ORIGINAL ARTICLE

Survival and Causes of Failed Amalgam Restorations

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ABSTRACT:

Objective: To determine the reasons for failure of amalgam restorations and evaluate the association between the reasons for failure of restorations with gender, classes of cavities, and teeth involved.

Materials and Methods: This cross-sectional study was carried out in the Operative Department of Dental Section of Bahria University Medical and Dental College Karachi, from June 2013 to February 2014.Patients were selected randomly who had presented with complaint in amalgam restoration. Specially designed proformas were used to get the information such as the name of the patient, age, gender, teeth in need for replacement of restorations, age of the restorations and the reasons for failed restorations. The criteria for failed amalgam restorations were secondary caries, improper proximal contact, fractured restoration and gingival irritation due to overhang. Chi-square test was applied to get the significance of the result.

Results: A total of 141 patients with failed amalgam restorations were examined. The mean age was 40 (±16.18). In all 95 molar and 46 premolar teeth were observed. Secondary caries was leading reason for failure of amalgam restorations (44.68%), followed by gingival irritation due to overhang (17.02%), and margin fracture (12.05%). The mean of longevity of amalgam restoration was 5 years. Chi-square test showed significant association between causes of failure and duration of restorations, different classes of cavities (p-value <0.000) and insignificant relationship with gender (P-value < 0.67).

Conclusion: Secondary caries was the most common cause of failure of amalgam restoration in Class II cavities.

Key words: Amalgam, Secondary caries, Longevity of amalgam restoration, Fracture of restoration.

INTRODUCTION:

Dental hard tissue does not have the ability to repair, therefore structural loss requires replacement with restorative material such as Amalgam, Composite, and Glass ionomer cement.[1] 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's position in the dental arch, the restoration's design, the restoration's size, the number of restored surfaces and the patient's age.[2,3] Amalgam has a 160-year proven track record and its use has been controversial for the past 3 decades,[4,5] but it is still considered as dental restorative material of choice due to economical and easy manipulation.[6,7] Its uses vary worldwide.[8] It is less technique sensitive comparable to other restorative material, and can moderately tolerate presence of saliva.[9]

A restoration is considered a failure when it is incapable to perform as expected. Many survey have been performed to find out reasons of failure of amalgam restoration, the results vary by national contrast.[10] Replacement of restoration is time consuming and challenging.[11] It has been estimated that about 60% of the operative work comprises of replacement of faulty restorations.[12] Clinical studies have shown that recurrent caries and tooth fracture are the most common causes of amalgam failure.[13,14,15,16] Van Dyke also observed the presence of either secondary caries or fracture under every amalgam restoration.17 Dickerson reported the presence of caries in 40% cases of clinically well shaped and functional amalgam restorations.[18] Boston et al examined two margins of [17] extracted tooth microscopically, and observed 41% of the cases having caries.[19]

The aim of the present study was to determine the reasons for failure of amalgam restorations and assess its longevity.

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MATERIALS AND METHODS:

A total of one hundred and forty one patients of either gender with failed amalgam restorations were selected from the Department of Operative Dentistry of Bahria University Dental Hospital (BUDH) from May 2013 to Feb 2014. The duration of the restoration, which included the time since the restorations were placed, was noted down. This helped in calculating the time duration in which the restoration failed. The time durations were based on patients' history and gave the average time figures for the restorations. The inclusion criteria was patients 16 years and above, with complaint in amalgam restoration and who do not had any objection to participate in the study. Patients with limited mouth opening, had signs and symptoms of irreversible pulpitis or periapical infection under amalgam restoration were excluded. Proformas were designed to record information regarding age, gender, different classes of cavity, tooth involved, duration of placement and causes of failure. Each restoration was examined in dry field under dental unit light illumination by naked eyes using explorer and mouth mirror and cases suspected for secondary caries were confirmed by taking intra-oral radiograph. The data was collected and analyzed with SPSS software version 17. Mean and standard deviation for age was determined. Chi-square test was applied to establish the relationship between gender, class of cavity, duration of placement of amalgam restoration before failure, and

tooth involved with reasons of failure of restoration.

RESULTS:

A total of 141 patients with failed amalgam restorations were included in this study, 51.8% were male and 48.2% were female. The mean age of patients was 40.89 (±16.187) and mean age of amalgam restoration was found more than 5 years as shown in Table 1. There were 95 molar and 46 premolar teeth with failed amalgam restoration. The majority restorations were failed in Class II cavities (46.8%) followed by Class I (21.99%), MOD cavities (21.27%), and cuspal coverage (9.92%), as shown in Table 2.

Secondary caries was primary cause of failure of amalgam restorations accounting for 63 cases (44.68%). It was commonly observed in Class II restoration (41.27%) followed by Class I restorations (33.3%), and MOD restorations (22.2%). Gingival irritation due to overhang (24 cases) was second leading cause for failed amalgam restorations, and (79%) Class II restorations were affected.

12.05% restorations were failed because of margin fracture, it was also observed in Class II restorations (82.35%). while supplementary reasons for failed amalgam restoration include tooth fracture (13.47%), and food impaction (4.2%) figure 1 and Table 2. Amalgam restorations were more failed in molars due to secondary caries 40% and gingival irritation due to overhang 23.15%. Survival rate of restoration was more than 5 years in 56.73% cases.

All the data was based on patient's history. Cross tabulation between duration of restoration, classes of cavity and cause of failure showed significant association (p-value <0.000) Table 2.

Table 1
Mean age and Duration of placement

AGE	
Mean	40.89
Minimum	16
Maximum	79
Standard deviation	16.187
LONGEVITY	
Mean	5.0
Standard deviation	1.590

Figure 1
Causes of Failure

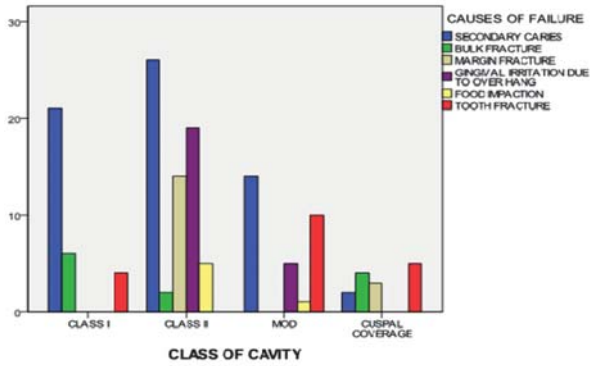

Table 2
Causes of failure of amalgam restoration in gender, class of cavity, duration of placement and tooth involved

	Secondary Caries	Bulk Fracture	Margin Fracture	Gingival irritation due to Overhang	Food Impaction	Tooth Fracture	Total	Chi-square test P-value
Gender								
Male	33	6	7	12	2	13	73	
Female	30	6	10	12	4	6	68	< 0.587
Total	63	12	17	24	6	19	141	
Class of cavity								
Class I	21	6	0	0	0	4	31	
Class II	26	2	14	19	5	0	66	
Mod cavities	14	0	0	5	1	10	30	<0.000
Cuspal coverage	2	4	3	0	0	5	14	
Total	63	12	17	24	6	19	141	
Duration								
six months or less	0	2	2	7	1	2	14	
1 year	0	0	1	0	1	0	2	
2 years	2	0	2	0	1	0	5	
3 years	8	0	1	1	1	1	12	<0.007
4 years	12	3	3	5	0	5	28	
5 years or more	41	7	8	11	2	11	80	
Total	63	12	17	24	6	19	141	
Tooth involve								
Molar	38	10	7	22	1	17	95	
Premolar	25	2	10	2	5	2	46	<0.000
Total	54	12	17	24	6	19	141	

DISCUSSION:

Amalgam is a restorative material especially suitable for class I and II restorations in teeth that encounter heavy masticatory forces. The advantages of amalgam restorations include resistance to wear, tolerance to a wide range of clinical placement conditions, and excellent load-bearing properties.

In the present study, secondary caries was the most dominant cause of failure of amalgam restoration (44.68%), followed by gingival irritation due to overhang (17.02%). A number of earlier studies also reported similar results that secondary caries was the most common reason for the failure of amalgam restorations [20,21,22,23] Jokstad and Mjor, in their study observed that the main reason for replacement of class II amalgam restorations was secondary caries.[24] Kidd et al, demonstrated that every functional restoration had a chance to fail within few years[20] Substantial data has been confirming the secondary caries as prime rationale for failed amalgam restoration. Bernardo et al, in a controlled clinical trial reported that secondary caries accounted for 66.7% of failures in amalgam restoration and 87.6% failure in composite restorations.[25] Gingival surface is more frequently involved in secondary caries because the gingival aspect of any restorations is more difficult to keep plaque free than any other surfaces, especially if it is located inter-proximally. Secondly, during the placement of restoration, the contamination by gingival fluid and saliva impairs the visualization of gingival floor and improper placement of restorative materials, leading to secondary caries more frequently.[26]

In few studies fracture was found more frequent than secondary caries.[27] Fracture of the tooth is more common in MOD restorations than any other cause of failure. Replacement or coverage of fracture-prone cusps may result in improved life expectancy of complex amalgam restorations. The incidence of cusp fractures was greater in endodontically-treated teeth with MOD amalgam[28]. The approximate median survival of amalgam restoration in different studies ranged from 5 to 15 years [22,23]. According to Norman and colleagues, larger restorations performed more poorly, regardless of material.[29] The median age calculated in this study was 6 years. Opdam et al, 21 reported survival rate for amalgam, was 89.6% at five years and 79.2% at 10 years. Both genders were equally affected in this study. Large studies have revealed that amalgam longevity is appreciably superior to composite resin longevity[30,31]. It is essential that there should be well established, wide-ranging, consistent and universally acceptable guiding principle, precise enough to help the dentist in taking clinical decisions[28]. In order to achieve more consistent results it would be advisable to evaluate greater number of teeth for longer period of time.

CONCLUSION:

The predominant causes of failed amalgam restorations were secondary caries, gingival irritation due to overhang and margin fracture. The longevity of restorations was more than 5 years. The incidence of secondary caries was higher in Class II followed by Class I cavities and greater in molar than premolar tooth.

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