

## EVALUATION OF DENTAL WASTE MANAGEMENT IN THE EMIRATE OF AJMAN, UNITED ARAB EMIRATES

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### Abstract

Management of dental waste was investigated in Ajman, United Arab Emirates. A comprehensive survey was conducted for 49 of the 52 dental clinics available in the Emirate of Ajman to assess the current situation.

The focus was placed on hazardous waste produced by dental clinics and the handling, storage, disposal measures taken. Dentists were interviewed regarding their disposal of different dental waste. All the clinics segregated infectious waste from the main waste stream. Most of the segregation (75.5%) took place inside the clinics; Non contact amalgam was placed in trash in 47% of the clinics. Used fixer and developer poured down the drain by 93.9% of the clinics. About 83.7% of the clinics disposed the used X-ray films into regular waste.

The findings revealed that there is no proper separation of dental waste. Further research should be conducted, and construction of a training program constructed for the dentists and personnel who are in charge of waste management.

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### Introduction

Health care establishments (including dental clinics) are mainly concerned with providing high standard services to the community; this cannot be fully accomplished unless a proper waste handling policy that is consistent with the international regulations is strictly implemented. Even though dental clinics generate relatively small quantities of healthcare waste compared to the other medical facilities. Nevertheless they are responsible for generating a certain amount of waste which can produce serious health and environmental hazards if not dealt with properly.

The World Health Organization<sup>1</sup> defines healthcare waste (HCW) as discarded (and untreated) materials from health care activities on humans or animals that have the potential of transmitting infectious agents to humans. These wastes include equipment or materials from the diagnosis, treatment and prevention of disease that have been in contact with blood and its derivatives, including tissues, tissue fluid or excreta, or waste from infection wards. According to Kizlary *et al*<sup>2</sup>, dental waste consists of three main categories: Infectious waste, non-infectious waste and domestic-type waste. Infectious waste contains materials contaminated with blood or other infectious fluid of the mouth, sharps and amalgam.

The common sources of major hazardous waste at dental clinics includes X-ray fixers and film, chemical disinfectants, dental amalgam, sharps and blood-soaked dressings, silver, lead, various solvent and other chemicals<sup>3</sup>.

The key to minimization and effective management of health care waste is segregation (separation) and identification of the waste. Appropriate handling, treatment and disposal of

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waste by type reduce costs and does much to protect public health<sup>4</sup>.

Although many developed countries have successfully managed to establish comprehensive systems for waste management, developing countries still tend to suffer from improper waste disposal<sup>5-7</sup>, insufficient financial resources<sup>8</sup>, lack of awareness of health hazards and few data on health care waste generation and disposal<sup>9</sup> were identified as the main reasons responsible for that problem.

Consequently, generated dental waste has the potential to be discharged into the waste water system and the majority of dental solid waste is dumped into household disposal sites and landfills without any recycling and separation processes. Since some of these wastes are hazardous in nature, this practice can create a potential risk to human health and to the environment<sup>10</sup>.

Currently, no study has investigated the generation and management of dental waste in the Emirate of Ajman. In the absence of such study, we investigated the handling and disposal of various types of dental waste generated on daily basis within the dental clinics throughout the Emirate of Ajman in United Arab Emirates.

### Materials and methods

There were a total of 52 registered dental clinics in the Emirate of Ajman distributed between governmental and private sectors. Out of those 52 clinics, 49 were private according to Ajman Municipality records in 2009. After preliminary construction of the questionnaire, it was distributed to six dentists to test its validity; their suggestions regarding some modifications in the design of some of the questions were taken into account.

Field visits to all dental clinics in the Emirate of Ajman were carried out over the month of March and April 2009.

Structured interviews lasting from 20 to 30 minutes were conducted, with the dentists using the pilot-tested questionnaire designed by the authors of this article. In each clinic, only 1 dentist was interviewed.

However, data could not be collected from 2 of the private clinics because the dentists serving these clinics were abroad at the time of the study.

The first part of the questionnaire (Appendix 1) included data on gender of the dentist, years of experience, number of staff at the clinic, and whether the dentist or their working staff were vaccinated against Hepatitis B. The last item was included due to the risks that are present for the health personnel who handle dental wastes, especially sharps; whether it was the dentist himself/herself or staff such as nurses, assistants or waste handlers. We have also included a question whether the person in charge of waste handling had received any professional training on dental waste management procedures before. In addition, the dentists were asked if they were aware of any documents outlining the clinics' waste management policy.

The second part of the questionnaire focused on the types of the clinical waste being segregated from the main waste stream on a daily basis, and where segregation and storage takes place in addition to the period of time the waste kept before removing it out of the clinic. Amalgam waste question focused on the disposal of the old removed or extra newly placed amalgam fillings. Furthermore, dentists who used X-ray units in their clinics were asked about the disposal of the processing solutions and X-ray films.

Data were entered and analyzed using the statistical program SPSS (Statistical Package for the Social Sciences) Version 11.0. Descriptive statistics such as frequencies were utilized.

### Results

In this study 61% of participated dentists were male and 43% had more than 10 years experience. The majority of the dentists (96%) were vaccinated against hepatitis B virus. Most of the clinics (86%) had other personnel rather than the dentist (dental assistant, nurse...etc.), of those only 60 % were vaccinated against hepatitis B virus.

The waste handlers in 51.1% of the clinics were the persons in charge of waste collection, handling and storage (Table 1). Around half (51.1%) of the staff responsible for waste management did not receive any professional training on waste management. Concerning documents outlining waste management, 83.7% of the dentists were unaware of any document outlining the policy of waste management in the Emirate of Ajman.

Question	Number	Percentage
<b>Who is in charge of waste collection handling in the clinic?</b>		
Dentist	7	14.3%
Assistant	11	22.4%
Nurse	6	12.2%
Waste handler	25	51.1%
<b>Has he/she received any professional training on waste management?</b>		
Yes	24	48.9%
No	25	51.1%
<b>Are you aware of any document outlining dental waste management policy?</b>		
Yes	8	16.3%
No	41	83.7%

**Table 1.** Status of personnel in charge of waste management.

All the clinics segregated infectious waste (blood soaked dressing, extracted teeth, sharps) from the main waste system, while 30.6% segregated infectious and heavy metal waste (amalgam mainly) and only 18.4% segregated infectious, heavy metal waste and chemical waste (cleaning solvents) as presented in table 2.

Question	Number of Clinic	Percentage
<b>Indicate which waste is segregated from the main waste system?</b>		
Infectious waste only	25	51.0%
Infectious waste & heavy metal waste	15	30.6%
Infectious waste, heavy metal waste & Chemical waste	9	18.4%
<b>What type of bags/containers are used to segregate the waste?</b>		
Normal plastic bags	1	2.0%
Color-coded bags/containers	48	98.0%
<b>Disposal of non contact amalgam</b>		
Trash	23	47.0%
Drain & trash	3	6.1%
Return to capsule then trash	10	20.4%
Separate bottle	13	26.5%
<b>Where does segregation take place?</b>		
Inside clinic	37	78.5%
Outside clinic	7	14.3%
Lab area	5	10.2%
<b>Where is the waste stored while awaiting removal from clinic?</b>		
Inside clinic	20	40.8%
Outside clinic	18	36.7%
Lab area	11	22.5%
<b>How long is the waste kept before removing it out of the clinic?</b>		
Less than 5 days	33	67.3%
More than 5 days	16	32.7%

**Table 2.** Segregation, storage, and disposal of dental waste.

The majority of these clinics (98%) used color coded bags/containers to segregate the waste. Non-contact amalgam was placed in trash in 47% of the clinics, while, in 20.4 % of the clinics it was returned to capsule and then trashed. Most of the segregation (78.5%) took place inside the clinic's treatment area, waste was stored inside the clinic treatment area in 40.8% of the clinics, and in more than half the clinics (67.3%) it was kept for less than 5 days until the municipality collected it.

Regarding disposal of used fixer and developer 93.9% of clinics poured it down the drain. About 83.7% of the clinics disposed the used X-ray films into the regular waste. As for the lead foil, 81.6% of the dentists discarded it with the regular waste (Table 3).

Question	Number of Dentist	Percentage
<b>Disposal of used fixer</b>		
Drain	46	93.9%
Dumped in specific grounds	3	6.1%
<b>Disposal of used developer</b>		
Drain	46	93.9%
Dumped in specific grounds	3	6.1%
<b>Disposal of used x-ray film</b>		
Trash	41	83.7%
Recycling companies	2	4.1%
Medical waste bag	6	12.2%
<b>Disposal of used x-ray foil</b>		
Trash	40	81.6%
Recycling companies	3	6.1%
Medical waste bag	6	12.2%

**Table 3.** Modes of disposal of X-ray related waste.

## Discussion

The validity and reliability of questionnaire based surveys can be influenced by design, question content, analysis and response rates. The main limitation of this study is its cross-sectional nature and the information collected represent a "snap-shot" of what the dentists are actually doing; this could perhaps have introduced some inaccuracies in reporting.

The 49 dental clinics included in this study represent about 94.2% of all Ajman dental clinics (49 out of 52) and the results showed that there is a clear shortfall in waste regulations if compared to the international standards.

The majority of dentists had been vaccinated against hepatitis B virus, while 40% of the supporting staff at the clinics had not, which is alarming. Like any other health personal, dental care professionals are at risk of infection from blood borne pathogens. Therefore, it is strongly recommended that hepatitis B vaccination be administered to all dental health care workers as well as others who deal with medical waste.

Safe handling of hazardous waste is essential. All involved personal need to be aware of possible health hazards present and must be trained in the appropriate handling, storage and disposal methods. In this study, around half of personal dealing with dental waste did not receive any kind of professional training outlining this issue, although OSHA states that all employees with occupational exposure must receive initial and annual training<sup>11</sup>. The overall aim of training is to raise awareness and highlight roles of all personnel involved. It was disappointing to find that the majority of the dentists did not have any knowledge of any documents outlining waste management, which does not only jeopardize the safety of the workers, but also causes avoidable mishaps in handling of dental waste.

Sharps such as needles, syringes, and used ampoules are regarded as highly hazardous health care waste since they can cause injuries and transmitted diseases, especially to waste collection, treatment and disposal personnel<sup>11,12</sup>. These wastes must be segregated at the point of origin and packed in a rigid, leak-proof, puncture resistant container and the container must be specially labeled<sup>13</sup>. In the current study, all the clinics segregated infectious waste, were disposed off in the color coded yellow bags, with sharps placed in puncture resistant containers as outlined by the National Center for Chronic Disease Prevention and Health Promotion<sup>4</sup>. Studies conducted in Riyadh found that 72% of dental clinics in primary health care centers had containers for disposable needles and sharp instruments<sup>14</sup> and 56% of dentists had special containers for sharp objects<sup>15</sup>.

On the other hand, one third of the clinics segregated heavy metals (amalgam mainly) but all were placed in the yellow bags for infectious wastes and ended up being incinerated which is not the best management protocol for amalgam<sup>16</sup>.

Research work has shown that improper disposal of mercury waste may be detrimental to the environment and public health. A variety of health problems linked to mercury intoxication range from joint pain to multiple sclerosis<sup>17</sup>.

The amalgam waste should remain in a properly labeled sealed container that is appropriate for storing contaminated amalgam waste and should be sent for the contents to be recycled<sup>18,19</sup>. Used and empty amalgam capsules may be disposed of as solid waste since they are non-hazardous. Most of the segregation 78.5% took place inside the dental clinic treatment room, as recommended by Pruss et al.<sup>11</sup> where waste should always be segregated at site of generation, immediately. In the current study, 40.8% of the dental clinic store their waste inside the clinic, until the municipality collected it in less than 5 day intervals. As long as the waste is kept in appropriate receptacles complying with WHO recommendations and is inaccessible for vectors such as rats, rodents or cockroaches, it can be stored for a period not exceeding 30 days<sup>19</sup>.

Most of the used fixer and developer were poured down the drain, for used developer it is quite safe to be disposed down the drain<sup>20</sup>. Fixer is hazardous because of its high silver content. Therefore, discarding of used fixer down the drain or into the garbage, as is done by dentists in the Emirate of Ajman, poses a serious threat to the environment and human health. This should be collected in a clearly marked container and should subsequently be recycled or treated as hazardous waste. The World Health Organization recommendations require a silver recovery unit to be installed at the end of the X-ray processing unit<sup>11</sup>.

The recovered silver can then be sold to a metal reclaimer and the treated fixer can be disposed of down a drain. As most dental clinics in Ajman and many developing countries produce small amount of waste individually, the silver recovery unit designed to these standards is needed rather than the more commonly designed units that handle larger and continuous quantities of waste. Furthermore, lead foil, used to shield the X-ray film, should be dealt with as hazardous waste and not disposed of with regular waste. It is worth noting that none of the dental clinics surveyed uses the digital system of x-ray machines.

Training courses regarding waste management should be mandatory as it is crucial

for the upgrade of dental waste management practices. This should be part of a more comprehensive continuous education program for all dental personnel. The overall aim of training is to develop awareness of the health, safety, and environmental issues relating to health-care waste, and how these can affect employees in their daily work. Every dental clinic should have a written document explaining the dental waste management policy which should be understood by those who have to follow it taking in consideration those who do not have a good command of English or Arabic.

## Conclusions

This study might be considered as the first step in a more in depth research that should be performed in the future regarding the issue of dental waste management in specific and medical waste management in general. Such issues pose a high level of hazard to the community but are still over looked in most of the third world countries. Therefore, a national collaborative effort should be made to minimize the effects of solid and liquid wastes to the minimum, and to address these threats in comprehensive, effective ways. An environmentally responsible dental office can help in restoring a healthier environment and can always make a difference.

## Declaration of Interest

The authors report no conflict of interest and the article is not funded or supported by any research grant.

### (Appendix 1)

#### Dental Waste Management Questionnaire

Gender: Male Female

Years of experience:

1- Are you vaccinated against HBV?

Yes No

2- Does the clinic have any personal other than the dentist?

Yes No

If yes are they vaccinated against HBV?

Yes No

3- Do they use any PPE -personal protective equipment - (gloves, mask, and lab coat)?

Yes No

4- Who is the person in charge of waste collection handling and storage at the clinic?

- Dentist      • Assistant
- Nurse        • Waste handlers

5- Has she\he received any professional training on waste management?

Yes No

6- Are you aware of any document outlining dental waste management policy?

Yes No

7- Indicate which waste is segregated from the main waste stream?

- Infectious waste only
- Infectious waste & heavy metal waste
- Infectious waste, heavy metal waste & Chemical waste

8- What types of containers\bags are used to segregate the waste?

- Normal plastic bags
- Color coded bags
- Other

9- How do you deal with non contact amalgam?

- Thrown in trash
- In drain and trash
- Returned to capsule then trash
- Separate bottle

10- Where does the segregation take place?

- Inside clinic
- Outside clinic
- Lab area (if present)

11- Where is the waste stored while awaiting removal from clinic or disposal?

- Inside the clinic
- Outside the clinic
- Lab area (if present)
- Other

12- How long is the waste kept before removing it out of the clinic\store area?

- Less than 5 days
- More than 5 days

13- How do you dispose the used fixer?

- In the drain
- Dumped in specific grounds
- Given to recycling companies
- Returned to manufacturing company

14- How do you dispose the used developer?

- In the drain
- Dumped in specific grounds
- Given to recycling companies
- Returned to manufacturing company

15- How do you dispose used x-ray films?

- In the trash
- Given to recycling companies
- Medical waste bag

16- How do you dispose lead foil used in film packet?

- In the trash
- Given to recycling companies
- Medical waste bag

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