



Full Length Research Article

PLACEMENT AND REASONS FOR FAILURE OF AMALGAM VERSUS COMPOSITE POSTERIOR RESTORATIONS FOR PATIENT ATTENDING TO DENTAL SCHOOL

***Ranjdar Mahmood Talabani**

Department of Conservative Dentistry School of Dentistry, Faculty of Medical Sciences, University of Sulaimani (Kurdistan Region, Iraq)

ARTICLE INFO

Article History:

Received 22nd April, 2015
Received in revised form
18th May, 2015
Accepted 21st June, 2015
Published online 30th July, 2015

Key words:

Posterior Restoration,
Amalgam,
Resin composite,
Failed restoration,
Secondary caries.

ABSTRACT

Objective: The aim of this study is to assess the prevalence of distribution of posterior amalgam and composite restoration and to register various reasons for replacement or repair of amalgam or composite restorations of patients visiting a dental school.

Materials and Methods: A cross sectional study on 635 patients aged 17 years and above, visiting School of Dentistry, Faculty of Medical Sciences/University of Sulaimani was carried out over a period of 6 months. These patients were examined clinically and radiographically to determine the choice of direct amalgam and composite restorative material for restorations of teeth and to find out the reasons of the failed amalgam or composite restorations which needed replacement or repair.

Results: The results of the present study revealed that the sample group comprised of 334 males and 301 females, it was concluded that the Amalgam (65.52%) was the most frequently used restorative material. This was followed by resin composite (34.48%). Seven reasons were found responsible for replacement or repair of restorations; Secondary caries was the most prevalent reason for replacement or repair of both amalgam (32.54%) and composite (54.7%).

Conclusion: It was concluded that amalgam was the most chosen direct restorative material and the majority of restorations were placed in class I and II preparations in lower molar. Secondary caries was the most common reason for repairing or replacing existing restorations.

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INTRODUCTION

Over 100 years, dental amalgam was considered one of the best choice for restoring primary and permanent dentition while now a days after improvement in physical, chemical and mechanical properties of tooth-colored filling materials given dentists the opportunity to place more esthetic and durable resin-based restorations (Lee Pair *et al.*, 2004). Amalgam has been used successfully as a final restoration to replace tooth tissue in bulk in root-treated posterior teeth; however, this material does have disadvantages poor color, low initial strength, lack of inherent bond to tooth structure, less conservative cavity preparation compared with other direct tooth colored restorative materials and a high coefficient of thermal diffusivity. In addition, there has been much controversy regarding its alleged harmful effects on systemic health, although these effects have never been scientifically proven (Ferrier *et al.*, 2008). Evidence now exists in the dental literature to support the use of resin composite as a direct

restorative material in stress tooth bearing occlusal surface and occlusoproximal cavities (Routers *et al.*, 2005) (El-Mowafy *et al.*, 1994). When placed correctly, posterior resin composite restorations may be as serviceable as those using silver amalgams, compared with silver amalgam, resin composite has a more accepted esthetic appearance, more conservation during tooth preparation, which reduces the subsequent risk of tooth fracture, and reinforces the remaining tooth substance through adhesive properties, disadvantages of resin composites include greater technique sensitivity, time consuming during placement, polymerization shrinkage with less wear resistance and higher cost than silver amalgam (Lynch *et al.*, 2006). The newest posterior resin composites show reduced wear rate; however, the marginal adaptation of these restorations particularly in the proximal boxes, has remained unacceptable. Resin composite materials undergo a volumetric polymerization contraction of at least 2.0% which may result in gap formation. Such gaps can result in the passage of salivary fluids along the tooth restoration interface resulting in micro leakage with secondary caries formation which considered one of the drawbacks of using resin composite on posterior dentition (Basavanna *et al.*, 2012).

***Corresponding author: Ranjdar Mahmood Talabani,**
Department of Conservative Dentistry School of Dentistry, Faculty of
Medical Sciences, University of Sulaimani (Kurdistan Region, Iraq).

Surveys are simple and designed to cover large regions in a short period of time, perceptions of restorations have changed a lot over the years. Amalgam was promoted for a while till there were apprehensions on its toxicity and its ill effect on human body. Several studies hence, toxicity of amalgam still continues to be debated in the academic circles. There have been studies vouching for and against amalgam. Composite resins were overwhelmingly welcomed in this backdrop. After the initial euphoria it was realized that this new material demanded a different kind of protocol so, specific methods of tooth preparation and conditioning was proposed (Akbar *et al.*, 2015). Failure of a restoration may take many forms and may be due to major defects (such as fracture and loss of a portion of the supporting tooth or restoration) or may be due to minor defects such as marginal deficiencies, staining or micro leakage, and when a restoration has failed, but does not involve loss of restoration or tooth bulk, it is unlikely that the failure would be noticed by the patient unless there are symptoms or there is a visible aesthetic problem (Ijaimi *et al.*, 2015).

MATERIALS AND METHODS

A questionnaire was developed to elicit an overview concerning the use of amalgam and resin composite in the posterior dentition. This cross sectional study was carried out on 635 patients aged 17 years and above classified into 5 age groups (17-29) (30-39) (40-49) (50-59) and 60 years and above, who visited the dental school of faculty of Medical Science/University of Sulaimani. The dental restorations placed with the direct restorative materials amalgam and composite in permanent posterior teeth were included. All those patients having temporary fillings were excluded from the study. The demographic information like age and sex were recorded. Restoration class (according to GV Black classification) distribution between amalgam and composite according to arch, type of tooth with number of surface was examined and recorded on a case sheet form specially designed for this study.

We noted several tooth and restoration characteristics to further investigate their relationship with failure. These characteristics included the arch (maxillary or mandibular), the type of tooth (premolar or molar) and the number of restored surfaces (one, two, three and more than three surface). In this study the need either for replacement or repair of existing restoration of amalgam and composite depending on the conditions and extension of defects of the failed restorations for existing restoration were examined or assessed. These restorations were examined clinically and radio-graphically to find out the reasons of the failed amalgam and composite restorations which needed replacement while the teeth were still vital and restorable or need endodontic treatment. Examination was carried out on dental chair using examination instruments and other examination aids i.e. radiographs and thermal tests, after getting a thorough history of the patient. All defective restorations were radio-graphed to explore the defects (e.g. secondary caries, overhanging fillings) in hidden areas (i.e. proximal areas of the teeth and under the filling materials) so as to find the reasons for the replacement of restorations. The examination of patients involved the sequential assessment of all restorations for the

evidence of caries (secondary or recurrent), marginal ditching or degradation (ditched amalgam), dislodgement or debonding of the restorations, esthetic reasons for replacement of the restorations, pain or sensitivity, fracture of bulk of restorative materials, macro-leakage space and fracture of the tooth with any other reasons like need for endodontic treatment were recorded in a special Proforma. The data were entered and analyzed in statistical software (SPSS version 10) a computer based software program. The qualitative variable like sex, type of restorative material according to arch, type of tooth and restoration classes were presented as frequency and percentages between amalgam and composite restoration.

RESULTS

The sample population comprised of 334 males and 301 females (Fig. 1).

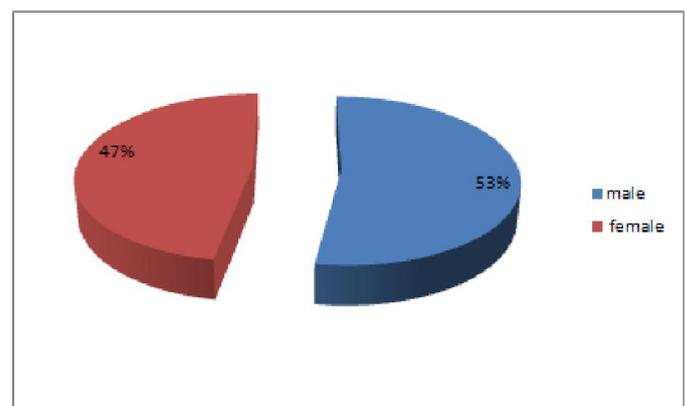


Fig. 1. Distribution of patients according to the gender

Sample Distribution according to age group was shown in (Fig. 2) in which the majority of the sample population fell in the age groups (17-29 years).



Fig. 2. Distribution of patients according to age group

Number of posterior restorations placed for each restorative material, by arch, tooth type and restoration characteristics shown in (Fig. 3) in which amalgam (65.52%) was the most frequently used restorative material followed by resin composite (34.48 %). Among (1897) restorations placed on the maxillary and mandibular arch, the number of amalgam placement for mandibular arch was 694 (36.58%) followed

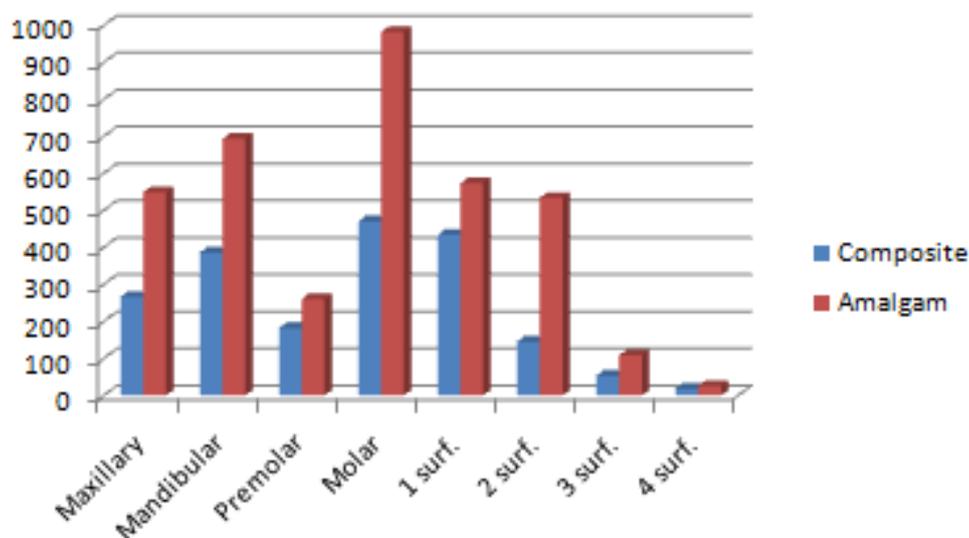


Fig. 3. Number of teeth restored with composite vs. amalgam in relation to dental arch, tooth types and number of surfaces

Table 1. Distribution of amalgam and composite restoration according to dental arch

Dental arch	Number of filled teeth (%)			Chi square	p-value
	Composite	Amalgam	Total		
Maxillary	267(14.08%)	549 (28.94%)	816 (43.02%)	X ² = 1.9522	P= 0.162351 (N.S)*
Mandibular	387 (20.4%)	694 (36.58%)	1081 (56.98%)		
Total	654 (34.48%)	1243 (65.52%)	1897 (100%)		

Table 2. Distribution of amalgam and composite restoration according to tooth type

Tooth type	Number of filled teeth (%)			Chi square	p-value
	Composite	Amalgam	Total		
Premolar	183 (9.65%)	261 (13.76%)	444 (23.41%)	X ² = 11.6596	P=0.000639 (H.S)*
Molar	471 (24.83%)	982 (51.76%)	1453 (76.59%)		
Total	654 (34.48%)	1243 (65.52%)	1897 (100%)		

Table 3. Distribution of amalgam and composite restoration according to tooth surface

No. of surfaces	Number of filled teeth (%)			Chi-square	P-value
	Composite	Amalgam	Total		
One surface	435 (22.93%)	574 (30.26%)	1009 (53.19%)	X ² = 85.553	P-Value is < 0.00001 (H.S)*
Two surfaces	146 (7.7%)	534 (28.15%)	680 (35.85%)		
Three surfaces	54 (2.85%)	109 (5.74%)	163 (8.59%)		
Four surfaces	19 (1%)	26 (1.37%)	45 (2.37%)		
Total	654 (34.48%)	1243 (65.52%)	1897 (100%)		

Table 4. Reasons for failure, by arch, tooth type and restoration characteristics due to amalgam restoration

Reasons for failures	Amalgam								Total
	Arch		Tooth type		Restored tooth surface				
	Upper	Lower	Premolar	Molar	One surface	Two surface	Three surface	Four surface	
Secondary caries	36	74	31	79	14	84	10	2	110 (32.54%)
Fracture	40	58	24	74	7	71	19	1	98 (29%)
Pain and sensitivity	11	10	4	17	10	5	6	0	21 (6.21%)
Aesthetic reason	37	24	15	46	43	14	3	1	61 (18.04%)
Microleakage	16	14	11	19	5	19	4	2	30 (8.88%)
Debonding	6	9	5	10	5	4	5	1	15 (4.44%)
Others	1	2	1	2	1	1	1	0	3 (0.89%)
Total	147	191	91	247	85	198	48	7	338 (100%)

Table 5. Reasons for failure, by arch, tooth type and restoration characteristics due to composite restoration

Reasons for failures	Composite Restoration								Total
	arch		Tooth type		Restored tooth surface				
	Upper	Lower	Premolar	Molar	One surface	Two surface	Three surface	Four surface	
Secondary caries	56	43	31	68	32	57	8	2	99 (54.7%)
Sensitivity and pain	11	44	17	38	7	29	11	8	55 (30.39%)
Fracture	7	8	4	11	8	1	4	2	15 (8.29%)
Aesthetic reason	0	0	0	0	0	0	0	0	0 (0%)
Microleakage	1	4	3	2	3	1	1	0	5 (2.76%)
Debonding	1	3	1	3	2	1	0	1	4 (2.2%)
Others	2	1	1	2	2	1	0	0	3 (1.66%)
Total	78	103	57	124	54	90	24	13	181 (100%)

by 549 (28.94%) amalgam placed on the maxillary arch then 387 (20.4%) composite placed on the mandibular arch and the number of composite placed on the maxillary arch was least and represent 267 (14.08) among total restorations placed on the upper and lower arch as shown in Table (1). Concerning the number of amalgam and composite restorations placed on the premolar and molar dentition, amalgam restoration placed on the molar represent most frequent type of restoration 982 (51.76%) and premolar restored with composite represent least frequent among restorations 183 (9.65%) as shown in Table (2) Amalgam restoration with only one surface cavity preparation were mainly recorded 574 (30.26%), followed by two surface restoration with amalgam 534 (28.15%) then one surface restored with composite restoration 435 (22.93%) and composite restoration with four surface cavity preparation represent the least 19 (1%) as shown in Table 3.

Among 1243 restored teeth with amalgam, 338 (27.19%) of them showed defective restoration and need replacement or repair. The most frequent reason for failure was due to secondary caries representing (32.54%) followed by fractured restoration (29%) and replacement of amalgam due to aesthetic reason (18.04%) as shown in Table (4). While among 654 restored teeth with composite, only 181 (27.68%) showing reasons for replacement or repair and the most frequent cause for failure was due to secondary caries which is present in 99 teeth representing 54.7% of total reasons for failure. The second frequent cause is pain and sensitivity representing 30.39% Table (5).

DISCUSSION

The purpose of the present study was to determine the frequency of placement of direct amalgam and composite posterior restoration and the reason for replacement or repair of the restorations among the patient attending to dental school in the University of Sulaimani. The performance of dental restorations is influenced by several factors, including the restorative materials used, the clinician's level of experience, the type of tooth, the tooth position in dental arch, the restoration design, the restoration size, the number of restored surfaces and the patient's age (Soares and Cavalheiro, 2010). Concerning the distribution of the placement of amalgam and composite restoration according to tooth type a molar receiving both amalgam restoration (51.74%) and composite (24.84%) nearly three times higher as compared to a bicuspid and this is come in harmony with other research which reported that most of the cases placed in molar were class I surface restoration (Lubisich *et al.*, 2011) (Pallesen *et al.*, 2013). Amalgam still predominated (Table 3) in this study for restoration of occlusal one surface (30.26%) and proximal posterior two surface cavities (28.15%), but was only used slightly more than resin composite in restoring of one surface cavity (22.93%). In marked contrast, amalgam is used three times more than resin composite in restoring posterior two surface cavities and the result of the present study agree with the other research done by (Tyas, 2005), (Ahmed *et al.*, 2012), (Terada *et al.*, 2014) and (Parolo *et al.*, 2011) and the reasons for not using composite materials in load bearing situations compared to amalgam are perceived poorer wear resistance than amalgam, perceived difficulties in manipulation, less good value for money for the patient, increased number of

symptoms with composite, more time-consuming placement, and perceived reduced longevity (Burke *et al.*, 2003). However, resin-based composite has replaced amalgam as the primary direct restorative material in posterior teeth in countries such as Sweden and Norway, since amalgam is no longer an available option. While in the other countries, most of the participating dentists still preferred amalgam in more challenging restorations with respect to caries activity, lesion depth, and tooth type (Laegreid *et al.*, 2014). While the result of this study disagree with study done by (Lubisich *et al.*, 2011) who observed that from all 1943 surveyed patients and among 42.8% of them who received treatment, only 18% of permanent teeth was treated with amalgam and 72% were treated with resin composite. Replacement of failed restorations is still the most common procedure in general dentistry, accounting for a larger proportion of restorative treatments in adults than primary caries, and represents enormous economic expenses each year (Pallesen *et al.*, 2013).

Concerning the effect of cavity type on the on longevity, in this study one surface restoration tended to show significantly better survival function restorations compared to other cavity types and its agree with study done by (Da Rosa Rodolpho *et al.*, 2006) while disagree with study done by (Kubo *et al.*, 2011) (Kubo *et al.*, 2011) and (Nikaido *et al.*, 2007) who indicated that though the sample sizes were small, Class II restorations tended to show better survival than Class I restorations. In the present study, the failed restorations presented with seven reasons for replacement or repair of restorations assessed were secondary caries, sensitivity or pain, fractured restoration, aesthetic reason, microleakage, debonding and others reason. Secondary caries was the most common cause for the failure of amalgam restoration by 32.54% which is nearly in accordance with international studies with different percentages. (Ali Shah *et al.*, 2010) (Gordan *et al.*, 2012) (Kim *et al.*, 2013) (Bernardo *et al.*, 2007) (Bahsi *et al.*, 2013) Posterior tooth fracture when amalgam was present accounted 29% and the result agrees with study done by (Tyas, 2005) which can be explained that it is clear the tooth fracture is a fatigue process and that it is commonest in teeth with amalgam restorations, so it may be that the longer an amalgam is present, the more likely tooth fracture becomes.

Interestingly, the degree of occlusal load did not affect the longevity of amalgam restorations, whereas it has an adverse effect on that of resin composite restorations. In the present study, secondary caries was the most common reason for replacing resin composite restorations 54.7% followed by presence of pain and sensitivity by 30.39%. This result agrees with the findings by several other studies. (Asghar *et al.*, 2010) and (Bahsi *et al.*, 2013) reported that the most common reason for replacement of composite restorations was secondary caries 52.3%, secondary caries is the main reason for the failure of amalgam and resin composite restorations in permanent teeth including class II restorations. (Deligeorgi *et al.*, 2001) observed that The principal reason for the replacement of restorations of amalgam and composite has consistently been found to be secondary caries, as diagnosed clinically, ranging from 25% to 67% for amalgam and from 20% to 44% for composite. Despite the many varied differences between the studies reviewed in terms of different circumstances, and not withstanding improvements in clinical

techniques and dental materials, secondary caries has remained the predominant reason for the replacement of restorations. The high incidence of secondary caries associated with the resin composite restorations may be explained on the basis of microbiological findings, significantly higher proportion of streptococcus mutans was found at the cavity margins of the resin composite restorations than for the other materials (Kirkevang *et al.*, 2009).

Conclusion

It was concluded that amalgam was the most chosen restorative material followed by resin composite and majority of restorations were placed in class I and II preparations in lower molar. Secondary caries was the most common cause for the failure of amalgam and composite restoration.

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