistically significant in terms of the reason for restoration replacement, there was no significance in terms of diagnosing secondary caries ( $P < 0.05$ ).

Table 1: the percentage distribution of causes of restoration replacement as indicated by male and female clinicians

Clinician's Gender	Reason for replacement (%)										
	S.C	M.D	B.D.A	M.F	B.D.P	L. R.	T.F	A.F.D	P/S	M.C	Other
Male	31.7 <sup>a,A</sup>	1.6 <sup>b, A</sup>	9.9 <sup>d,A</sup>	10 <sup>d,A</sup>	8.3 <sup>c,A</sup>	8.6 <sup>c,A</sup>	3.8 <sup>b, A</sup>	8.2 <sup>c</sup>	10.3 <sup>d,A</sup>	6.1 <sup>c</sup>	1.5
Female	33.9 <sup>a,A</sup>	1.4 <sup>b,A</sup>	10.5 <sup>b,A</sup>	9.6 <sup>b,A</sup>	7.5 <sup>b,A</sup>	10 <sup>b,A</sup>	6.6 <sup>b,A</sup>	6.4 <sup>b</sup>	6.3 <sup>b,B</sup>	6.3 <sup>b</sup>	1.5
Average	32.8	1.5	10.2	9.8	7.9	9.3	5.2	7.3	8.3	6.2	1.5

Pearson's Chi Square test  $P = 0.003$ . Different small letters in superscript indicate statistical differences between marked groups in the same row. Different capital letters in superscript indicate statistical differences between marked groups in the same column.

### 3.3 Clinician's Gender And Choice of Restorative Material

The effect of the clinician's gender on the choice of restorative material in the posterior region is given in Table (2). Both men and women preferred composites significantly. However, there were no statistically significant differences ( $P = 0.128$ ) in the choice of restorative materials between male and female clinicians. However, within the same gender, the choice of composite more than amalgam was significantly different.

Table 2: The choice of restorative materials in the posterior region based on the clinician's gender.

		Restorative Material (%)			Total%
		Amalgam	Composite	GIC	
Clinician's Gender	Male	16.7 <sup>a,A</sup>	77.6 <sup>b, A</sup>	5.7	100
	Female	12.3 <sup>a, A</sup>	81.4 <sup>b, A</sup>	6.3	100
Average		15	79	6	100

Different small letters in superscript indicate statistical differences between marked groups in the same row. Different capital letters in superscript indicate statistical differences between marked groups in the same column.

### 3.4 Restorative Treatments and Choice of Restorative Material Based on Clinicians' Experiences

Restoration replacement-placement rates based on clinicians' experiences are shown in Table (3). Clinicians with professional experience between 1-10 years performed more restoration replacement than the ones with 11-20 years and this difference showed statistical significance ( $P = 0.000$ ). The choice of restorative material depending on the clinician's experience is shown in Table (5). Composite resins were the most preferred restorative material in posterior teeth ( $P = 0.000$ ). In posterior teeth, it was seen that the clinicians whose experiences ranged from 11-20 years opted for amalgam more frequently. The differences in the choice of restorative material according to clinician experience were significant ( $P = 0.000$ ).

Table 3: Restoration replacement-placement rates based on clinicians' experiences.

		Restorative treatment %		Restorative Material %		
		Initial restoration	Replacement	Amalgam	composite	GIC
Clinician's experience (years)	1-10	82.8 <sup>a, A</sup>	17.2 <sup>b, B</sup>	9.6 <sup>a, B</sup>	85.3 <sup>b, A</sup>	5.1
	11-20	90.2 <sup>a, A</sup>	9.8 <sup>b, C</sup>	19.4 <sup>a, B</sup>	73.7 <sup>b, A</sup>	6.9
Average		87	13	15	79	6

Different letters in superscript indicate statistical differences between marked groups in the same row. Different capital letters in superscript indicate statistical differences between marked groups in the same column.

### 3.5 Variation of Causes of Restoration Replacement Due To Clinician's Experience.

The variation of causes of restoration replacement due to the clinician's experience is shown in Table (4). Secondary caries was the most frequently identified reason for restoration replacement in both groups ( $P = 0.000$ ). After secondary caries, the most frequently diagnosed reason for replacement was marginal fracture by clinicians with 1-10 years of experience and restoration losses by clinicians with 11-20 years of experience. The overall difference between the groups was statistically significant ( $P = 0.001$ ). When detailed analysis was performed, the percentage differences between the two groups in terms of marginal discoloration, marginal fracture, pain and sensitivity, and bodily discoloration posterior teeth were not significant ( $P < 0.05$ ).

Table 4: Variation of causes of restoration replacement due to clinician's experience.

		Reason for replacement (%)											
		S.C	M.D	B.D.A	M.F	B.D.P	L.R.	T.F	A.F.D	P/S	M.C	Other	Total%
Clinician's experience	1-10	38 <sup>a, A</sup>	1.9 <sup>b, A</sup>	7.2 <sup>c, A</sup>	10.4 <sup>c, A</sup>	8.1 <sup>c, A</sup>	7.1 <sup>c, A</sup>	9.2 <sup>c, A</sup>	6.2 <sup>c</sup>	8.5 <sup>c, A</sup>	2.4 <sup>b, A</sup>	1 <sup>b, A</sup>	100
	11-20	27.6 <sup>a, B</sup>	1.1 <sup>b, A</sup>	13.2 <sup>c, B</sup>	9.2 <sup>d, A</sup>	7.7 <sup>d, A</sup>	11.5 <sup>c, B</sup>	1.2 <sup>b, B</sup>	8.4 <sup>d</sup>	8.1 <sup>d, A</sup>	10 <sup>d, B</sup>	2 <sup>b, B</sup>	100
Average (%)		32.8	1.5	10.2	9.8	7.9	9.3	5.2	7.3	8.3	6.2	1.5	100

Different small letters in superscript indicate statistical differences between marked groups in the same row ( $P = 0.000$ ). Different capital letters in superscript indicate statistical differences between marked groups in the same column ( $p < 0.05$ ).

#### 4. Discussion

Numerous prior studies investigated the potential impact of various factors, including the age, experience, gender, and organizational affiliation of clinicians, on their routine restorative preparation [8,9]. Limited research had been conducted in the region of Kurdistan, Iraq, regarding the various factors influencing dentists' decision-making processes in the placement and replacement of dental restorations [10,11]. Nevertheless, there is a scarcity of research studies examining this particular matter.

The present study was practice-based, conducted in Erbil City Northern Iraq, it was observed that the rates of restoration replacement were found to be low in the routine clinical practice of clinicians, irrespective of their gender. A study conducted in Sweden found no discernible disparity in restorative treatment practices between clinicians of different genders [12]. The percentage of replacement restorations has increased and continues to represent over half of all restorations placed. For the restoration of posterior teeth, composite is more often used than amalgam, with the exception of typically developing nations and current trends pointing to a rise in the use of resin composites [1].

A study conducted in Turkey [6] observed a higher frequency of secondary caries diagnosis among female dentists compared to their male counterparts. The statistical analysis conducted in this study did not reveal a significant difference between female and male dentists in their ability to diagnose secondary caries. However, the current study found no discernible distinction between male and female dentists concerning their ability to diagnose the factors necessitating the replacement of restorations. According to the reviewed literature, posterior composite restorations had a long survival rate when patient, operator, and material considerations were considered during restoration procedures [13]. The degree of oral hygiene, a patient's risk of developing caries, the potential for secondary caries development, and the need for restoration replacement all work together [14]. Previous studies have noted that less experienced clinicians exhibited a higher rate of restoration replacement due to secondary caries when compared to their more experienced counterparts [15]. A study by Bashi [6] found that 64% of class II composite restorations were replaced due to secondary caries. In the current study, this rate was lower (33.1%). Perhaps the most important of the disadvantages of composite restorations is that it is technique-sensitive. Factors such as saliva and gingival crevicular fluid make isolation particularly difficult in composite restorations. In addition, it has been noted that, especially in deep class II restorations, the inability to see the gingival base after placement of the first layer, lack of polymerization, the inadequacy of adaptation, and void formation, leads to an increased risk of plaque accumulation and formation of secondary lesions in this region [8].

The ability to differentiate between secondary carious lesions and marginal discolorations is enhanced by experienced clinicians. When it is clinically feasible, it is recommended to repair failed restorations due to their expediency and ability to minimize patient anxiety [16]. Five variables exhibited significant importance in relation to the endpoint of replacement or repair of resin composite restorations. These variables included the age of the patient, the age of the operator, the jaw involved, the type of tooth, and the size of the cavity [9]. This situation has been elucidated by researchers who posit that young dentists may opt to replace previously placed restorations due to their perception of imperfections [17]. The replacement of composite and amalgam occurred for several causes such as secondary caries. Amalgam outlasted composite and had a lower chance of acquiring secondary caries [18].

Several cross-sectional and questionnaire studies have demonstrated the influence of the dentist's gender on the selection of restorative material. According to Alsughair (2012) a research conducted in Saudi Arabia, male dentists exhibit a lower frequency of amalgam usage compared to their female counterparts, as it appears that female patients tend to find amalgam aesthetically unappealing [19].

The results of our study indicate that there is a preference among female dentists for using composites in the posterior region, as compared to their male counterparts. However, it is important to note that this observed difference did not reach statistical significance. A study conducted in Copenhagen examined the durability of resin composite restorations over an eight-year follow-up period. The findings indicated that these restorations were found to be durable, and dentists expressed a preference for their use in dental practice as a replacement for existing restorations [7]. However, the substitution of composite and amalgam materials took place due to distinct factors. Al-Asmar (2023) summarized that amalgam demonstrated superior longevity compared to composite and exhibited a reduced susceptibility to the development of secondary caries [18]. In a study conducted in the USA, it was reported that the choice of restorative material is influenced by the clinician's gender, working sector, and clinician's experience [20]. In this study, it was found that male and experienced dentists preferred amalgam more than female and younger clinicians the relationship in material selections was significant.

In contrast, the results of our study indicated that dentists with less than 10 years of experience performed a higher number of restoration replacements compared to their counterparts with over 10 years of experience. The advancements in adhesive techniques over the past decade, coupled with the adoption of minimally invasive approaches in restorative dentistry and effective restoration repair methods, may account for the relatively low rates of restoration replacement observed among younger dentists. It was determined that a significant proportion of dentists exhibited a lack of conservatism during recall visits when assessing previously placed restorations, regardless of the specific failure type, number of surfaces involved, or the material utilized. However, a substantial majority of these restorations were observed in molars [2].

Studies assessing the impact of a clinician's age or professional experience on material selection have yielded inconsistent findings. According to existing literature, there is evidence to suggest that young dentists may tend to refrain from utilizing amalgam due to their concerns regarding environmental and health-related implications. Despite the absence of empirical evidence supporting this notion, a survey carried out in the Baltic States revealed that clinicians below the age of 40 perceived amalgam as a substance associated with various adverse effects [21]. The gender of the clinician, the sector in which they work, and their level of experience had an impact on the selection of the restoration. The male clinicians significantly chose more amalgam compared to their female counterparts and the older clinicians chose amalgam more than the younger counterparts significantly [16]. The current investigation yielded comparable results, indicating a preference among dentists with 1-10 years of experience for resin composites over amalgam.

The trend in dental restoration is repair rather than replacement. The newly graduated dentist should know about restoration repair. Composite repair rather than replacement should be included in undergraduate study. To enhance the understanding and proficiency in composite restoration repair, it is recommended that dental curricula include clinical training components [22]. Nearly 40% of dentists include repair of composite restorations in their daily practice, while the remaining 59 % lacked the knowledge of repairing restorations. The majority of dentists (82.1%), did not receive any previous repair training during their undergraduate education for that reason these individuals met a shortage in an optimal principle for substitution or repair. Therefore, it is imperious to start and adhere to precise standards and guidelines for replacement and repair in the realm of post-graduate education [23].

The Academy of Operative Dentistry put guidelines for the importance of monitoring restoration, or repair as the preferred method for managing a defective restoration, as it is the least invasive approach. When all the measures of monitoring and repair fail then it is necessary to consider the option of substitution. Evidence-based practice principles should be taken into consideration when dealing with



defective restoration. The dentist should utilize his clinical expertise effectively and consider the perspectives and preferences of the patient. It may be necessary to educate the patient about the advantages of repair as an alternative to replacing defective restorations [24]. In a study in Norway, the authors recommended repair over replacement as a measure of minimally invasive dentistry [3]. This viewpoint has gained acceptance and is being taught in numerous academic institutions, although further empirical investigations are warranted to validate its efficacy in practical settings. The implementation of repairs is a viable strategy for enhancing the longevity of restorations, as repaired restorations demonstrate comparable durability to their replacement counterparts [25]. Limitations of the study, are that it relies on the opinion of the dentist and not controlled clinical trials dose not provide scientific accuracy just as experimental studies.

## 5. Conclusion

The greater the level of experience possessed by dentists, the more proficient they become in diagnosing the underlying causes necessitating dental replacements. Both genders and various age groups exhibit a preference for composite as a restorative material. However, the replacement of the defective filling by amalgam was more common in older age group dentists. accuracy is required in diagnosing defects in previously performed fillings and whether they are worth replacing or not, as well as motivating dentists to follow minimally invasive dentistry.

## 6. Author's Contribution:

*We confirm that all named authors have read and approved the manuscript. We also confirm that each author has the same contribution to the paper.*

## 7. Conflict of Interest:

*There is no conflict of interest in this paper.*

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