Factors affecting choice of restorative materials and Awareness of Minamata Convention among dental practitioners in a tertiary institution in Nigeria

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ABSTRACT

There are many restorative materials in use today, each with its unique selling points. They include products like dental amalgam, composite resin, glass ionomer cement and compomer. They can be used in the treatment of dental caries in posterior teeth. However, dental amalgam has generated the most controversy because of its content of mercury.

Objective: To determine the attitudes and practices towards the treatment of dental caries as well as the level of awareness of the Minamata declaration among restorative dentists and dental students in a tertiary dental institution in Lagos, Nigeria.

Method: A structured questionnaire was administered to all the dentists and students involved in restorative treatments. The questionnaire assessed the factors that determined the choice of materials among the respondents. The respondents were divided into three categories based on professional experience to group 1 comprising students and house officers, group 2 comprising medical officers and registrars and group 3 comprised of senior registrars and consultants.

The respondents were aged between 23 and 60 years and comprised 20 males and 25 females.

.**Results**: Dental amalgam (100%), composite resin (97.8%) and glass ionomer cement (95.6%) were the materials the respondents were most conversant with as well as being the

most frequently placed (80%, 71.1%, and 84.4% respectively). Significantly however, compomer was mostly used by group 1 respondents (p=0.009). The commonest factors affecting choice of restorative materials were availability of restorative material (93.3%), age of patient (82.2%), this was statistically significant (p=0.013), tooth type (88.9%), cost of restoration (86.7%), type of tooth defect (88.9%) and patient's preference (73.3%). Level of awareness was highest among Group 3 respondents and least among Group 2 respondents (p = 0.045). **Conclusion:** While majority of the respondents still prefer and place amalgam, the steps to making a choice of restorative material are intricate. Again, almost half of the study respondents were unaware of the Minamata Convention while awareness of the Convention was highest among the most experienced professional category

Key words: Dental amalgam, composite, glass ionomer cement, Minamata.

INTRODUCTION

Dental amalgam was invented in 1819[1] and has served as a restorative material in dentistry for nearly two centuries. Almost from its origin it has been controversial [1], and there are arguments on both sides of the divide regarding its toxicity potential [1, 2]. However, amalgam has some good selling points: it is cheap, durable, easy to manipulate and insert [3]. Nonetheless, a major disadvantage is its lack of aesthetics [2]. Despite these positive selling points, there has been controversy about the mercury content of dental amalgam. This controversy led to a stakeholder's convention - the Minamata Convention [4] which held in 2013 in Minamata, Japan. The outcome of this was an agreement to phase down and eventually eliminate the production and use of mercury containing products.[3] Amalgam is an alloy of mercury and other metals such as silver, tin, copper. The report of the Minamata Convention was adopted by 139 countries including Nigeria. Thus, Nigeria is a signatory to the Convention [4].

There are alternative filling materials to dental amalgam but they are usually technique sensitive, difficult to insert, more expensive than and not as durable as dental amalgam, this has made amalgam the material of choice for many dentists [5]. Some of these alternatives include Composite resin, Glass ionomer cement and their modifications.

Some advantages of these materials over amalgam include: less tooth structure is lost in the process of cavity preparation, cavities prepared do not have to be complex [6, 7], adequate working time because some of the materials would not harden until it is cured [6, 7], the finished restoration perfectly mimics the natural tooth [6, 7]. When they fracture, they can be repaired by the addition of new filling material over the old filling material [6, 7].

Gbadebo et al [8] noted that the choice of amalgam as a restorative material was related to its resilience, ease of manipulation as well as cost effectiveness [2]. With regard to tooth type, their study demonstrated more use of composite (91.8%) than amalgam (8.2%) in the treatment of premolars. This could be attributed to anatomical configuration as well as the occlusal load borne by the tooth.

Another study [9] demonstrated those factors such as age, gender, the patient's previous caries experience as well as tooth type and the presence of a pre-existing amalgam filling impact on the choice of restorative material by dentists. Other factors include the severity of the dental caries and the depth of the cavity. The authors observed that younger patients and females were more likely to receive tooth coloured fillings while patients with deep cavities, high previous caries experience and cavities involving the molars are more likely to be treated with amalgam [9].

The type of the practice which was not one of the factors examined in this present study was noted as being a factor in the choice of restorative material in a Norwegian study by Mjor et al [10]. The authors noted that composite restorations were favoured by private practitioners when compared to those in paid or public employment who did more of GIC restorations.

They also observed that dentists with more years of experience placed more amalgam and composite while the younger generation of dentists favoured GIC [10]. Aesthetics was also a factor for choice as both the younger and female patients received treatment with tooth coloured materials [9, 10].

A study by Hawthorne et al [11] in 1992 also demonstrated the relevance of factors such as age and gender of the dentist as determinants of choice of restorative materials. Contrary to the observations of Mjor et al [10], Hawthorne et al [11] noted that older generation dentists placed more GICs and fewer composites and amalgam.

Involvement of the patient in the decision making by providing them with all the needed information was a factor of note in a study by Espelid et al [12]. This is because patients have the right to give informed consent. They noted that while longevity of the restoration is paramount to the dentist, the patient might just be considering aesthetics alone.

According to a study across some Scandinavian countries, factors that influence treatments are the experience of the dentist as well as criteria laid down by the dental schools and/or the health authority [13]. With the Minamata declaration, it may be time for our dental schools together with the ministry of health to draw up a road map for the use of these restorative materials and with Nigeria being a signatory to the convention, provide a definitive time table for the phase down of dental amalgam.

This study while acknowledging the need to phase-down dental amalgam sought to determine the attitudes and practices towards the treatment of dental caries as well as the level of awareness of the Minamata declaration among restorative dentists and dental students in a tertiary dental institution in Lagos, Nigeria.

METHODOLOGY

Materials and methods

Ethics approval for this study was obtained from Health Research and Ethics Committee of the Lagos State University Teaching Hospital, Ikeja. Consent was also sought and obtained from all the respondents. The study population included all the dentists and students who carried out restorative treatments in the dental centre of the Lagos State University Teaching Hospital. A questionnaire (see Appendix 1) was administered to all the correspondents. After the initial presentation of the demographics, categorization of respondents into three groups was done as follows: Group1 (house officers and Students), Group 2 (Medical officers and Registrars), Group 3 (Senior Registrars and Consultants. The data were analysed with IBM Statistical Package for the Social Sciences (IBM SPSS) version 23 using significant values were determined by p values less than 0.05.

Comparison of conversance with materials, materials mostly used, factors affecting choice of restorative materials and awareness of the Minamata Convention among the three groups was done with Chi Square at 95% confidence interval

RESULTS

Table 1 shows the demographics of study respondents. There were a total of forty-five respondents in this study, 20 (44.4%) males and 25 (55.6%) females. The respondents comprised of seven students (15.6%), 12 house officers (26.7%), three medical (dental) officers (6.7%), 18 registrars (40%), three senior registrars (6.7%) and two consultants (4.4%) (Table 1a).

In terms of years of clinical practice experience, 33 (73.3%) of the study participants had between 1-5 years of clinical experience, seven (15.6%) had 6-10 years clinical experience

and four (8.9%) had 11-15 years of clinical experience. One participant (2.2%) had over 25 years of clinical experience (Table 1b).

CONVERSANCE WITH AND USE OF RESTORATIVE MATERIALS

Figure 1: shows the pattern of conversance with and use of restorative materials among the respondents. Dental amalgam (100%), Composite resin (97.8%) and Glass ionomer cement (95.6%) represent the commonest restorative materials respondents were conversant with. Respondents were least conversant with Compomer (19%).

Dental amalgam (100%), Composite resin (100%) and Glass ionomer cement (97.8%) also represent the commonest restorative materials the respondents have placed in the past or mostly worked with by respondents with Compomer (13.3%) as the least placed.

In this study, the respondents were categorised into three groups in relation to their professional experience. Group 1 comprised students and house officers, Group 2 comprised registrars and medical (dental) officers, and Group 3 comprised senior registrars and consultants.

Table 2a shows the analysis of conversance with restorative materials among the three groups of respondents. There was no statistically significant difference in familiarity of restorative materials among the three groups of respondents,

Table 2b shows the analysis of type of restorative material placed in the past by the three groups of respondents. Past placement of Compomer was statistically significant ($p = 0.009$) and was more commonly placed by Group 1 respondents.

Table 2c shows the analysis of types of restorative material mostly used by each respondent across the three groups of professional designations. The use of Compomer by Group 1 respondents was statistically significant ($p=0.039$) compared with the other two groups.

FACTORS AFFECTING CHOICE OF RESTORATIVE MATERIALS AMONG RESPONDENTS

The analysis of factors affecting choice of restorative material among the three groups of respondents is shown in Table 3. Availability of restorative material, age of patient (statistically significant p=0.013), tooth type, cost of restoration, type of tooth defect and patient's preference represent the commonest factors affecting respondents' choice of restorative material. The less common determinants include type of previous restoration placed, ease of restorative placement, the respondent's competence, respondent's perception of safety of amalgam and patient's source of funding for treatment.

AWARENESS OF MINAMATA CONVENTION AMONG RESPONDENTS

Figure 2 shows that while 51% of respondents had heard of the Minamata Convention, 49% of the respondents had not. Also, awareness of the Minamata Convention was highest among Group 3 respondents followed by Group 1 respondents. Awareness was least among Group 2 respondents. The differences were statistically significant (p = 0.045)

DISCUSSION

This was an exploratory study to determine the attitudes and practices towards the treatment of dental caries as well as the level of awareness of the Minamata declaration among a population of restorative dental practitioners with different categories of clinical experience. Out of the 65 dentists and students in the study environment 45 responded by completing and returning the study questionnaire giving a response rate of 69.2%. This was better than the responses (42.1% and 57.3%) obtained from two different studies done in Finland [14]. The higher response rate in this present study may have been due to the relatively easy access of this author to the respondents occasioned by working in the same environment. A study among Jordanian dentists [16] showed a higher response rate (85.2%) than that in this present study. However, the study population in the Jordanian study was much higher than that in this present study (196 dentists compared to 45 dentists). The respondents in this present study are from different cadres and have different years of experience (Table 1)

In the present study, dental amalgam, composite resin and GIC constitute the materials that respondents were most conversant with, had placed in the past and were the materials the respondents had mostly worked with (Fig 1). This is consistent with the assertion that the criteria laid down by dental schools influence the choice of materials. [13] This may suggest that most dentists stick with what they were taught in dental school even if newer materials are recommended [13]. Though Compomer was the material the respondents in this study were least conversant with, it was mostly used by dental students and house officers (Table 2). This was statistically significant p=0.039. It suggests that though the less experienced dentist align with the more experienced dentists in terms of their conversance and treatment choices, their use of compomer might be a reflection of the training curriculum they were exposed to. There seems to be a difference in choices of materials preferred between different categories of clinical experience. This is seen from studies [10, 11] where the more experienced dentists placed more of amalgam and composite and the less experienced dentists, placed more of GIC [10] or where the older generation placed fewer amalgam and composite and more of GIC in yet another study [11]

From the present study, some of the most common factors affecting respondent's choice of restorative materials were availability of the restorative material, tooth type, cost of restoration, age of patient, type of tooth defect and patient's preference (Table 3). Of these only patient's age was statistically significant (p=0.013). These common factors have also been noted in other studies. [2, 8,-13].

The age of the patient as a factor in the choice of dental material was statistically significant in the present study. While it was a factor for most of groups 1 and 2 respondents, it was not so for group 3. This could be because Group 3 respondents were the most experienced and

for this group it was more of cost and availability of material as well as type of defect that influenced their choice of dental material. The availability of restorative material limits the choice made by the respondents. Cavity size was another factor affecting choice of restoration. For a pin point occlusal cavity, the preferred approach by most dentists in a study was using preventive resin procedure [13] . The less common determinants include type of previous restoration placed, ease of restorative placement, the respondent's competence, respondent's perception of safety of amalgam and patient's source of funding for treatment. While cost is a major factor, patient's source of funding was not. This might be because in this environment, majority of the patients do not have health insurance coverage and out of pocket payment represents the source of funding in majority of cases[17, 18].

On the awareness of the Minamata declaration, there was statistically significant differences (p=0.045*) between the most experienced practitioners and the others. This present study showed that while the more experienced practitioners (senior registrars and consultants) were aware and could state what it involves, only a few respondents from less experienced (students and house officers, medical officers and registrars) were aware. In a study among Jordanian dentists [16] to assess their awareness of the Minamata convention, the authors noted that the level of awareness was low (13.8%). This is much lower than the level of awareness in this present study. The reason for low awareness could be lack of communication of the Minamata Convention to the dental practitioners in the study environment. [16, 19, 20]

CONCLUSION

There is a complex interplay of factors when making a choice for which restorative material to use and these factors may be classified as clinical, knowledge, patient's preference, type of clinical practice, biological and environmental.[14, 15] No single factor can determine the choice of restorative material.

In many settings dental amalgam remains the material of choice because of the reluctance of dentists to let go. [15, 20] Although implementing a phase down would mean a paradigm shift from drill and fill approach to a more preventive and minimal intervention approach, the absence of basic infrastructure such as electricity and water supply even in our urban setting may not favour this[19, 20]. There is a need for collaboration among policy makers, relevant government agencies, dental schools and the dentists to achieve the goal of amalgam phase down for benefit of the patient.

LIMITATIONS OF THIS STUDY

The relatively small sample size in this study was occasioned by the limited number of available study population.

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TABLES

Table 1: Demographic characteristics of respondents

VARIABLE	FREQUENCY	PERCENTAGE
a: Designation of respondents		
Consultant	2	4.4
Senior Registrar	3	6.7
Registrar	18	40.0
Medical (Dental) officer	3	6.7
House officer	12	26.7
Student	7	15.6
b: Years of experience		
1-5 years	33	73.3
6-10 years	7	15.6
11-15 years	4	8.9
16-20 years	0	0.0
21-25 years	0	0.0
25 years and above	1	2.2

Table 2: Relationship between restorative materials' use among the respondents

VARIABLE	GRP 1	GRP 2	GRP 3	X	df	P-value
a: Restorative materials conversant with						
Dental amalgam	19(100)	21(100)	5(100)	-	-	-
Composite resin	19(100)	20(95.2)	5(100)	1.169	2	0.557
Glass ionomer cement	19(100)	19(90.5)	5(100)	2.392	2	0.302
Compomer	11(57.9)	7(33.3)	1(20)	3.605	2	0.156
Others	1(5.3)	1(4.8)	1(20)	1.611	2	0.447
b: Types of materials placed in the past						
Dental amalgam	19(100)	21(100)	5(100)	-	-	-
Composite resin	19(100)	21(100)	5(100)	-	-	-
Glass ionomer cement	18(94.7)	21(100)	5(100)	1.42	2	4.97
Compomer	6(31.6)	0(0.0)	0(0.0)	9.174	2	*0.009**
Others	1(5.3)	0(0.0)	0(0.0)	1.42	2	4.97
c: Mostly used material						
Dental amalgam	13(68.4)	20(95.2)	2(40)	5.890	2	0.053
Composite resin	15(78.9)	14(66.7)	3(60)	1.070	2	0.586
Glass ionomer cement	16(84.2)	17(81.0)	5(100)	1.117	2	0.572
Compomer	6(31.6)	1(4.8)	0(0.0)	6.497	2	0.039*
Others	0(0.0)	1(4.8)	1(20)	3.738	2	0.154

*= significant p values.

Table 3: The factors affecting the respondents' choice of restorative materials.

VARIABLE	GRP 1	GRP 2	GRP 3	X	df	P-value
FACTORS AFFECTING CHOICE OF MATERIAL						
Age of patient	15(78.9)	20(95.2)	2(40.0)	8.671	2	0.013*
Gender of patient	12(63.2)	11(52.4)	1(20.0)	2.977	2	0.226
Tooth involved (molar/premolar)	17(89.5)	20(95.2)	3(60.0)	5.089	2	0.079
Availability of material	18(94.7)	20(95.2)	4(80.0)	1.611	2	0.447
Cost of restoration	16(84.2)	19(90.5)	4(80.0)	0. 555	2	0.758
Patient's preference	15(78.9)	14(66.7)	4(80.0)	0.897	2	0.638
Restoration already in mouth (type)	9(47.4)	8(38.1)	1(20.0)	1.295	2	0.523
Restoration already in mouth (number)	8(42.1)	10(47.6)	1(20.0)	1.263	2	0.532
Previous restorations placed by you	8(42.1)	4(19.0)	0(0.0)	4.7	2	0.093
Previous restorations placed by another dentist	6(31.6)	6(28.6)	0(0.0)	2.092	2	0.357
Ease of placement of restoration	12(63.2)	9(42.9)	1(20.0)	3.524	2	0.172
Your level of competency	7(36.8)	7(33.3)	1(20.0)	0.505	2	0.777
Type of defect (carious/non-carious)	16(84.2)	20(95.2)	4(80.0)	1.678	2	0.432
Type of caries (primary or secondary/minimal or extensive)	17(89.5)	16(76.2)	2(40.0)	5.663	2	0.060
Whether patient is paying out of pocket or with insurance	10(52.6)	8(38.10)	0(0.0)	4.628	2	0.099
Do you believe that dental amalgam filling has harmful effects	12(63.2)	12(57.1)	2(40.0)	8.77	2	0.645
Others	1(5.3)	0(0.0)	1(20.0)	3.856	2	0.145

*= significant p value.

FIGURES

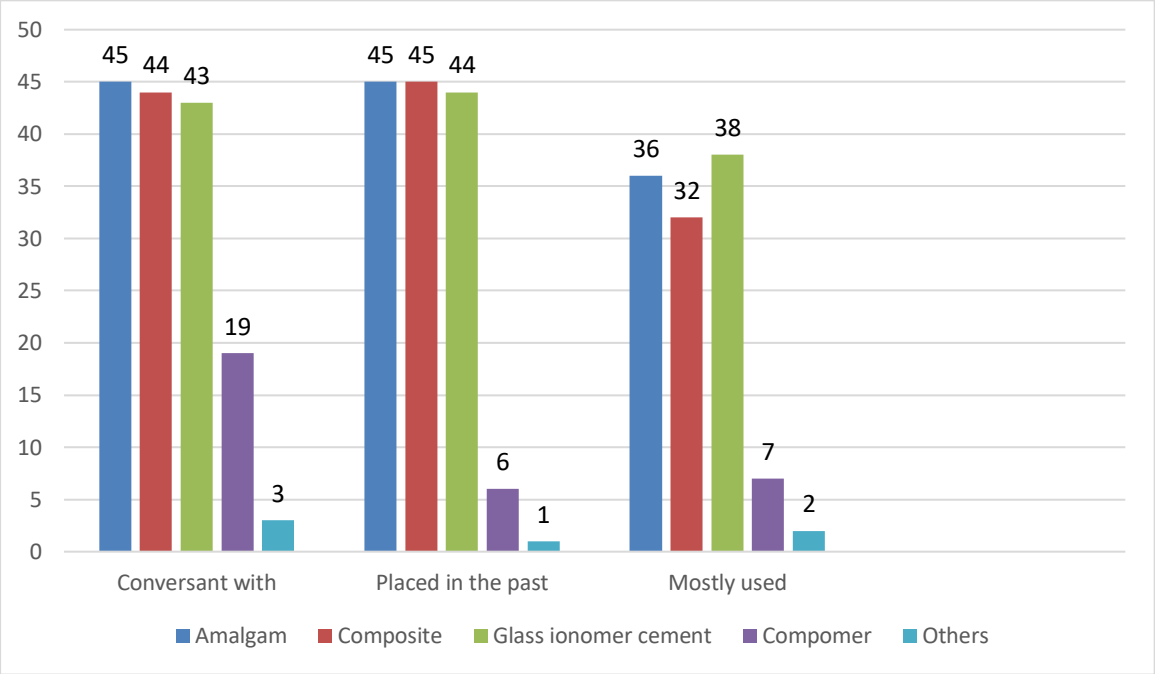
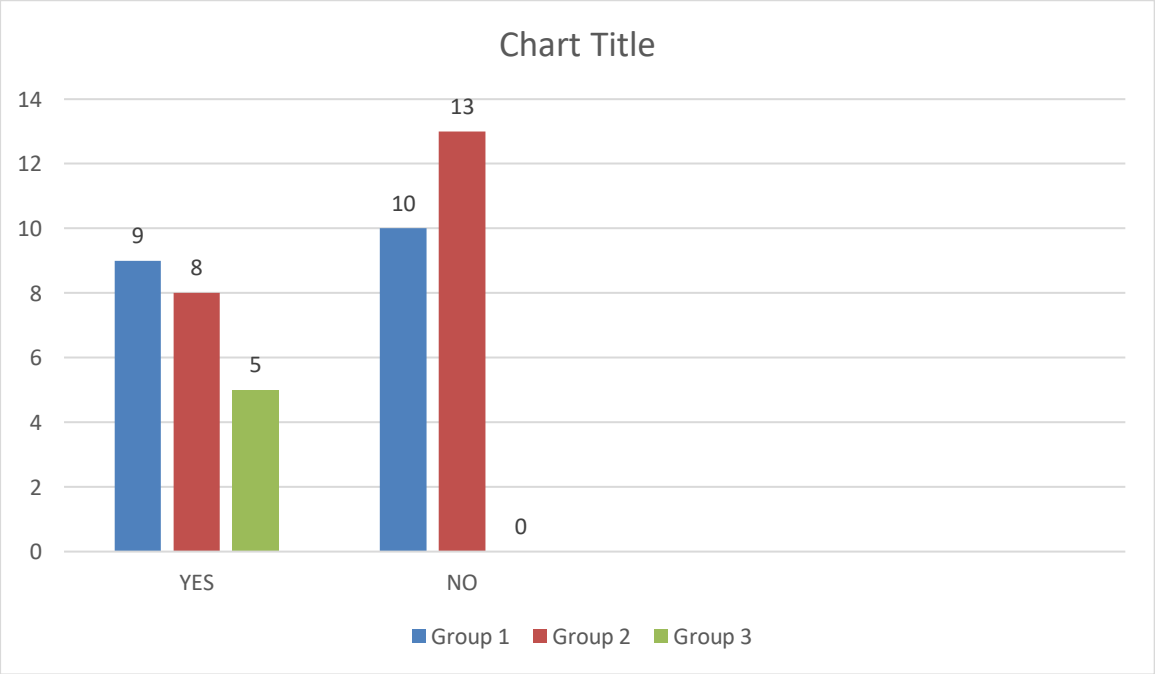


Figure 1: Conversance with and Use of restorative materials



p-value=0.045*

Figure 2: Awareness of Minamata convention among respondents

APPENDIX 1

QUESTIONNAIRE

You have been selected to participate in this study. Please complete this questionnaire on **Factors affecting choice of restorative materials in a tertiary institution in Nigeria.**

Some of the questions will require that you tick the appropriate box or indicate yes or no, others would require that you write a brief response.

Part 1

1. Are you a Dentist ( ) or a student ( )
2. Years of experience
    a. 1-5years
    b. 6-10years
    c. 11-15years
    d. 16-20years
    e. 20-25years
    f. Above 26years
3. Gender of practitioner: Male ( ), Female ( )
4. Age of practitioner

Part 2

5. Which of these restorative materials are you conversant with?
    a. Dental amalgam
    b. Composite resin
    c. Glass ionomer cement
    d. Compomer.
    e. Others. Please state

6. Type of restorations you have placed in the past
    a. Dental amalgam
    b. Composite resin
    c. Glass ionomer cement
    d. Compomer.
    e. Others. Please state
7. Factors affecting choice of material (Tick as many as apply)
    a. Age of patient Yes ( ) No ( )
    b. Gender of patient. Yes ( ) No ( )
    c. Tooth involved: molar or premolar. Yes ( ) No ( )
    d. Availability of material. Yes ( ) No ( )
    e. Cost of restoration. Yes ( ) No ( )
    f. Patients preference. Yes ( ) No ( )
    g. Type of restoration already in the mouth. Yes ( ) No ( )
    h. Number of previous restorations in the mouth. Yes ( ) No ( )
    i. Whether the previous restorations placed by you. Yes ( ) No ( )
    j. Whether the other restorations placed by another practitioner. Yes ( ) No ( )
    k. Ease of placement of restoration. Yes ( ) No ( )
    l. Whether you have the competency to use the material. Yes ( ) No ( )
    m. Type of defect (carious/non-carious). Yes ( ) No ( )
    n. Type of caries (primary or secondary/ Minimal or extensive). Yes ( ) No ( )
    o. Whether patient is paying out of pocket or through insurance. Yes ( ) No ( )
    p. Do you believe that dental amalgam filling has harmful effects? Yes ( ) No ( )
    q. Other factors. Please state.

Part 3

8. Which of these restorative materials have you worked with more (Please tick only one option).

a. Dental amalgam

b. Composite resin

c. Glass ionomer cement

d. Compomer.

e. Others. Please state

Part 4

9. Have you heard of the minamata convention? Yes/No

10. What is the minamata convention about?