ORIGINAL ARTICLE

Knowledge and Attitude of Dentists towards the Use and Safety of Amalgam, Observance of Mercury Hygiene and Amalgam Waste Management

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ABSTRACT

Objective: To assess the knowledge and attitude of dentists of Rawalpindi and Islamabad towards the use and safety of amalgam, observance of mercury hygiene and amalgam waste management.

Study Design: Cross Sectional survey.

Place and Duration of Study: The study was carried out at Operative Dentistry Department of Army Forces Institute of Dentistry, (AFID) Rawalpindi, from 1st March to 31th April 2021.

Materials and Methods: An online questionnaire was circulated among 384 private and public hospital dentists of Rawalpindi and Islamabad. Final questionnaire consisted of close ended questions related to demographic details, questions regarding the handling and disposal of amalgam and perception of dentists regarding mercury hygiene. Data was analyzed using SPSS version 21 and evaluated as frequencies, percentages, mean and standard deviation. Chi-square test was used to correlate demographic to the responses of the participants to the items of the questionnaire.

Results: Majority of the dentists were doing 5-10 amalgam restorations per week (34.6%) but they didn't place rubber dam while restoring tooth with amalgam (95.7%). Most of the dentists take no specific measures for storing leftover amalgam (65.4%) and do not periodically monitor mercury vapor (91.5%).

Conclusion: The majority of dentists of Rawalpindi and Islamabad are not following dental mercury hygiene recommendations as there is a significant lack of knowledge regarding mercury hygiene and amalgam waste disposal.

Key Words: *Amalgam Waste, Dental Amalgam, Mercury Hygiene.*

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Introduction

Dental amalgam has been widely used in dentistry as a restorative material for many decades due to its low cost, durability and ease of use.[1,2] A major concern in this regard is the management and disposal of amalgam waste. Amalgam manipulation and its waste management in dental office if not strictly regulated, contribute to the risk of occupational exposure as well as environmental risk from this neuro and nephrotoxic material.[3] This is because it is composed of nearly 50% mercury and 69% silver. Mercury poisoning (also known as hydrargyria or mercurialism) is a disease caused by exposure to mercury or its compound. Mercury (Hg) is a heavy metal occurring in several forms, all of which can produce toxic effects in high enough doses.[4] The routes of mercury pollution from the dental office include: unregulated disposal of amalgam waste in the regular municipal waste or the domestic sewerage waste water; high-risk methods of amalgam manipulation; disposal of amalgam filled extracted teeth in hospital waste that is often incinerated; and autoclaving/heat sterilizing of amalgam-filling dental instruments.[5,6,7]

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According to the history of Amalgam use, this material was declared as malpractice by The American Society of Dental Surgeons 12 years after its discovery in 1833. However it is still used because of its properties of durability and user friendly. Dentists are encouraged to follow best management practices for amalgam waste handling and disposal to limit its potential environmental effects. These practices are designed to provide guidelines to practitioners for limiting the occupational and environmental hazards of mercury. For mercury, best management practices are designed to address the various forms that are used and generated in the dental office.[8,9] In 1920, Professor Alfred E Stock, a leading chemist whose own health was affected due to mercury exposure in the laboratory, questioned the supposed safety of dental amalgam.[10] Later on Dodes[11] in 2001 did an evidence-based analysis of data supporting and condemning the use of amalgam. Considering all the history Amalgam use is still Prevalent in developing countries.[12] It is believed that with Proper Mercury Hygiene i.e. proper handling and use of mercury in oral health care settings, amalgam can be easily and safely used in daily practices. The essentials of mercury hygiene involves periodic monitoring of mercury vapors using dosimeter, keeping its limit till 50µg/m³ per 8 hour shift over 40 hour work week, this can be achieved by proper ventilation and evacuation of amalgam waste. Along with that periodic evaluation of the dental staff and provision of PPE should also be made sure. Patients can be kept safe by avoiding mercury contact with the help of rubber dams and high Volume Suctions.[11]

Several studies have investigated the amalgam safety issues; however limited local data is available about the use and disposal of amalgam. Pakistan Medical Commission and Pakistan Dental Association have no official consensus and guidelines on amalgam waste management in dental settings. Lack of knowledge of mercury toxicity and mercury hygiene highlights the need of assessing perception of general dentist towards this problem. Thus, this survey was designed to assess the knowledge and attitude of dentists of Rawalpindi and Islamabad towards the use and safety of amalgam and their observance of mercury hygiene and amalgam waste management and to create self-assessment of their knowledge and awareness regarding management of amalgam waste. In addition, this study estimated dentists' knowledge and attitude towards amalgam waste management and to correlate the findings with the age, gender and work experience of the participants.

Materials and Methods

This cross sectional survey was conducted in the Operative Dentistry Department of Armed Forces Institute of Dentistry from 1st March 2021 to 31th April 2021 and the participants were the practicing dentists of Rawalpindi and Islamabad. A total of 384 dentists were included in study; this sample size was calculated using WHO Calculator using following equation; Sample size n = [DEFF*Np(1-p)]/ [(d2/Z21-α/2*(N-1)+p*(1-p)] such that the Population size of the dentists present in Rawalpindi and Islamabad (for finite population correction factor or fpc)(N) was kept 5000 as mentioned by Pakistan Medical Council, Confidence interval was kept 95% and the Power of test was 80. Non practicing dentists were excluded. After taking Approval from Ethical Committee of Armed Forces Institute of Dentistry (918/Trg /26th February 2021) a questionnaire was developed and pretested in a group of ten dentists including general dentists and restorative dentists. Difficulties regarding the comprehension of the questionnaire were identified and addressed according to the results of this pilot study. The final questionnaire consisted of close ended questions related to demographic details, questions regarding the handling and disposal of amalgam and perception of dentists regarding mercury hygiene. This questionnaire on google form was distributed online via social media among participants. Response data was entered and analyzed using SPSS version 21 and evaluated in the form of descriptive such as frequencies, percentages, mean and standard deviation. Means and standard deviations were calculated for variables like age and years of practice. Gender and the 11 items of questionnaire were evaluated for their frequencies and proportions.

Results

Of the total 384 dentists, 376 responded, making a response rate of 97.92%. Among these participants majority 226 (60.10%) were from the age group of 26-30 Years and 243(64.63%) were Female. The dentists were divided into three categories according to qualification and 48 (12.76%) were General

Dentists, 228 (60.63%) were FCPS Residents and the remaining 100 (26.59%) were Consultants (Table 1).

Table 1: Demographic details of the Participants

Characteristics		Frequency (n)	Percentage (%)
Age Groups	20-25 Years	33	8.77%
	26-30 Years	226	60.10%
	31-35 Years	17	45.21%
	36-40 Years	16	42.55%
	41-45 Years	84	22.34%
Gender	Male	133	35.37%
	Female	243	64.63%
Qualification	General Dentists	48	12.76%
	FCPS Resident	228	60.63%
	Consultant	100	26.59%

130 dentists (34.6%) were doing 5-10 amalgam restorations per week but did not place rubber dam while restoring tooth with amalgam 360 (95.7%). 246 dentists (65.4%) take no specific measures for storing leftover amalgam, most of them i-e 344 (91.5%) do not periodically monitor mercury vapor. Detailed responses to these questions are shown in (Table 2).

Table 2: Knowledge and Practice Regarding Mercury Waste Disposal and Management among Dentists

S.No	Knowledge and practice regarding amalgam disposal and waste management			Frequencies	Percentage
1.	How many amalgam restorations do you do in your practice?	a.	<5 week	130	34.6%
		b.	5-10 week	130	34.6%
		c.	10-15 week	51	13.6%
		d.	15 and more	65	17.3%
2.	Do you place rubber dam during removal of amalgam restorations?	a.	Yes	16	4.3%
		b.	No	360	95.7%
3.	Please tick type of evacuation method used?	a.	Saliva Ejector	181	48.1%
		b.	High volume suction	179	47.6%
		c.	Any other	16	4.3%
4.	Do you use trap/filter/separator with high volume suction?	a.	Yes	114	30.3%
		b.	No	262	69.7%
5.	In your setup evacuation system gets drained into?	a.	Regular drain	376	100%
		b.	Any other	0	0
6.	Do you use amalgamator with pre-capsulated alloy?	a.	Always	344	91.5%
		b.	Never	32	8.5%
7.	Do you use mortar and pestle for trituration?	a.	Always	48	12.8%
		b.	Never	328	87.2%
8.	Where do you store leftover amalgam scrap?	a.	In the empty bottle	97	25.8%
		b.	In bottle of radiographic fixer	33	8.8%
		c.	In water bottle	246	0
		d.	None of the above	0	65.4%
9.	If you have answered Q.8 as option a/b/c, then how is the bottle disposed of?	a.	Along with biomedical waste	344	91.5%
		b.	Others	32	8.5%
10.	How do you dispose amalgam contaminated cotton and gloves?	a.	In regular dustbin	180	47.9%
		b.	With other biomedical waste disposal	196	52.1%
11.	Do you periodically monitor mercury vapor in your clinic?	a.	Yes	32	8.5%
		b.	No	344	91.5%

Discussion

In our study only 17.3% of the dentists do more than 15 amalgam restorations /week. Similar to this a study conducted by Sarita Bhardawaj in 2017 showed only 6% of dentists in Punjab, India who were doing more than 15 amalgam restorations/week.[12] In contrast to this a study conducted in Pakistan in 2010 showed 71% of dentists were doing amalgam restorations.[13] The overall use of dental amalgam has been reduced significantly during the past few decades in most developed countries.[5,6] This clear decline in the use of amalgam restorations is due to two main reasons. One is related to its non-esthetic property and other is related to mercury toxicity. Amalgam should be best managed as per amalgam management practices by American Dental Association (ADA). According to this, high-volume evacuation would be used while removing or finishing amalgam and evacuation system should have traps or filters which are periodically cleaned. In our study, during removal of amalgam restorations only 4.3% of dentists placed rubber dam. Similar to this a study conducted by Sarita Bhardawaj only 6% of dentists used rubber dam during removal of amalgam restorations which means both the dentist and the patient are at the risk of mercury exposure and toxicity.[12] In contrast to this, a study conducted by Saleem Abdul Rab in 2016 reported that 62% dentists were using rubber dam for amalgam restoration.[14] Placement and removal of dental amalgam restorations generate amalgam waste particles that are removed by vacuum pump filters and chair side traps however, some amalgam particles still enter into the sewer system. Amalgam separators are used to trap these remaining particles. These separators

remove the particles using different techniques such as sedimentation, filtration, centrifugation, or ion exchange. In current study, 47.6% of dentists used high volume suction and traps/ filters/ separators were used by 30.3% of dentists and for 100% of dentists evacuation gets drained into regular drain. This simply shows that local sewer system is getting contaminated in Pakistan by mercury which can cause serious health effects. According to the ADA guidelines, pre-capsulated alloy should be used in amalgamator with completely closed arm. In our study 91.5% dentists always use amalgamator and only 12.8% dentists used mortar/pestle for trituration. Similar to this a study conducted by Ashima Garg Sood in 2011 showed that 55% of the respondents used amalgamator to mix amalgam which is the safe method where silver powder and mercury are forced together in a capsule by provision of a vibration.[15] However, a study conducted by Sarita Bhardawaj in 2017 showed that 86% of dentists never used amalgamator, and mortar/pestle was used for trituration.[12] That means bulk mercury and alloy is used which puts them at high risk. Amalgam leftover scrap should be stored in tightly closed container either dry or in radiographic fixer solution, which cannot be disposed along with biological wastes because mercury contaminated waste cannot be incinerated or autoclaved. If incinerated or autoclaved mercury vapors would volatize and enter into the atmosphere posing health hazard to the dental professionals.[16] In our study only 25.8% of dentists stored amalgam scrap in empty bottle and 8.8% of them stored in a bottle with radiographic fixer and 91.5% of dentists disposed this bottle with other biomedical waste. Similar to this a study conducted by Sarita Bhardwaj where 31% of dentists were storing leftover amalgam scrap in a bottle with radiographic fixer solution.12% were storing in an empty bottle. However 51% of the dentists disposed this bottle along with other biomedical waste.[12] Dental operatory should be periodically checked for vapors to avoid the risk of mercury toxicity. The occupational exposure standard limits (OELs) for mercury vapor are 25 µg/m3 for 8 hours a day and 40 hours a week on time/weight average (TWA).[17] In our study only 8.5% of dentists periodically monitored mercury vapors. Similar to this a study conducted by Sarita Bhardawaj in 2017 showed that 83% of dentists were not checking mercury vapor periodically.[12] This means that there is lack of knowledge regarding periodical monitoring of mercury vapors which poses a great threat to the health of dental professionals.

Conclusion

Results of the present survey showed that dental mercury hygiene recommendations are not being followed by dentists because there is a significant lack of knowledge regarding mercury hygiene and amalgam waste disposal among dentists of Pakistan. Our survey was limited to Rawalpindi and Islamabad, a country level survey should be conducted and there is an urgent need to develop a systematic amalgam waste management plan and the guidelines on mercury waste management need to be strongly implemented by the concerned areas to prevent contamination of environment by mercury.

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