

# Placement and Replacement of Amalgam and tooth colored restorations: A challenge for developing nations.

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## Abstract

The study investigated the usage of restorative materials in Nigeria, the reasons for the usage and the longevity of the used materials. A cross sectional study on 370 odd numbered attendees aged 18 years and above referred to the Restoration clinic for placement or replacement of 450 restorations was done by two experienced dentists over 9 months. While class II cavity was prepared most often, primary and secondary caries were responsible most often for placement and replacement, respectively. Furthermore, replacements due to secondary caries occurred most often in class II cavities, while amalgam was both the most durable and the most often used material. Public campaign against primary and secondary caries, with attention to the risk group is recommended.

## INTRODUCTION

Unlike most living things, hard tooth tissue lacks the ability to repair itself. A loss of a part may be of infective origin (caries), physical (trauma) or of chemical origin (erosion). To restore the tooth's form, contour or function, a restorative material, such as amalgam, resin based composite (RBC) or glass ionomer cement (GIC) is desired. These materials are used world over, though at varying levels (1).

World over, amalgam has been the most widely accepted restorative material over the past 160 years, based on its biomechanical properties, clinical characteristics, versatility and serviceability(2-4). 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 alternative (RBC) and GLC)(5-7). Currently, there is a shift from its use to tooth colored materials in some countries, due to concerns of mercury content and its non esthetic appearance(8). Nevertheless, amalgam has proved to last the longest relative to its alternatives, and it is less technique sensitive (8,9).

Placement and replacement of existing restorations account for a significant portion of the clinician's time, besides the economic challenges in a developing nation like Nigeria (10). In the posterior teeth, 13-14 years is the reported mean amalgam restoration's life span, whilst secondary caries is the commonest reasons for replacement (11).

Trever Burke (8) in his worldwide survey on restorative material usage reported that data on the subject are sparse in Africa. Udoe and Aguwa (6) in their survey on Nigerian dentists' amalgam attitude found that over 80% do not support amalgam ban, whilst over 84% would not even recommend an alternative. Considering the economic and man-hour implications of placement and replacement of restorations and the accompanying serviceability and longevity concerns in Nigeria, the following questions arise:

How long should amalgam, RBC or GIC restoration last?

What are the commonest reasons given for failure?

What are the potential causes for these failures?

The answers to these questions will be provided in the study. The purpose of the study was to investigate the usage of restorative materials in Nigeria, the reasons for usage and the longevity of these materials.

## MATERIALS AND METHODS

Three hundred and seventy odd numbered patients referred to the restorative clinic of the University Nigeria of Teaching Hospital (UNTH) for placement or replacement of 450 restorations over a 9 months period (October 2, 2007 to June 30, 2008) were recruited in the cross sectional randomized clinical study. The inclusion criteria were 18 years old and above odd numbered patients who attended the clinic within the study period and who wished to participate

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or who possessed the desired variables. Excluded were those with limited mouth opening (poor access) or acute intra oral infection.

The information recorded in the data sheet (Table 1) include age and gender of the patient, class of cavity preparation, type of restorative material used, as well as reasons for initial placements. Others are class and reasons for replaced restoration due to secondary caries and the age of restoration.

The examination was done by two experienced dentists, using naked eye, sharp explorer and mouth mirror. Each restoration was examined independently by the dentists under a dental unit light illumination, whilst dry field was provided by cotton rolls. Earlier, the examiners had joint session on scoring criteria. Cases of suspected secondary caries were confirmed with bitewing film (E-speed, Agfa, Belgium), using a dental X-Ray unit (Athos, Italy). Detectable penetration of the underlying dentine, with an explorer is a hallmark of secondary caries. The resulting 10% inter-examiner discrepancy resolved after a joint review.

### Figure 1

Table 1 Questionnaire

- Age of Patient (years) .....
- Gender of patient. Male [ ] Female [ ]
- Class of cavity preparation.  
I [ ] II [ ] III [ ] IV [ ] V [ ]
- Type of restoration material used?  
Amalgam [ ] RBC [ ] GIC [ ]
- Reason for initial restoration  
Caries [ ] tooth fracture [ ] NCCL [ ] other [ ]
- Reason for replacement of restoration  
Secondary caries [ ] Bulk Fracture [ ]  
Tooth Fracture [ ] other [ ]
- Class of replaced restoration due to secondary caries  
I [ ] II [ ] III [ ] IV [ ] V [ ]
- Longevity of restoration to be replaced.  
Amalgam [ ] RBC [ ] GIC [ ]

## RESULT

### Figure 2

TABLE 2: REASONS FOR INITIAL RESTORATION BY AGE

Reason	Age (years)						Total
	18 -20	21 -30	31 - 40	41 - 50	51 60	61+	
Primary caries	8 (5.1)	50 (31.6)	42 (26.6)	35 (22.1)	18 (11.4)	5 (3.2)	158 (35.0)
NCCL	3 (3.1)	25 (25.8)	24 (24.7)	20 (20.6)	15 (15.5)	10(10.3)	97 (21.6)
Tooth Fracture	2 (4.0)	12 (24.0)	8 (16.0)	10 (20.0)	3 (26.0)	5 (10.0)	50 (11.1)
Other	-	10(50.0)	4 (20.0)	-	3 (15.0)	3 (15.0)	20 (4.4)

### Figure 3

TABLE 3: REASONS FOR REPLACEMENT OF RESTORATIONS

Reasons	Material			Total
	Amalgam	RBC	GIC	
Secondary caries	20 (55.6)	30 (54.5)	15 (42.0)	65 (51.6)
Bulk Fracture	8 (22.2)	5 (9.1)	3 (8.6)	16 (12.7)
Discoloration	-	10 (18.2)	7 (20.0)	17 (13.5)
Tooth Fracture	3 (8.3)	2 (3.6)	3 (8.6)	8 (6.3)
Pain/lost Restoration	5 (13.9)	8 (14.5)	7 (20.0)	20 (15.9)
Total	36 (28.6)	55 (43.7)	35 (27.8)	126

### Figure 4

Table 4: Class of Replaced Restorations Due to Secondary Caries

Class	Distribution (%)
I	16 (25.0)
II	32 (49.0)
III	7 (10.0)
IV	5 (8.0)
V	5 (8.0)

### Figure 5

Table 5: Mean Ages of Restorations by Tooth Type and Restorative Material

Restorative materials	Age (years)		
	Molar	Premolar	Anteriors
Amalgam	7.5	9	-
RBC	3.5	3	5
GIC	3	2.5	3.5

**Figure 6**

Table 6: Used Restorative Material by Class of Cavity

Class	MATERIAL %			Total
	Amalgam	RBC	GIC	
I	108 (24.0)	9 (2)	-	117 (26)
II	189 (42.1)	31 (6.9)	-	220 (49)
III	-	23 (5.1)	13 (2.9)	36 (8)
IV	-	23 (5.0)	-	23 (5)
V	23 (5)	13 (3.0)	18 (4.1)	54 (12)
IV	320 (71.1)	100 (21)	30 (6.1)	450 (100)

Four hundred and fifty restorations (324 or 72% initial and 126 or 28% replacement restorations) were done on 370 patients (152 or 41.1% males and 218 or 58.9% females) over 9 months period, resulting in 2.3 restorations per day and 1.2 restorations per patient. The age range and mean age of the population were 18-77 years and 34.78±14.52, respectively, whilst the mean ages by gender were 35.98±15.02 for males and 33.94±14.14 for females. The class II cavity (220 or 49%) was prepared most often, followed by class I (117 or 26%). Class IV (23 or 5%) was the least prepared.

The commonest reason for initial restoration was primary caries (158 or 35.1%), followed by non-carious cervical lesion, NCCL (97 or 21%). Initial placement occurred most commonly in the 21-30 year age band (97 or 30%), followed by the 31-40 year band (78 or 24%) (Table 2).

Secondary caries (65 or 51.6%) accounted for over half of all replacements, followed by pain/sensitivity and lost restorations (20 or 15.9%) and discolorations (17 or 13.5%). Tooth fracture (8 or 6.3%) accounted least for all replacements (Table 3).

Replacement restorations due to secondary caries occurred most often in class II preparations (32 or 49%), followed by class I (16 or 25%). (Table 4).

Amalgam was the most durable material in all types of teeth over all alternatives (7.5 years for molars, and 9 years for premolars), while GIC was replaced earliest in all types of teeth (3 years for molars, 2.5 years for premolars and 3.5 years for anterior) (Table 5), while type of restorative materials used by class of cavity is shown in Table 6.

## DISCUSSION

As with most researches, the sample in the current study may not be a true representative of the entire Nigeria. However, the size is reasonable enough to inspire confidence

in the result. Furthermore, the examiners went through no formal calibration other than a joint session on scoring criteria, whose interpretation is prone to subjectivity.

Worldover, until recently, amalgam remained the most popular restorative dental material (2). The use of amalgam is in demise and alternative are expected to replace it gradually and in countries like Sweden, there is already a proposal to eliminate it (13). In contrast, Oginni et al (14) observed that amalgam remained the commonest material in Nigeria. This is in accord with the finding of the present study. Udoeye et al (6) in a survey of Nigerian dentists' amalgam attitude further collaborated that over 80% did not support amalgam ban, whilst 84% would not even recommend an alternative. In a world where so much has changed, the reason for the continued popularity of amalgam amongst Nigerians may be multifarious. They include affordability and availability, less number of exacting steps involved in usage, as well as its time tested reliability and serviceability. It may even be, humorously, a case of amalgam being so much 'amalgamated' into the psyche of Nigerian amalgam stakeholders. The inability to keep pace with trends worldover may be many of a manifestation of backwardness, characteristic of developing nations, or a demonstration of continued confidence in amalgam safety.

Primary caries account as the commonest reason for placement of restorations in the current study agrees with other reports (12,14,15), but not with those of from developed countries, where caries incidence is rather declining(16,17). The reason for the differences may be due ignorance lack of unawareness, negligent oral hygiene practices, as well as inadequate public campaign against the disease in developing countries.

Secondary caries is the commonest reason for replacements of all types of restorations in the present study. This is in agreement with other reports (11,18), but not with that of Oginni and Olusile (14). Though 'real life' dentistry is based on the use of subjective criteria, diagnosis of secondary caries is no exception and several authors(14,20) agree that visual inspection, exploratory probing and bitewing radiograph are aids to solving secondary caries diagnosis problem. The predisposing factors may include difficulty in controlling clinically the gingival part of restorations during their insertion, as well as poor access to susceptible areas for meticulous oral hygiene measure. Though elemental components of amalgam are reported to be bacteriostatic (21), this effect was not reflected in the current study

considering the high amalgam usage recorded with attendant high prevalent rate of secondary caries as a reason for replacement in the current report. Similarly, low secondary caries rate associated with GIC may be due to the reported fluoride release, both in vivo and in vitro (22). Factors against secondary caries are reported to be associated with sound cavity preparation design features, adaptation of restoration to the cavity walls and reestablishment of physiologic contours and emphasis on the patient home care(4).

Issues on durability of restorations are complex, making comparison of data difficult. The present study agrees with the report of Leinfelder(21) that durability of amalgam is greater than its contemporary alternatives, though longevity of restorations varies across studies. For RBC, its longevity depends on the cavity configuration, type of tooth surface that is to be bonded, quality of hybrid layer, presence or absence of micro and nanoleakage, composition of the material and the magnitude of polymerization shrinkage stress of the materials(23). It would appear that durability of restorations may be impacted positively by proper treatment planning, quality of tooth preparation, proper manipulation of the material and proper moisture control at the operating site. Others are disciplined technique and the dentist's skill, as well as good oral hygiene and plaque control and oral habits.

## CONCLUSION

Whilst amalgam was the most durable and the most often used material, RBC and GIC were seldom used. Furthermore, primary and secondary caries were the commonest reasons for material usage. Within the limits of the study, it is recommended that relevant authorities should mount enlightenment campaign against primary and secondary caries targeted especially at the risk group.

## References

1. Burke FJ, Wilson NH, Cheung SW, Mjor IA Influence of patient factors on age of restoration failure and reasons for their replacement and replacement Journal Dentistry 29:317-324.
2. Lavelle C.L A cross sectional longitudinal survey into the durability of amalgam restorations. Journal Dentistry 4:139-143.
3. Tveit AB, Espelid I Class II amalgam: inter observer variations in replacement decisions diagnosis of caries and crevices International Dental
- Journal 42: 12-18.
4. Forss H, Widstrom E Reasons for restorative therapy and the longevity of restorations in adults Acta Odontologica Scandinavica 62: 82-86.
5. Klausner LH, Green TG, Chexbonneau GT Placement and replacement of amalgam restorations: A challenge for the profession Operative Dentistry 12: 105-112.
6. Udoeye C, Aguwa E. Amalgam safety and dentists' attitude: A Survey among a subpopulation of Nigerian dentists Operative Dentistry 33: 365 -472.
7. T.Baker E. Mr. Parmly and his amalgam war. New York Dental Recorder 1:126 – 129.
8. Trevor Burk FJ Amalgam to tooth colored materials – implications for clinical practice and dental education, governmental restrictions and amalgam usage survey results Journal Dentistry 32: 343-350.
9. Todd JE, Lader D Adult Dental Health Survey London: Her Majesty's Stationary Office, 1991.
10. Jokstad A, Bayne SC, Blun U, Tyas MJ, Wilson NHE Quality of dental restorations FDI Commission Project 2-99 International Dental Journal 51:117 – 158.
11. Friedl KH, Hiller KA, Schmalz G Placement and replacement of amalgam restoration in Germany Operative Dentistry 19: 228 – 232.
12. Mahmood S, Smales RJ Placement of restorations in selected patients from different practice environments Journal of Pakistan Dental Association 11: 131 – 136
13. Jones DW The enigma of amalgam in dentistry British Dental Journal 177: 159 -170.
14. Oginni AO, Olusile AO A survey of amalgam restorations in a south western Nigerian populations Journal of Oral Rehabilitation; 29:295-299.
15. Al-Negrish AR Reasons for Placement and replacement of amalgam restorations in Jordan. International Dental Journal; 51:109 -115.
16. Barmes DE, Tala H Oral health trends in WHO Africa Region Africa Dental Journal 2-A, 3.
17. Skartveit L, Riordan PJ , Dallal E Effect of fluoride in amalgam on secondary caries incidence Community Dentistry and Oral Epidemiology 22:122 – 125.
18. Mjor IA, Toffeneti F Placement and replacement of amalgam restoration in Italy Operative Dentistry 17:70 -73.
19. Ozer L The relationship between gap size, microbial accumulations and the structural features of natural caries in extracted teeth with class II amalgam restorations A stereo and polarized light microscopic study. PhD Thesis, University of Copenhagen. 1997.
20. Hewlett ER, Atchison KA, White SC, Flack V Radiographic secondary caries prevalence in teeth with clinically defective restorations Journal Dental Research 72: 1604 – 1608
21. Leinfelder KF Do restorations made of amalgam outlast those made of resin based composite? Journal of American Dental Association 131: 1186-1187.
22. Forsten L Fluoride release and uptake by glass ionomers Scandinavica Journal of Dental Research 99: 241-245.
23. Tseng KC, Weinberg GA , Woodlock DF Dental adhesives in the foundation of esthetic dentistry General Dentistry 13 (Special Issue): 698 – 708.

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