JAEHR Journal of Advances in Environmental Health Research

Assessment of dental waste production rate and management in Sari, Iran

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Original Article

Abstract

Dental offices produce a variety of dangerous wastes during normal business day. Most of these waste are non-hazardous that can be managed as household wastes; however, some component are hazardous and can pose a risk to human and the environment if discarded to Municipal Solid Wastes. These types of wastes must be managed separately. Therefore, the aim of this study was to assess the component and production rate of dental waste in Sari city, northern of Iran in 2011-2012. A descriptive cross-sectional study was conducted on 64 private dental practices from 146 available dental clinics in Sari city using a checklist and questionnaires which contain 25 questions and items. Dental wastes were weighed to determined qualitative and quantitative analysis. The data were analyzed using SPSS and MS-Excel. The results indicated that 77% of produced wastes were non-hazardous. The acceptable level management was observed only in 3.7% offices. The most desirable element management was accurate collecting (30.88%) in these offices. In general, it can be concluded that there is no proper management of wastes in dental centers of Sari. The mercury recycling is required for optimal management of dental waste. Furthermore, the dentists' education must be takes place to perform the management activities including reduction, separation and recycling inside the office.

KEYWORDS: Waste Management, Dental Waste, production

Date of submission: *23 Oct 2013*, ***Date of acceptance:*** *28 Jan 2014*

Citation: Zazouli MA, Ehsan R, Barafrashtehpour M. **Assessment of dental waste production rate and management in Sari city, Iran.** J Adv Environ Health Res 2014; 2(2): 120-5.

Introduction

Dental waste is one of the high sensitivity environmental problems due to its hazardous toxic and pathogenic factors, including pharmaceutical, chemical, radioactive, infectious and sharp wastes.[1] Dental wastes are relatively new environmental issues that have been focused more in recent years and have been conducting several studies in different countries.[2]

Generated wastes at the dental centers are contained various types. Blood and bloody tissues, sharp objects, heavy metals, paper, cardboard, glass, gloves and many other materials, which are produced in these centers can be classified as infectious, non-infectious, hazardous, household and administrative wastes, etc.[3,4] The fixer and developer drugs, which are used in advent and X-ray processes contain hazardous material.[5] The conservation and recovery act Section11008(a) includes guidelines and information toward the medical waste and production centers. This information includes the quantity and quality of waste and

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its production facility and its proper management method. Dental clinics and offices produce such wastes.[6]

Some products in dentistry clinics, such as amalgam, contain mercury. Approximately, 10,000 tons per year of mercury is extracted, and it is estimated that about 3-4% is used in dentistry of Australia.[7] The most important work that can be performed in the field of efficient dental waste management is to prevent waste component to be mixed, because of their different characteristics. Therefore, management method must be regulated based on such properties.[5] Although hazardous wastes have a small fraction of dental wastes, however, they need to be managed correctly, otherwise they can transmit the disease agents, such as HIV and hepatitis B virus, and other infectious agents. They also can have negative environmental impacts, caused by heavy metals and radioactive components.[4,8]

Collection, recycling and disposal of dental wastes depend on their component. Radioactive waste must be separated from other wastes. However, infectious and sharp wastes must be collected separately in a puncture resistant container.[8] The studies in Hamadan[2] and Qazvin,[9] Iran, Palestine and India[8,10] showed the amount of produced and specific dental waste management.

Therefore, the aim of this research was to assess the component and production rate of dental wastes in Sari, Iran.

Materials and Methods

This is a descriptive cross-sectional study which it is conducted on 64 offices (which participate in this study) from 146 private dentistry offices and dentists clinics in Sari city. The data about management method of each parameter was collected by observation, interviews and questionnaires. The questionnaires were consisted the 25 questions.[5] The offices with negative total points had poor management level, point of 0-5 had average management level and more than 5 point had top management level.[5] The produced wastes were weighed using a scale (Vidas, model: vi4051). The production per capita was determined by referring to 14 randomly selected offices. Various components of wastes (non-hazardous, sharp and infectious wastes, etc.) were weighed, and the number of visiting people was recorded at a special table. Then, the amount of production per capita was calculated with whole produced waste divided to the number of visiting people. The collected data were analyzed by the descriptive statistic using the using SPSS for Windows (version 18.0, SPSS Inc., Chicago, IL, USA).

Results and Discussion

Quality and quantity of dental wastes

The amount of generated waste generated wastes per capita and percent of each part of the wastes are shown in table 1. The maximum production rate in dental clinics was related to common waste (77.06%).

Dental waste management

The results indicated that there are low, average and acceptable levels of management in the studied offices, 51.85%, 44.45% and 3.7%, respectively.

Table 1. Produced waste in dental offices of Sari with 6 ± 2 visited persons per day

	Infectious waste	Safety box wastes	Common wastes
Average of waste produced in day (g)	98.16 ± 24.38	19.66 ± 3.55	395.83 ± 96.56
Maximum (g)	122.00	25.00	520.00
Minimum (g)	60.00	15.00	270.00
Per capita (g)	16.82	3.37	67.85
Percentage (%)	19.10	3.83	77.06

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Figure 1 shows that the positive activity in various stages of dental waste management is very poor except for waste separation.

According to the results obtained by the questionnaire, proper waste disposal was observed in 3.84% of clinics. Also, the proper wastes are collecting, with regarding time, place and collecting along with municipal wastes observed in 30.88% of the studied clinics.

Table 2 presents the management methods of different parts of dental wastes, obtained by questionnaires. Mostly, the recycling and separation was poor, and the dangerous wastes were released directly into the trash or sewer system.

The reduction of waste generation is the first priority in solid waste management. While the results of this study indicated that there is no program for waste reduction in 69.2% of the Dental offices of Sari (Figure 1).

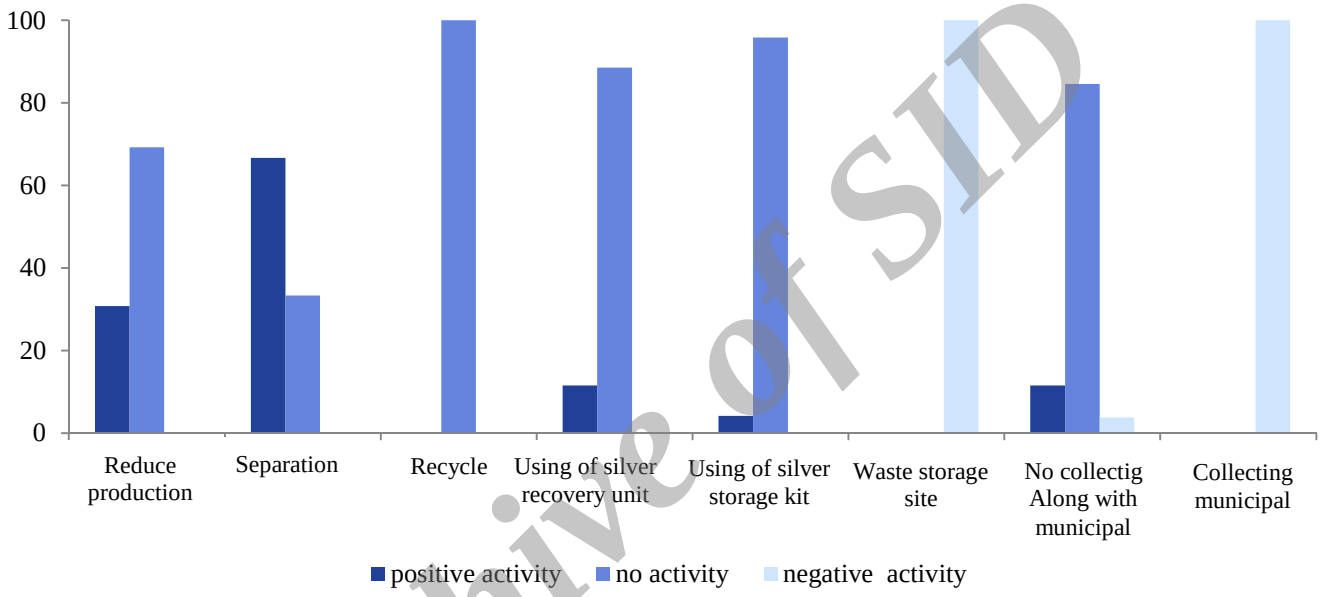

Figure 1. The percentage of the functional element of dental solid waste management in Sari

Table 2. Method for dentistry offices waste management in Sari based on questionnaires

Type of waste	Management method	Percent of clinics
Amalgam wastes	Discharge into toilet, Trash and sewer system	91.7
	Recycling	8.3
Empty amalgam capsules	Recycling of residues amalgam and then disposed to trash	30.4
	Unloading to trash	69.6
Radiographic film pocket	Unloading to trash	78.9
	Separation and recycling of lead foil and disposal of residues part into trash	21.1
Fixer	Discharge to toilet and sewer system	94.4
	Recycling	5.6
Developer	Discharge to toilet and sewer system	94.7
	Recycling	5.3
Sharp wastes	Using of Safety box, cutter	78.9
	Temporary storage in various containers and then disposed of them with the container into the trash	11.5
	Directly dispose in trash	9.6
Method of sterilization of dental instrument and equipment	Using of autoclave and combination of sterilizing agents (oven, autoclave, disinfecting and sterilizing solutions)	100

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Therefore, to gain the optimum waste management, it is vital to pay attention to waste reduction. Waste reduction program is applicable by using reusable dental equipment and instrument, and products with less packaging.[5] A study by Sudhakar and Chandrashekar indicated that 39.1% of respondents did not separate their extra amalgam or mercury; but, disposed it to municipal solid wastes.[11] According to the results, dentists had no plan for waste recycling in their offices. Therefore, educational programs are essential to improving their knowledge and attitudes on waste management programs, which can lead to increase their participation in such programs. As can be seen from table 1, the highest percent of the wastes are common or semi-domestic wastes. The most important work that can be performed for optimum dental waste management is to prevent dental wastes to be mixed up, due to their different component and characteristics (infectious, toxic, semi-domestic and etc.), which requires different management methods. Kizlary et al. investigated the composition and production rate of solid waste in 4 dental labs in Xanthium of Greece. These four centers produced 75% of total solid waste of this state. The sampling was done in 2 month and the samples were divided in to three groups: (a) the infectious and potentially infectious wastes, (b) none-infectious wastes, (c) house hold wastes. The amount of these groups was 74%, 26%, 0.5%, respectively. This amount was 0.007% of municipal solid wastes in this state.[3] Rezai et al. conducted a survey on the weight and volume of the infectious waste from offices, laboratories, dressings and private radiology in Shiraz city in 2004. They observed that the maximum amount of infectious waste (62.2 Kg and 666 L) was produced in dental clinics.[12]

A part of the results from the questionnaire is shown in table 2. According to this table, 84% of the dug-out amalgam particle from patient's teeth and 4.2% of the excess residual amalgam is discharged to the wastewater. One of most common material in tooth restoration is amalgam.[9] The study of Sushma et al. indicated that 97.9% of dentists were aware of waste management policy. About 47.9% of them delivered the wastes without separation and disinfection to municipal waste collectors, 42.7% of gases and bloody swabs were placed in special color-coded plastics. 32.2% of dentists were delivered the collected residual amalgam to waste management services and 85.4% of dug-out amalgam from teeth is poured into wastes directly.[10] A study by Ogden et al. in dental clinics of northern Sweden showed that only 36% of dentists separated the mercury or the residual amalgam.[13] Treasure and Treasure were studied disposal of hazardous wastes in dental offices in New Zealand. The results of 767 filled questionnaires showed that 56.4% of dentists were covered the bloody swabs by wastes paper. Only 24.4% of infected and sharp wastes were collected in common wastes. Qualitative interviews with dentists indicated that they did not have the knowledge on the infected wastes disposal. The Government regulations on waste disposal did not motivate dentists to care for the guidelines. There were no specific waste disposal services in some areas, and some dentists did not embrace special services due to the high cost.[14] Results of this study showed that dental's units were not equipped by amalgam filter. Thus, using units equipped by amalgam filter is effective to achieve optimal management of generated wastes. For example, Germany has decreed all dentistry to use an amalgam separator and remover with at least 95% removal efficiency.[15] The study of Jamie in Montana of USA indicated that the mercury was disposed of by 79% of dental offices in Bio-hazardous materials storage containers and is burned along with other bio-medical wastes. 13% of the dug-out amalgam from teeth was poured in wastes. Only 5% of dentists recovered the empty capsules of amalgam. 70% of dentistry disposed of the empty capsules in municipal solid wastes, and 20% of capsules were putted in bio-hazardous containers.[16] In the present study, 69.6% of empty

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amalgam capsules were disposed of in the trash. Using of mercury storage kit is another method to manage the generated amalgam. The results of this study showed that 95.85% of dentistry did not use storage kits. Fixer liquid along with advent solution is widely used for oral radiology. The fixer liquid is classified as a hazardous material because it contains a high concentration of silver, and should not be directly discharged into sewer or trash. Silver recycling is the best method for its management. However, only 5.6 percent of the offices in the present study used this method for the management of fixer drug. If fixer liquid is not mixed with the developer solution (hydroquinone + potassium hydroxide), it can be discharged in sewer.[15]

It is contained 50% of mercury approximately which are combined with silver, tin and other metal in lower amount.[17] Mercury should not be entered into the septic tank because it is a toxic and hazardous material and can lead to groundwater contamination.[15] Several methods may be used to control dental's mercury discharges, e.g. dental mercury control by development of Best Management Practices (BMP) is one of the choices. For example, laws of installation of amalgam separator in many states of USA are considered as a type of BMP.[18] In this study, the autoclave were applied in 48.1% of the offices to sterilize the dentistry equipment, and 51.9% used the combined methods (autoclave, oven, disinfecting and sterilizing solution). In another survey by Cannata et al. it was reported that all clinics used autoclave for sterilization. Chemical disinfectant solutions were used in 12 clinics from 14 clinics that were performed the superficial disinfection mainly. In five clinics, there was a separate section for contaminated wastes storage.[7]

Although, in recent decades, the institutions, dental associations and government agencies have been issued various guidelines and recommendations to observe the principles of infection control,[19] which can lead to improve the principles observance; but, these recommendations and guidelines was not enough. Failure to comply with the law by dentists, increasing the number of patient with AIDS and hepatitis B and C, and, consequently, the increasing transmission risk of these diseases in the dental center has led many people to be frightened and anxious about being treated by the dentist, and going to the centers.[1]

Assurance of proper sterilization operation by these devices is effective step to controlling the transmission of infectious via dentistry's equipment. In addition, knowledge on the proper application of disinfectant solutions can reduce contaminations discharged into sewer systems.

Conclusion

Generally, it concluded that there is no proper management of wastes in dental centers of Sari. It is recommended that the increasing the knowledge of dentists about reduction, separation, and recycling of wastes is essential to achieve the proper management of dental wastes. In the next step, clear codification must be done to restrict the using of certain toxic compound and their discharge to sewer and trash, and, also, continuous monitoring implementation of such codifications.

Conflict of Interests

Authors have no conflict of interests.

Acknowledgements

The research was performed with the assistance and cooperation of the research committee of the Mazandaran University of Medical Science and dentists of Sari. The authors are thankful because of their cooperation.

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