Original Article

Dental amalgam and mercury waste disposal practices in dental clinics of Lahore, Pakistan

Nauman Ahmed Noor, Maria Asmat, Aneela Qaisar, Samia Shafiq, Sanam Ayesha, Saadia Bano Lone

Department of Dentistry, FMH College of Medicine and Dentistry and Bolan Medical College Sandeman Provincial Hospital, Quetta, Pakistan

Objective: To determine the awareness and implementation by dental clinics of contemporary guidelines for disposal of amalgam waste complying with American Dental Association (ADA) specifications for control of mercury and amalgam.

Methodology: This cross-sectional survey of 70 clinical practices was conducted in Lahore. We used a questionnaire about the frequency of amalgam restorations performed and removed per month and also regarding the dispensing methods and measures to control amalgam waste.

Results: Out of 70 practices, only 60% were using dental amalgam and none of the dental clinics complied with the ADA standards to dispose and recycle the amalgam waste. Most of the dentists claimed that they had an adequate knowledge of standard methods to control the amalgam waste at the chairside by using special containers for waste disposal. The majority of the participants were not following the current protocol of mercury waste disposal. None of the dentists had installed amalgam separators in their clinics. 66% were disposing of amalgam wastes in common waste bins, 4% in sinks, and 22% were placing it in a photographic fixer solution. 56% of three practices were using the encapsulated form whereas, 43% were triturating it with mortar and pestle.

Conclusion: Guidelines for disposal of amalgam waste were not being followed in many dental clinics. Dental practices need to be aware of contemporary practices and disposal techniques to minimize the hazards to people and the environment. Government regulationsand necessary legislation may help in proper disposal of mercury and other hazardous wastes.

Keywords: Dental amalgam, mercury waste, amalgam separators.

INTRODUCTION

Ever since the advent of the use of amalgam as a restorative material back in 1845, it has been marred by controversies. The American Society of Dental Surgeons declared that the use of amalgam constituted malpractice. In the 1930s and later in the 1980s, the controversy deepened further when it was claimed that mercury can be absorbed in the body from dental amalgam, leading to serious health issues.[1-3] Meanwhile, in 1997, the World Dental Federation (FDI) and the World Health Organization concluded in a consensus statementthat scarce published data was proving the systemic adverse effects from amalgam restorations.[2,4] The results of a comprehensive literature review carried out by the American food and Drug Administration (FDA) and the American Dental Association (ADA) Council on Scientific Affairs concluded that dental amalgam is a safe and valuable choice for patients.[5,6]

One of the main areas of concern with regards to amalgam is proper waste disposal and mercury hazards to health and the environment. However, many debates are focused on its effects on the patient and dentist during the preparation, installation, and dismantling of wastes.[6] According to the studies conducted by FDA, the amount of mercury released from an amalgam restoration may be as low as 1 – 3 µg/day or as high as 27 µg/day.[7,8] The exposure from dental amalgam occurs mainly by inhalation of elemental mercury, which may evaporate during the initial stages of mixing and placing the restoration.[9] The lungs may absorb the mercury vapors and may transfer about 80% of them to the bloodstream. Through blood circulation, mercury can enter the central nervous system and the kidneys.[10,11]

FDI or ADA recommendations present easy guidelines, which should be followed to avoid the mercury hazards in dental clinics. If amalgam waste or mercury is spilled in the sink then a chlorine containing bleach should be used to clean pipelines.[11,12] This study aimed at evaluating the procedures and knowledge for disposing of amalgam in dental clinics of Lahore according to FDI/ADA guidelines.

METHODOLOGY

This cross-sectional study was approved by the Institutional Review Board of Fatima Memorial College of Dentistry Lahore. A questionnaire was formulated keeping in mind the current practices and guidelines in the country. The survey was conducted across 70 different private practices in Lahore, which were randomly selected from different areas of the city.

The dentists were asked to fill the questions related to manipulative methods of amalgam alloy and the number of amalgam restorations performed and removed per month. In addition, their preferred method for dental amalgam waste disposal such as the use of special containers for disposal and protocols of waste management were determined. The knowledge of the practice of use of equipment like amalgam separators, chairside traps, and using vacuum pump filters was also evaluated.

Statistical Analysis: The data was analysed using SPSS version 23 and expressed in frequency and percentages.

RESULTS

Out of 70 dentists, only 45 dentists are using dental amalgam (Table 1). Among 45 dentists, none followed the ADA and FDI standards to dispose and recycle the amalgam waste. Most of the dentists thought that they have adequate knowledge of standard methods to control the amalgam waste at chairside. Only about 49% were of opinion that amalgam waste should be discarded in special containers (Fig. 1). Only 25% suggested that amalgam separators should be installed at chairside to prevent environmental damage and contamination of water and sewerage lines. There were only 8% of participants knew that vacuum pump filters should be used for amalgam waste disposal.

Table 1: Usage of dental amalgam amongst dentists.

Usage of Dental Amalgam in Clinic	Total No of Participants (70)	Percentage
Dentists using amalgam	45	64
Dentists not using amalgam	25	36

We found that 66% of the practices were using the normal waste bin for disposal of amalgam waste and about 4% were dumping it in the sink, while 22% were disposing of amalgam waste in fixer solution. 8% of them were using other methods of disposal (Table 2). No one had adequate knowledge of the proper disposal of amalgam waste. The majority of dentists (56%) preferred to use the encapsulated (amalgamator) alloy/mercury ratio as shown in (Fig. 2).

Table 2: Method of disposing amalgam waste.

Method	Number	Percentage
Sink	2	4%
Bin	30	66%
Photographic fix solution	10	22%
Proper recycling method	0	0%
Others	4	8%

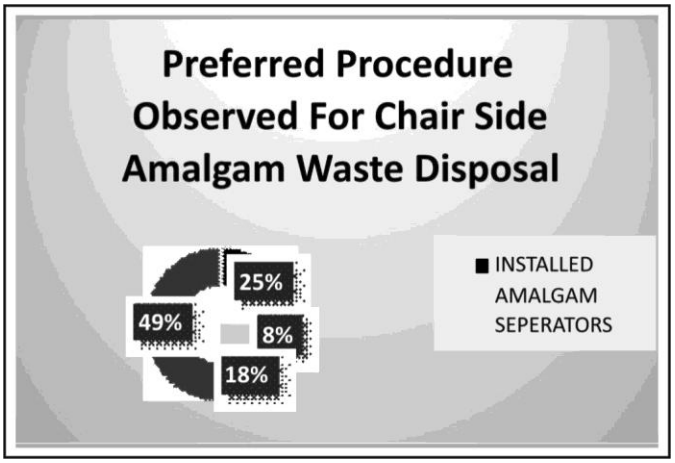

Fig. 1: Preference of amalgam waste disposal procedure by dentists.

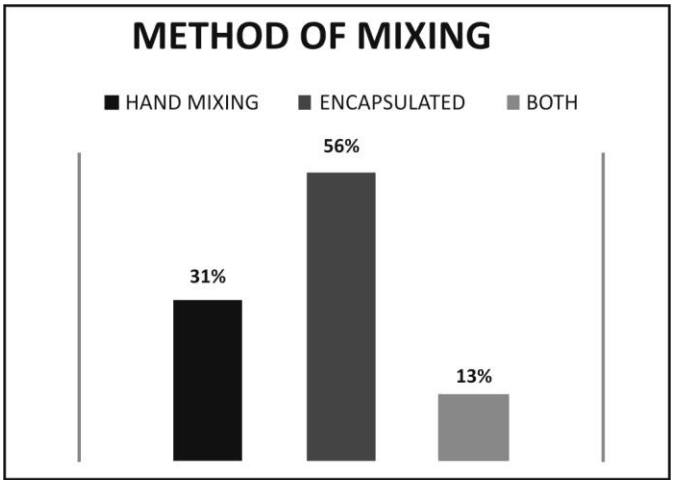

Fig. 2: Routine methods of amalgam mixing by dentists.

DISCUSSION

Dental amalgam has been the choice of material for the restoration of posterior teeth for over a century.[13] The

waste associated with leftover amalgam and mercury has often been disposed of casually with the resulting waste ending up in bins and sewers and contaminating the environment. With the passage of time, the advent of newer materials has resulted in a decline in the use of amalgam but many dentists still use amalgam in their practices due to its low cost and long service life.[14-16] These finds are in accordance with another study by Bhardwaj et al which concluded that 63% of dentists were doing amalgam restorations and 29% were not performing amalgam fillings.[17]

Our findings are in accordance with the results of an earlier study which reported that 37.5% of dentists were using manual trituration while 58.6% were using the encapsulated form with mechanical trituration.[18] Many studies conducted by different researchers have concluded that there is a lack of awareness among general dentists about the proper disposal of amalgam waste as proposed by FDI/ADA.[18,19] Our results showed that 66% of the dentists throw the amalgam scrap in the waste bin, while only 22% used a fixer solution for storing the waste.[20]

There have been several studies from Pakistan regarding amalgam waste and mercury disposal and practices adopted by dental practitioners. In Karachi and Peshawar, studies were conducted in which researchers evaluated the procedure/s of amalgam waste disposal at dental hospitals.[14] According to the survey results, none of the studied dental hospitals in Karachi followed theADA or International Standards Organization (ISO) protocol of mercury disposal and recycling.[21,22]

The results of our study coincide with a previous study carried out by Iqbal et al to evaluate dental amalgam waste practices at teaching institutions and private clinics of Islamabad, Lahore, and Rawalpindi.[18] According to several studies, private clinics disposed of amalgam waste in the sink while the hospitals dumped it in the trash cans.[21,22]

For mercury hygiene protocol there needs to be a proper layout of the dental clinics. The removal of amalgam restorations and amalgam waste storage is also a matter of concern. The release of mercury into dental office wastewater or solid waste is an important concern as these particles could then be released into the environment.[23] All of the potential hazards can easily be avoided by taking precautionary measures as specified by ADA /ISO.[2,24] There is no prerequisite of costly equipment for disposal of amalgam waste. Safe practices can be employed by providing fundamental guidelines by the Government to hospitals and dental clinics. The facilities relating to permanent disposal should be established and equipment required to assess mercury levels according to international standards should be available in the market.

CONCLUSION

Guidelines for disposal of amalgam waste were not being followed in many dental clinics. The health regulatory authorities of our country need to develop and implement guidelines for amalgam waste and mercury disposal. Educating the dentist on how to deal with the waste is an essential component of this task and such should be made part and practice of the teaching curriculum. All hospitals and clinics should take immediate necessary measures to update their hazardous waste disposal systems to minimize the environmental impact.

Author Contributions:
Conception and design: Nauman Ahmed Noor.
Collection and assembly of data: Sanam Ayesha.
Analysis and interpretation of data: Maria Asmat.
Drafting of the article: Nauman Ahmed Noor.
Critical revision of article for important intellectual content: Nauman Ahmed Noor.
Statistical expertise: Saadia Bano Lone.
Final approval and guarantor of the article: Aneela Qaisar, Samia Shafiq.
Corresponding author email: Aneela: draneelaqaiser@gmail.com
Conflict of Interest: None declared.
Rec. Date: Sep 6, 2021 Revision Rec. Date: Nov 30, 2021 Accept Date: Mar 10, 2022.

REFERENCES

1. Hegde A, Shetty G, Jayasheelan N. The Perturbation Encompassing Dental Amalgam Toxicity: A Review. Ind J Forensic Med Toxicol. 2020; 14: 147-53.
2. Ajiboye AS, Mossey PA, IADR Science Information Committee, Fox CH. International Association for Dental Research Policy and Position Statements on the Safety of Dental Amalgam. J Dent Rese. 2020; 99: 763-8.
3. Marin E, Boschetto F, Pezzotti G. Biomaterials and biocompatibility: An historical overview. J Biomed Mater Res Part A. 2020; 108: 1617-33.
4. Manchanda AS, Narang RS, Kaur N, Kaur J, Kaur D. A systemic review & meta-analysis on association between amalgam fillings and systemic diseases. IJCDC. 2017; 7: 944-951.
5. Julian F, Benoit V, Desiree N. The Minamata Convention and the Phase Down of Dental Amalgam. Bull World Health Organ, 2018; 96: 436-8.
6. National Centre for Toxicological Research, US Food and Drug Administration, 2009. White paper: FDA update/review of potential adverse health risks associated with exposure to mercury in dental amalgam. Jefferson (AR): US Department of Health and Human Services.
7. Ogunseitan OA. Mercury safety reform in the 21st century: Advancing the new framework for toxic substances control. Environ Sci Policy. 2017; 4; 59: 4-13.
8. Smidt MB. In Celebration of Earth Day, 2020: How Far

Have We Come?
9. Reher V, Reher P, Peres KG, Peres MA. Fall of amalgam restoration: a 10-year analysis of an Australian university dental clinic. Aust Dent J. 2021; 66: 61-6.
10. Natarajan, K, Ranjan, M. Knowledge, Attitude and Practice on Dental Amalgam Restoration among Dental Students. JPRI. 2020; 32: 39-48.
11. Al-Khafaji TGH, Al-Timimi AHO, Abbas AS, Alanz MAA, Murshedi SJK, Alam MK. Mercury loss from dental amalgam fillings. Pesqui Bras Odontopedia Clín Integr. 2020; 20: e5267.
12. Sekovanić A, Piasek M, Orct T, Sulimanec Grgec A, Matek Sarić M, Stasenko S, et al. Mercury Exposure Assessment in Mother–Infant Pairs from Continental and Coastal Croatia. Biomolecules, 2020; 10: 821-4.
13. Kamel JH, Salman FD. Mercury release from a two surface amalgam restoration. Al-Rafidain Dent J. 2020; 1: 61-4.
14. Iqbal K, Asmat M, Kumar N. An evaluation of disposal of mercury waste in dental teaching hospitals of Karachi. J Pak Dent Assoc. 2012; 21: 108-11.
15. Al-Nahedh HN, El-Hejazi AA, Habib SR. Knowledge and Attitude of Dentists and Patients towards Use and Health Safety of Dental Amalgam in Saudi Arabia. Eur J Dent. 2020; 14: 233-8.
16. Haque N, Yousaf S, Nejatian T, Youseffi M, Mozafari M, Sefat F. Dental amalgam in Advanced Dental Biomaterials, 2019 Jan 1: (pp. 105-125). Wood head Publishing.
17. Bhardwaj S, Bhardwaj A, Kalra T. Knowledge and practices regarding mercury hygiene and amalgam waste disposal: A survey among general dental practitioners. Ind J Dent Sci. 2017; 9: 30-3.
18. Iqbal K, Husain S, Mahmood U, Rizwan Ullah. An Evaluation of Dental Amalgam Waste Disposal Practices in Dental Teaching Hospitals and Private Clinics of Islamabad. AJSMU. 2018; 4: 75-9.
19. Ramesh KK, Ramesh M, Krishnan R. Management and Disposal of Mercury and Amalgam in the Dental Clinics of South India; A Cross Sectional Study. J Pharm Bioall Sci. 2019; 11: 151-5.
20. Lakbala P. Dental waste management among dentists of Bandar Abbas, Iran. AIMS Environ Sci. 2020; 7: 258-67.
21. ADA Council on Scientific Affairs. Dental mercury hygiene recommendations. J Am Dent Assoc. 2003; 134: 1498-9.
22. Iqbal K, Maria A. Uses and Effects of Mercury in Medicine and Dentistry. J Ayub Med Coll Abbottabad, 2012; 24: 204-7.
23. Iqbal K, Ali S, Mohsin F. Amalgam waste disposal in dental hospitals of Peshawar. Pak Oral Dent J. 2012; 32: 540-2.
24. Olivera DS, Morgan MT, Tewolde SN, Botts EC, Horvath FP, Hamlin NJ. Clinical Evaluation of a Chairside Amalgam Separator to Meet Environmental Protection Agency Dental Wastewater Regulatory Compliance. Oper Dent. 2020; 45: 151-62.