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The Management of Dental Waste in Dental Offices and Clinics in Shiraz, Southern Iran

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Abstract

Background: Dental waste can be hazardous to humans and the environment.

Objective: To determine the current status of dental waste management in private and public dental clinics and private dental offices in Shiraz, southern Iran.

Methods: This cross-sectional study was conducted at the Shiraz University of Medical Sciences from February through June 2013. A stratified random sampling method was used to study 86 private offices, 14 private clinics and 10 public clinics. Types of waste studied included mercury and amalgam, lead foil packets, sharps, infectious tissues and fluids, pharmaceuticals and domestic waste materials. Compliance with established standards by the monitored dental offices and clinics and public clinics were compared.

Results: 89.1% of dental offices and clinics disposed their infectious waste with domestic waste. Only 60% of centers used standard method for sharps disposal. None of the dental centers disposed their pharmaceutical waste and x-ray fixer waste by standard methods. Less than 10% of centers recycled the amalgam and lead foil pockets waste to the manufacture.

Conclusion: Government agencies should establish monitoring programs for all dental offices and clinics to identify noncompliant activity and enforce recommended regulations.

Keywords: Dental waste; Medical waste; Waste management; Hazardous waste; Medical waste disposal; Solid waste

Introduction

The amount of waste generated in dental offices and clinics is considerably less than that coming from other types of health care facilities. However, the hazardous nature of these waste materials requires policy makers to enforce established waste regulations. Important types of waste generated in dental

clinics and dentists' offices include sharps, infectious waste, and waste with high heavy-metal contents.¹ Dental diagnoses and treatment generates several types of hazardous solid waste such as amalgam, etching acid equipment, caustic powders, used x-ray fixer, disinfectants and lead foils packets.^{2,3} Sharps and materials contaminated with blood and other body fluids generated in dental offices and clinics,

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if improperly managed, could expose patients, practitioners and their families to cross-transmission of blood-borne pathogens, including hepatitis B, hepatitis C and HIV and other opportunistic pathogens.^{4,5}

Contamination of the environment with heavy metals is a worldwide concern. Improper collection and disposal of amalgam waste can lead to occupational exposure to mercury. Environmental pollution with waste amalgam can have nephrotoxic and neurotoxic effects.^{6,7} Mercury has adverse effects on gastrointestinal, respiratory, immune and renal systems. Pregnant and lactating women and children are more susceptible to mercury exposure.^{8,9} Silver used in radiographic fixer solutions can negatively affect the environment. Lead also can have adverse effects, especially on water ecosystem.¹⁰

There are several guidelines directed towards the proper and safer management of dental generated waste.^{1,11} In developing countries, dental waste management tends to be sub-optimal. World Health Organization (WHO) recommendations are not always followed.¹²

A study from India reported that 35.7% of dental health care workers did not segregate various types of waste prior to disposal, while 15.9% add office/clinic waste to domestic garbage bins.¹³ A study conducted in dental clinics of Hamadan, northwestern Iran, found that 91.14% of dental waste was domestic, while 6.7%, 2.14% and 0.02% were chemical, infectious, and toxic, respectively.¹⁴ The studies also reported that dental waste management, especially hazardous waste, was inadequate. Recently, research conducted in Shiraz reported improper management in hospitals and clinical laboratories.^{5,15,16}

Because there are no published studies concerning dental waste management in Shiraz, southern Iran, we conducted this study to assess waste practices in private and public dental clinics and private den-

TAKE-HOME MESSAGE

- Dental waste can be hazardous to humans and the environment.
- Waste management in dental offices and clinics in Shiraz, Iran is inadequate.
- Waste management in private dental offices is less proper than public offices and clinics.
- Government agencies should establish monitoring programs for all dental offices and clinics to identify noncompliant activity and enforce the recommended regulations.

tal offices.

Material and Methods

This cross-sectional study was conducted in Shiraz University of Medical Sciences from February to June 2013. The study included 595 private and public dental offices and clinics in Shiraz. After a pilot study, the prevalence of abiding to the dental waste management recommendations was estimated to be 10%. Based on a prevalence of 10%, type I error of 0.05, type II error of 20%, precision of 0.05, and assuming a finite population, the minimum sample size was calculated to be 110. Therefore, 110 clinics and offices were selected for participation.

At the time of the study, there were 469 private offices, 73 private clinics and 53 public clinics in Shiraz. Using a stratified random sampling method, 86 private offices, 14 private clinics, and 10 public clinics were selected. A data collection form designed by the authors was used to evaluate the current status of dental waste management in the selected facilities. The gathered information were about the status of collection and disposal of different types of waste including mercury and amalgam waste, used lead foil packets and

Table 1: The frequency of different ways of collection and disposal of domestic, infectious, sharps and pharmaceutical waste

Waste type	Collection, n (%)				Disposal, n (%)			
	Black plastic bags	Yellow plastic bags	Safety boxes	Special container	As domestic waste	As infectious waste	As sharps waste	Encapsulation
Domestic	104 (94.5)	6 (5.5)	NA*	NA	104 (94.5)	6 (5.5)	NA	NA
Infectious	9 (8.2)	97 (88.2)	4 (3.6%)	NA	98 (89.1)	12 (10.9)	NA	NA
Sharp	1 (0.9)	8 (7.3)	101 (91.8)	NA	40 (36.4)	4 (3.6)	66 (60)	NA
Pharmaceutical	26 (23.6)	67 (60.9)	10 (9.1)	7 (6.4)	66 (60)	34 (30.9)	10 (9.1)	0 (0)

*NA: Not applicable

sharps and infectious, pharmaceutical and domestic waste.

The authors conducted unannounced visits to the selected dental facilities. The employees were asked questions about their dental management practices. Also, actual practices were observed.

Responses and observations were entered into the data collection form and analyzed using SPSS® for Windows®, ver 15. Using guideline recommendations, the current status of collection and disposal of each subgroup of waste were categorized as being “standard” or “substandard.”

Compliance with standards methods among private offices, private clinics and public clinics were compared using χ^2 test. A p value <0.05 was considered statistically significant.

Results

Table 1 shows the frequency of different processes for collection and disposal of domestic, infectious, sharps and pharmaceutical waste used in the studied dental offices and clinics. Approximately 90% of dental offices and clinics disposed their in-

Table 2: The frequency of different ways of collection and disposal of amalgam, x-ray fixer and lead foil pockets waste

Waste type	Collection, n (%)				Disposal, n (%)				
	Black plastic bags	Yellow plastic bags	Special container	Poured in the sewage	As domestic waste	As infectious waste	Poured in the sewage	Evaporation	Recycle to the manufacturer
Amalgam	4 (3.7)	6 (5.6)	97 (90.7)	NA*	66 (61.7)	23 (21.5)	9 (8.4)	NA	9 (8.4)
X-ray fixer	NA	NA	13 (19.7)	53 (80.3)	NA	NA	62 (93.9)	4 (6.1)	0 (0.0)
Lead foil pockets	20 (40)	24 (48)	6 (12)	NA	22 (44)	24 (48)	NA	NA	4 (8)

*NA: Not applicable

Table 3: Comparing the compliance of standards between public clinics, private clinics and private offices

Standard waste collection and disposal	Private offices, n (%)	Private clinics, n (%)	Public clinics, n (%)	p value
Standard amalgam...				
Collection	74 (89)	14 (100)	9 (90)	0.434
Disposal	5 (6)	3 (21)	2 (20)	0.077
Standard x-ray fixer...				
Collection	11 (25)	1 (7)	1 (14)	0.339
Disposal	0 (0)	0 (0)	0 (0)	—
Standard domestic...				
Collection	80 (93)	14 (100)	10 (100)	0.413
Disposal	79 (92)	14 (100)	10 (100)	0.352
Standard lead...				
Collection	3 (10)	0 (0)	3 (50)	0.006
Disposal	1 (3)	1 (7)	2 (33)	0.047
Standard infectious...				
Collection	74 (86)	13 (93)	10 (100)	0.366
Disposal	7 (8)	5 (36)	0 (0)	0.005
Standard sharp...				
Collection	78 (91)	13 (93)	10 (100)	0.590
Disposal	44 (51)	14 (100)	8 (80)	0.001
Standard drug...				
Collection	7 (8)	0 (0)	0 (0)	0.352
Disposal	0 (0)	0 (0)	0 (0)	—

fectious waste with domestic waste. Only 60% of centers used a standard method for sharps disposal.

Collection and disposal of three major types of hazardous chemical waste including amalgam, x-ray fixer and lead foil pockets is described in Table 2. None of the dental centers disposed x-ray fixer wastes by standard methods. Less than 10% of

centers recycled the amalgam to manufacture and 8% recycled lead foil pockets waste.

Comparison of compliance with collection and disposal standards among public clinics, private clinics and private offices is described in Table 3. There was a significant difference between the dental facilities concerning lead collection pro-

cedures ($p=0.006$) and disposal methods ($p=0.047$). Differences existed between the three types of dental facilities considering their adherence to the standards for disposal of infectious waste ($p=0.005$) and sharps ($p=0.001$). No dental office or clinic followed standard methods for disposal of x-ray fixer solutions.

Discussion

There was a high percentage of wrong disposal of infectious and sharp waste in participated dental offices and clinics. Less than 10% of centers followed recommendations for pharmaceutical waste collection but none of the dental centers disposed their pharmaceutical waste by standard methods.

Infectious waste should be segregated in yellow leak-proof plastic bags and incinerated or autoclaved. Neutralized infectious waste can then be placed in landfills. Sharps should be collected in puncture-proof containers (safety boxes) and incinerated or autoclaved and then be placed in landfills. Pharmaceutical waste should be collected in brown plastic bags or containers and disposed by encapsulation.¹

A study conducted in Sydney, Australia, indicated that only 5 of 14 dental clinics collected and disposed their infectious waste according to the accepted guidelines.¹⁷ A survey conducted in New Zealand indicated that 24.4% of offices/clinics disposed their dental sharps within household waste.¹⁸

Less than 20% of studied centers collected their x-ray fixer waste by standard methods; none of the centers disposed their x-ray fixer waste by standard methods. Almost 90% of centers collected amalgam waste in standard containers; less than 10% of centers recycled the amalgam by standard methods. Most of studied centers collected and disposed lead foil packets waste by wrong methods. This finding

is especially worrisome since most of these types of waste were distributed directly into the environment.

Amalgam waste should be placed in labeled containers containing a mercury vapor suppressant and disposed by approved waste handlers. Silver recovery companies can glean metals from used x-ray fixer solutions. Used lead foil packets need to be placed in labeled containers and disposed by recycling.¹¹

An study from India found that approximately 39% of participating dental staff members were not segregating amalgam waste.¹³ A survey conducted in Hamadan, north western Iran, reported that 100% of amalgam waste was simply added to the local sewage system and that all used sharps were simply added to domestic waste.¹⁴

We found that, in general, collection and disposal of dental waste in Shiraz was improper. Poor adherence to standard collection and disposal recommendations could be linked to a lack of awareness by policy makers and office/clinic staff and should be considered a general weakness of the applicable regulations. Also the standard collection and disposal of some dental waste need special facilities the provision of which may be difficult or costly. Governments should establish stricter waste management regulations and initiate active surveillance of dental offices and clinics. Proper training of dental staff members is also necessary to improve their compliance. Perhaps, if dental health care workers were more aware of the occupational risks associated with used sharps, compliance with standard recommendations and guidelines would increase.

Comparing different offices and clinics indicated that adherence to dental waste disposal (*eg*, sharps, infectious waste and x-ray lead foil packets) differed significantly among various types of facilities. Dental offices and clinics need to be monitored regularly and receive information

about proper waste management.

This study had some limitations. The amount of dental waste was not calculated. Further studies are needed to investigate the volume and weight of different types of dental waste. Interventional studies may improve our understanding of the current situation of dental waste management. Government agencies should establish monitoring program in all dental care facilities to identify noncompliant practices and to better enforce current regulations.

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