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ORIGINAL ARTICLE

Evaluation and Treatment of Failed Amalgam Restorations at Ibadan, Nigeria

Evaluationet Traitement de Srestaurations à l'amalgameéchoué à Ibadan, au Nigeria

D. M. Ajayi[†], I. M. F. Abiodun-Solanke[†], A. O. Arigbede*[‡]

ABSTRACT

OBJECTIVE: **Failure of tooth restoration is a major clinical problem of interest to patients, dentists and employers of labour. This study was designed to find out the average life span of amalgam as well as causes and management of failed amalgam restorations at the dental center, University College Hospital, Ibadan. The distribution of new caries in patients with this condition was also investigated.**

MATERIALS AND METHODS: **This was an interventional study conducted among consenting patients who presented with failed amalgam restoration in our conservative clinic over a three-year period. Oral examination was conducted to detect primary caries and causes of failure of the restoration. Bitewing radiograph was taken where necessary. The following data were recorded: socio-demographic variables of the patients and their complaints; life span of the failed restorations and the treatment given. Summary statistics was generated.**

RESULTS: **One hundred and forty three patients (54 males, 89 females) presented with 198 defective restorations. Sixty five (45.5%) of these had 118 new carious lesions which were majorly occlusal cavities (66.9%). Fractured restoration was the commonest cause of failure. Management was variable, but replacement with amalgam was the commonest treatment. The average life span of restoration was 8.3years.**

CONCLUSION: **The average life span of amalgam restoration was 8.3years and the major cause of failure was amalgam fracture. Replacement with amalgam was the commonest treatment. WAJM 2013; 32(4): 248–253.**

Keywords: **Amalgam, failed, restoration, replacement.**

RÉSUMÉ

OBJECTIF: Échec dela restauration dentaireestun problème clinique majeurd'intérêt pourles patients, lesdentisteset les employeursde main-d'œuvre. Cetteétude a été conçuepour savoirla duréede vie moyennede l'amalgameainsi que les causeset la gestion desrestaurations à l'amalgameéchoué.La répartition desnouvellescarieschez les patientsatteints de cette maladie a également été étudiée.

MATÉRIEL ET MÉTHODES: Il s'agissait d'uneétude interventionnellemenée auprès depatientsconsentantsqui se sont présentésà la restaurationd'amalgameéchoué dans notrecliniqueconservatricesur une périodede trois ans.Examen orala été menée pourdétecterles cariesprimaireset les causes del'échecde la restauration.Bitewingradiographie a été prisele cas échéant. Les données suivantesont été enregistrées: variables socio-démographiques des patientset de leursplaintes;durée de viedes restaurationsont échouéet le traitementdonné.Les statistiques sommairesont été générées.

RÉSULTATS: Centquarante-troispatients (54hommes, 89 femmes)présentésavec 198restaurationsdéfectueuses. Soixante-cinq(45,5%)d'entre eux avaient118 nouvelleslésions carieusesqui étaientmajorlycavitésocclusales(66,9%). Restaurationfracturéeétait lacause la plus fréquentede l'échec.Gestionétait variable, mais le remplacementde l'amalgameétait le traitementplus fréquente. La durée de viemoyennede la restaurationétait8,3 années.

CONCLUSION: La durée devie moyenne d'amalgame était 8,3 annéesetla principale caused'échec étaitfracturede l'amalgame. Remplacementd'un amalgameétait le traitementplus fréquente. **WAJM 2013; 32(4): 248–253.**

Mots clés:amalgame, a échoué, la restauration, le remplacement.

[†]Departments of Restorative Dentistry, Faculty of Dentistry, College of Medicine, University of Ibadan, Oyo State, Nigeria [‡]Restorative Dentistry, Faculty of Dentistry, College of Health Sciences, University of Port Harcourt, Rivers State, Nigeria

**Correspondence:* Arigbede AO, Department of Restorative Dentistry, Faculty of Dentistry, College of Health Sciences, University of Port Harcourt, Rivers State, Nigeria. Email: arisabbey@gmail.com

Abbreviations:

INTRODUCTION

The two direct dental restorative materials most commonly used today are silver-mercury amalgam and resin-based composites.[1] Amalgam had long been established as the commonest material for dental restorations because of its ease of manipulation, superior mechanical properties, good clinical performance, durability and relative low cost.[2,3] In recent years, the use of resin-based composites for restoration of posterior permanent teeth has increased significantly due to its aesthetic properties and because of the general concerns associated with the appearance of metals in the mouth,[1] although they are more technique-sensitive to place and more costly.[1,4] The health concerns about amalgam is still an issue in some quarters; however, the American Dental Association Council on Scientific Affairs had concluded that both amalgam and resin-based compomer/composite materials are safe and effective for tooth restoration.[5,6] Despite the general mixed reaction in recent years over amalgam usage, its acceptability in Nigeria remains unaffected by political dissension ('the Amalgam wars') and challenges by comparable alternatives like resin base composites and Glass Ionomer Cement.[7,8]

It has been estimated that the replacement of failed restorations constitutes about 60 percent of all operative work.[1] The performance of dental restorations is influenced by several factors, including the restorative materials used, the clinician's level of experience, the tooth type, 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.[1,9] In determining the restorative material of choice, the dentist should consider the important factor of longevity, because replacement of failed restorations is a burden to patients, practitioners and health care systems.[5,10] The criteria that help the dentist to decide whether or not to replace amalgam restorations are subjective and since dentists often encounter amalgam restorations presenting with secondary or recurrent caries, open contacts, body fracture, marginal fractures, poor contour/anatomic form, overhangs, pulpal pathology and tooth fracture[2,11] management of failed restoration therefore remains an interesting restorative discourse.

Failure of dental restoration is a major clinical problem of interest to patients, dentists, and employers of labour. Replacing a failed restoration, does not guarantee that the same imperfections will not occur again, nor that new lesions and/or secondary caries will not affect the new restoration.[11,12] Also, in line with the philosophy of minimal intervention, repair of defective amalgam restoration is being advanced.[11,13] Many studies[1,2,8-12] had been conducted both within and outside Nigeria on the longevity of amalgam restoration and the causes of its failure but the issue of longevity and management of defective restorations remained in forefront of operative dentistry research. In addition, survey of new caries in patients with defective restorations was rare in the literature. This study was designed to find out the mean life span of amalgam restoration, causes of failure and pattern of management at the Dental Clinic, University College Hospital. The distribution of new (primary) caries in patients presenting with defective amalgam was also investigated.

SUBJECTS, MATERIALS AND METHODS

This study was an interventional study involving patients who presented in our Conservative clinic with failed) amalgam restorations over a three-year study period. Assessment of failure of amalgam was carried out according to Oginni and Olusile[2] as follows: bulk amalgam fracture, recurrent caries, marginal defect, complete dislodgement and tooth fracture. The criterion was however expanded to include cervical overhang of amalgam restorations. Ethical clearance approval with number UI/EC/12/0417 was obtained from the University College Hospital. The participants were recruited from among patients referred to the Conservation unit of the Department of Restorative Dentistry, University College Hospital (UCH), Ibadan. All consenting patients were taken through a set of questions including their socio-demographic characteristics, presenting complaints, life span of the failed amalgam restorations as well as any previous history of replacement of the same failed restoration.

The patients were evaluated in restorative dental clinic by two of the investigators who had been calibrated (with a percentage agreement score of 92%). Clinical examination was done using a plane mouth mirror and blunt sickle probe with the aid of a dental chair light. The sickle probe was used to remove debris, check restoration margins and detect primary and secondary cavitations. Secondary caries was said to be absent when there was no detectable penetration on probing with firm pressure and present when a similar amount of pressure resulted in entry into the dentine[2] Posterior bitewing radiographs were taken when secondary caries or interproximal caries was suspected using Primax Ultra-Speed E Size 2 films (Primax Berlin, GmBH, Germany) and intraoral mobile X-ray unit (Blue X Imaging, Italy). Adhesive tags were used to position the films on viewing box without any magnification. The clinical and radiographic data were employed to draw the treatment plan.

The clinical diagnostic criteria for dental caries include visually apparent cavitation, discolouration showing through enamel or visual evidence of recurrent caries. The distribution of primary caries was based on the revised GV Black's classification[14] which categorized cavities on the incisal edge of anterior teeth or cusp tips of posterior teeth as class V1. Teeth with new caries and failed restorations were charted. Causes of the failure and the treatment given were also recorded. The patients recruited into the study were those who were 16 years and above and who were willing to participate in the study while those excluded were the critically ill, those with acute oral infections or those who had limited mouth opening. Informed consent was obtained from all the patients.

DATAMANAGEMENT

The data obtained were entered into SPSS version 19 (SPSS Inc, Chicago

Illinois,USA) and analyzed. Descriptive statistics (frequency, means and standard deviations) was conducted and the results presented in tables and figures.

RESULTS

During the 3-year study period, a total of 143 patients with failed restoration were seen. Fifty-four of these patients were males (37.8%) and 89 (62.2%) were females. The age range of the patients was 17–70 years with a mean of 40.4±12.5 years (while the median age was 38 years). One hundred and ninety eight teeth with defective restorations were encountered. The main presenting symptom among the patients was pain (39.2%) while failed restoration was discovered during routine dental check in only 1 (0.7%) patient (Table1).

Table 1: Characteristics of Patients Presenting with Failed Amalgam Restorations

Gender (%)	
Male	54(37.8%)
Female	89(62.2%)
Age in years	
Mean (SD)	40.4±12.5
Range	17–70
Presenting Symptoms n (%)	
Pain	56(39.2)
Sensitivity	14 (9.8)
Hole in the tooth	22 (15.4)
Fractured or dislodged restoration	41 (28.7)
Routine check-up	1(0.7)
Reasons unrelated to the Amalgam Restorations e.g. cervical abrasions	9(6.3)

Majority (70.7%) of the restorations failed within 10 years of placement. Only 2% of the restorations exceeded 30 years and overall, the average duration of amalgam restorations among the study participants was 8.29±7.14 years (Table 2). Various factors were responsible for failure of the restorations among our patients, as shown in Fig 1. About one-third of the restorations failed due to fractured filling. This was followed by dislodged restoration (19.0%) and marginal breakdown (19.0%) which jointly occupied the second position. Recurrent/ secondary caries was seen in 13% of the teeth, while tooth fracture occurred in 12.1% cases. Multiple reasons (i.e combination of any two or three of the above) contributed to failure in only 5 teeth (3%).

Table 2: Duration of Amalgam Restorations in Years

Duration (years)	n	%
1 – 10	140	70.7
11 – 20	41	20.7
21 – 30	13	6.6
31 – 40	4	2.0
Total	**198**	**100.0**

Average duration = 8.29 ± 7.14 years.

Among the 143 patients presenting with failed amalgam restorations, 65 of them also had 118 new carious lesions developing on other teeth or entirely new surfaces. The distribution is shown in Table 3. Majority (66.9%) of the carious lesions was limited to the occlusal surfaces and the upper molars had the highest proportion (46.6%) of new carious lesions. Composite resin was the main material employed for the restoration of teeth with primary caries during the study period. The ratio of amalgam to composite restorations was approximately 1:10 (Fig 2). The distribution of the treatments administered to the patients was reported in Figure 3. Six teeth had to be extracted, 95(48%) cases had the filling replaced with amalgam while replacement with resin composite restorations was done in 38 cases.

Table 3: Posterior Teeth with Primary Caries in Patients with Failed Restorations

Class of Caries	Upper Premolars	Lower Premolars	Upper Molars	Lower Molars	Total
Occlusal caries	–	1	44	34	79
Mesioocclusal	6	2	6	2	16
Distoocclusal	4	2	4	5	15
Mesiodistoocclusal(MOD)	2	–	–	–	2
Root Caries	1	–	–	–	1
Cervical one-third caries (Black's class V)	1	–	–	2	3
Cuspal tip (class V1)	–	–	1	1	2
	14	**5**	**55**	**44**	**118**

Number of Patients (N)=65

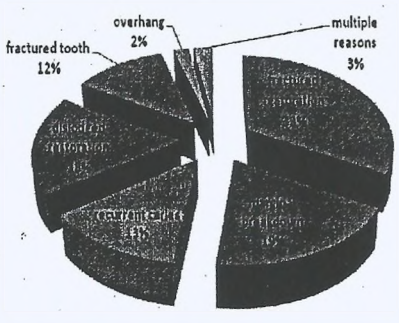

Fig 1: Reasons for Failure of Amalgam Restorations

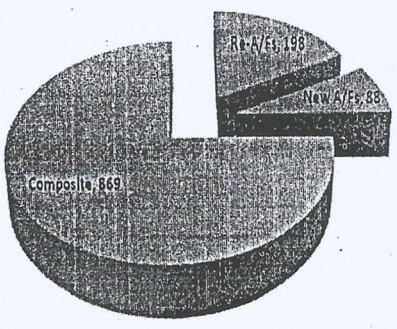

Fig 2: No of Basic Restorations Done During the Study Period

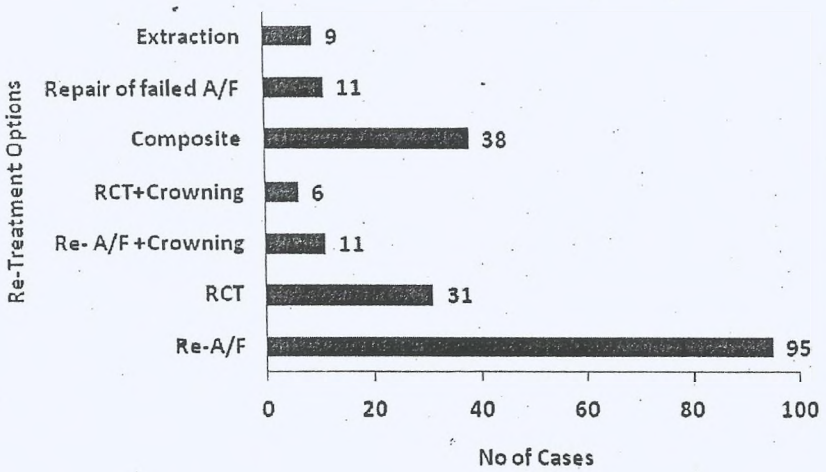

Fig 3: Treatment of Failed Amalgam Restorations

DISCUSSION

More females were encountered in this study compared to men with a female to male ratio of 1.6:1. A similar pattern was presented by Udoye and Okechi.[8]. It is not clear at the moment whether this trend was due to the fact that females tend to present more with caries,[14] be more concerned about their health and hence present more for oral health care,[15] be more in the general population[16] or whether it was a combination of the above. The ages of our patients range from 17–70 years. Patient's age is recognized as one of the factors that influence the overall performance of restorations.[5,10] Restorations placed early in life are at risk of being replaced repeatedly as predicted by the cycle of restoration[17] and the tooth may eventually be lost in the process.

Most of our patients presented with symptoms, the highest being the symptom of pain. Pulpal pathology and pain/dentinal sensitivity had been noted as major presenting features of failed restorations by previous authors.[2,8] Simecek *et al* (2009)[18] reported that major determinants for replacement of restoration among their patients were the presence of acute or chronic symptoms and restoration defects. When failure of restoration occurs, the dentine and the pulp are re-exposed to the same risks and insults they were exposed to prior to treatment, hence the complaints of dentinal sensitivity, pain and food accumulation in the cavity that reappears following a failed amalgam restoration.

Unlike previous years when posterior restorations were exclusively reserved for dental amalgam in our environment, it appears dental clinicians are beginning to embrace composite resins for the restoration of posterior teeth.[1,4] The ratio of composite to amalgam restorations in this study was 10:1. This was further demonstrated by the fact some fractured amalgam (4.9 %) restorations were replaced with resin composites as a result of dissatisfaction of the patients with the unesthetic appearance of amalgam on one hand and or anxiety over the safety of mercury on the other hand. Furthermore,in this study, 11 out of 198 (5.6%) teeth were repaired with composite thus corroborating the previous publication[1] on the increasing clinical application of resin composites in posterior teeth.The size of the cavity, tooth surface involved and the preference of the patients were some of the factors influencing choice of restorative material.

The mean life span of amalgam restoration in our study was 8.3 years. This was slightly higher than 7.5 years reported for molars and lower than 9 years reported for premolars by Udoye and Okechi.[8] Oginni and Olusile[2] like Friedl *et al*[19] reported an average life span of 5 years. The average life span of amalgam restorations reported in the literature appeared to vary from one environment to the other. Anprevious study by Golberg *et al,*[20] reported that 50% of amalgam restorations had to be replaced between 8 10 years. Fifteen-year life span presented by Forss and Widström[21] appeared to be one of the highest in the literature. When the reason for failure of the amalgam restorations were considered, fractured restoration constituted the predominant factor in our study unlike in most studies[22–26] where secondary caries was the predominant factor. McDaniel *et al*[27] in their own study reported tooth fracture as the major cause of restoration failure.

Our result on the treatment of failed amalgam restoration explicitly described the cycle of restoration as reported by Gordan *et al.*[17] Some of the failed restorations were simply replaced with amalgam or tooth coloured restorative material while others received a more extensive and advanced treatment as appropriate. Tooth mortality was inevitable in some cases (4.5 %) of failed restorations as shown in our results (fig 3). McDaniel *et al*[27] reported that among the cases of failed restorations that they encountered, 8.5% were non-restorable while in this study only4.5% were not restorable. Amalgam restorations had been found to perform better than composite restorations in terms of longevity; the difference in performance was accentuated in large restorations and in those with more than three surfaces involved.[1] In our environment where fractured restoration is particularly common, it is advisable that clinicians should be very conservative in the removal and replacement of old amalgam restorations.

When the distribution of the areas of tooth surfaces affected by new caries was analyzed, the occlusal surface was the mostly affected surface followed by the interproximal lesion. This finding corroborates previous report.[28] However, a reverse order was presented by Forss and Widström.[21] In the study by Kroeze *et al.*[28] mesio-occluso-distal lesion (MOD) was more than disto-occlusal (DO) and DO was more than mesio-occlusal (MO), but this was not the patternseen in our study as limited number of MOD cases was encountered and almost the same number of MO and DO were seen. It is a cause for concern

that a high proportion of patients with tooth restorations had new and active caries and majority of them did not come back for the management of the new carious lesion probably because they were not symptomatic. This is the pattern previously reported in this environment where people visit their dentists only when they experience pain or some other symptoms. It is important not to only focus on tooth restoration when new patients are seen particularly in a busy clinic, but rather emphasis shouldalso be placed on dietary, oral hygiene practices and routine oral health care visits. More upper posterior teeth were found carious in our study compare to the posterior teeth in the lower arch. This result was at variance with previous publications on this subject.[29,30]

CONCLUSION

The average life span of amalgam restoration in our centre was 8.3 years and the predominant cause of failure was amalgam fracture. The management of the cases was a clear reflection of the cycle of restoration. On the whole, one hundred and ninety-eight defective amalgam restorations and113 primary caries were found in the patients. Most of the caries were occlusal and they were found more in the upper arch.

RECOMMENDATION

In view of the fact that longevity of restorative treatments is a piece of relevant information for government, patients, and dentists as it relates to cost of dental restorations,[23] more efforts should be made to develop a widely acceptable treatment protocol for management of defective restoration.

CONFLICT OF INTEREST

The authors declared no conflict of interest.

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