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Original Article

Quantity and quality of solid wastes produced in dental offices of babol city

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Abstract

Introduction: Dental wastes due to having bacterial disease-causing agents and toxic chemicals are categorized in hazardous wastes. The aim of this study was to evaluate the quantity and composition of dental waste produced by general and specialized dental offices in babol city.

Materials &Methods: From all dental offices (170 and 40 dental offices were related to general and specialized respectively) in babol city, 20 general and 5 specialized offices were randomly selected. Waste samples were collected three times a week (Sunday, Monday and Tuesday), 50 sub-groups were separated and weighted by a digital scale with accuracy of 0.01 gram. The data were presented by excel and word software in figures and tables.

Results: The total wastes of general and specialized offices were 11829 and 2831.5 kg/year, respectively. The percentages of domestic-type, infectious, pharmaceutical and toxic wastes in general dental offices were 52.5%, 42.5%, 4.7% and 0.3%; and in specialized offices were 42.5%, 50%, 7% and 0.5%, respectively. Most components in a variety of dental waste included plastic, paper, plaster molds, glass and metal.

Conclusion: Due to the large contents of plastic, paper, plaster molds, glass and metals in domestic- type and infectious wastes produced in the general and specialized dental offices, it is necessary to manage the wastes and their separation and recycling in source place.

Keywords: Solid waste, Dental offices, Separation, Recycling

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بررسی کمیت و کیفیت پسماندهای جامد تولیدی از مطب های عمومی و تخصصی دندانپزشکی در شهر بابل

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چکیده

مقدمه: پسماندهای جامد دندانپزشکی به دلیل دارا بودن عوامل میکروبی بیماری زا و ترکیبات شیمیایی سمی، در رده مواد زاید خطرناک قرار می گیرند. هدف این مطالعه، بررسی کمیت و کیفیت مواد زاید جامد تولیدی از مطب های عمومی و تخصصی دندانپزشکی شهر بابل می باشد.

مواد و روش ها: از مجموع مطب های دندان پزشکی شهر بابل (۱۷۰ مطب عمومی و ۲۰ مطب تخصصی)، تعداد ۲۰ مطب عمومی و ۵ مطب تخصصی به شکل تصادفی انتخاب شدند. نمونه های پسماند، هفته ای ۳ بار در پایان روز کاری در روزهای یکشنبه، دوشنبه و سه شنبه جمع آوری و در ۵۰ گروه جداسازی و سپس با ترازوی دیجیتال با دقت ۰/۰۱ گرم توزین شدند. داده های کمی به کمک نرم افزارهای Excel و Word به صورت نمودار و جدول ارائه گردید.

یافته ها: میزان پسماند های تولیدی از کلیه مطب ها ی عمومی و تخصصی این شهر به ترتیب ۱۱۸۲۹ و ۲۸۳۱/۵ کیلوگرم در سال بدست آمد. میزان درصد مواد زاید جامد شبه خانگی، عفونی و بالقوه عفونی، دارویی و سمی در مطب های عمومی به ترتیب ۵۲/۵، ۴۲/۵، ۴/۷ و ۰/۳ و در مطب های تخصصی به ترتیب ۴۲/۵، ۵۰ ، ۷ و ۰/۵ بوده است. بیشترین اجزای موجود در انواع پسماندهای دندانپزشکی شامل پلاستیک، کاغذ، قالب های گچ، شیشه و فلز می باشد.

نتیجه گیری: با توجه به وجود مقادیر زیاد پلاستیک، کاغذ، گچ، شیشه و فلز در پسماندهای شبه خانگی و زباله های عفونی تولیدی از مطب های دندانپزشکی، مدیریت جامع این گونه ضایعات، شامل جداسازی و بازیافت آنها در محل، بسیار ضروری می باشد.

واژگان کلیدی: پسماند های جامد، مطب های دندانپزشکی، تفکیک، بازیافت

Introduction

Medical wastes are being considerably attended due to the presence of many hazardous, toxic and pathogenic agents and have triggered major concerns on the human and environmental health. [1, 2] A large amount of medical waste production originates from dental offices. Dental solid wastes are classified into four categories including a: domestic- type wastes; b: potentially infectious wastes; c: chemical and pharmaceutical wastes; and d: toxic wastes. [3, 4] Dental domestic type wastes are those which have no adverse environmental and public health problems and can be collected, recycled and disposed with the ordinary municipal solid wastes. Examples of domestic type wastes are tissues, gauzes, dental rolls, packaging materials for syringe and needle, carbon steel, clothing and paper. [5, 6] Dental infectious and potentially infectious wastes cause disease and disease transmission due to the presence of pathogens which include materials contaminated with blood and saliva, nylon gloves, dental suction tips, sharps, extracted teeth and mirrors. [7, 8] Major chemical, pharmaceutical and toxic solid wastes include tissues and gauzes contaminated with amalgam, lead foil (coming from the radiography film covers), disinfectants and batteries. Dental amalgam is commonly used to fill the teeth in dental offices. It contains a mixture of metals such as mercury, silver, copper, zinc and tin, thus represents a serious environmental and health risk. [9, 10] Nabizadeh, et al.in 2009 reported that total amount of dental wastes production in Hamedan city was annually 14662.67 kg and showed that percentages of infectious, domestic-type, chemical- pharmaceutical and toxic wastes were 51.93 %, 38.16%, 9.47 % and 0.44 %, respectively. [11] Also, in another study conducted by Kulivand et al. in 2009, the composition of dental solid wastes included domestic- type wastes (91.14%), chemical and pharmaceutical wastes (6.7%), potentially infectious waste (2.14%) and toxic waste (0.02%). [12] Kizlary et al. in 2005, found that the number of infectious wastes, chemical wastes and domestic- type wastes produced in the dental centers was 2%, 3.3% and 7.94%, respectively. [13] Many studies have been performed in

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field of dental solid wastes management by some researchers. [14-17] According to the limitations of database and the lack of data related to the composition and production rate of dental solid waste in northern Iran, this study was done to evaluate the composition and characteristics of solid wastes generation in general and specialized dental offices in babol city.

Materials&Methods

Babol is the most important city in Mazandaran Province, Iran. This city has several universities and scientific centers. Babol has totally 210 dental offices including 170 and 40 offices related to general and specialized centers, respectively. For this study, 20 general dental offices and 5 specialized dental centers were selected based on random sampling, and the generation rate and composition of dental solid wastes were measured, too (Table 1).

Table 1. Characterizations of the selected dental offices of babol city

Type of office	No
general	20
Specialized(restorative dentistry)	1
Specialized(orthodontics)	1
Specialized(periodontics)	1
Specialized(endodontics)	1
Specialized(oral radiology)	1
total	25

Common services provided in specialized dental offices contain endodontics, restorative, oral radiology, orthodontics and periodontics. In this study, dental solid wastes were categorized into four classes including: 1. Domestic-type wastes; 2. Infectious and potentially infectious wastes; 3. Pharmaceutical and chemical wastes; and 4. Toxic wastes. [11, 18] Color coded plastic bags were used to collect and segregate of solid wastes in these offices. Domestic- type wastes were segregated to black colored bags. Orange and red colored bags were used to collect the infectious and initially infectious wastes. Used sharps, as infectious waste, were separately collected in safety boxes and chemical and pharmaceutical wastes were packaged in yellow colored bags. Waste samples were collected three times a week (Sunday, Monday and Tuesday) at the end of the working day and the selected dental solid wastes were manually sorted into 50 categories and weighted by a digital scale (Mettler PM4000) with accuracy of 0.01 gram. Each component was weighted in duplicate and the data were presented as average. In this study, the content of waste produced daily by each patient was determined in the general and specialized dental offices. The obtained data were presented by excel and word software in figures and tables.

Results

The percentages of domestic-type waste, infectious, pharmaceutical and toxic wastes in general offices were 52.5%, 42.5%, 4.7% and 0.3% and in specialized offices were 42.5%, 50%, 7% and 0.5%, respectively (Figures 1 and 2). The largest components of solid wastes in general dental offices were latex gloves (23.7%), infected syringes and needles (12.3%) and suction tips (11.5%). In specialized dental offices, the maximum quantity of solid waste components included latex gloves (34%), paper towels contaminated with saliva (10.5%), infected syringes and needles (9%).

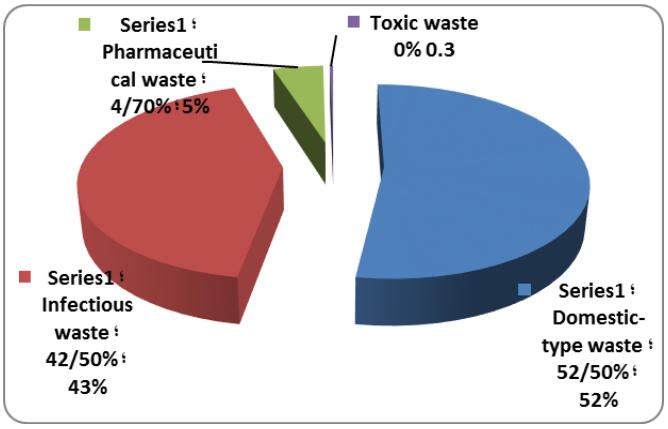


Fig.1. Components of dental solid waste in general dental offices

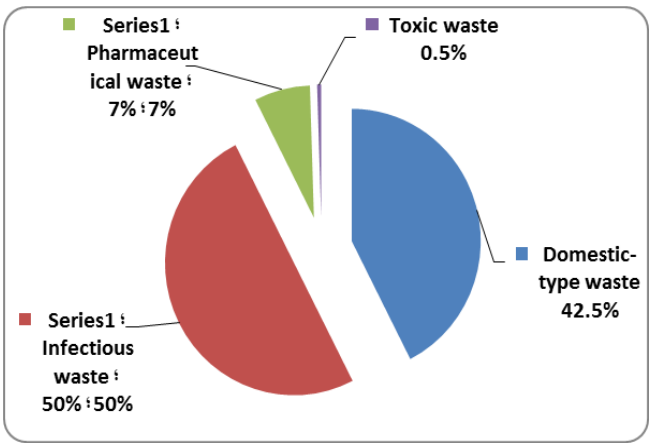


Fig.2. Components of dental solid waste in specialized dental offices

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In table 2, total types of solid wastes produced in the general and specialized dental offices were presented. In this table, total solid wastes generated were shown based on kg per day and gram per patient per day. Mean content of domestic-type, infectious and potentially infectious, pharmaceutical and chemical and toxic wastes production per person per day was more in the specialized dental centers than general dental offices (Table 2).

In table 3, the maximum content of the domestic-type waste components in the general offices was plastic (28.2%), gypsum (25.3%), and paper (18%) and in the specialized centers was belonged to plastic (27.3%) and paper (23.7%) respectively.

Table 2. Dental solid waste generation in the dental offices of babol city

Type of waste	General dental offices		Specialized dental offices		Total dental offices	
	Generation rate (Kg/day)	Generation rate (gram/patient/day)	Generation rate (Kg/day)	Generation rate (gram/patient/day)	Generation rate (Kg/day)	Generation rate (gram/patient/day)
Domestic-type waste	13.76	10.12	4.07	20.35	17.83	30.47
Infectious and potentially infectious waste	16.20	11.91	3.30	16.50	19.50	28.41
Pharmaceutical and chemical waste	2.28	1.68	0.36	1.82	2.64	3.50
Toxic waste	0.18	0.13	0.03	0.15	0.21	0.28
Total dental waste	32.42	23.84	7.76	38.82	40.18	62.66

Table 3. Total dental solid waste generated (kg/year) in general and specialized offices

Waste type	Components	General dental offices	Specialized dental offices
Infectious and potentially infectious waste	Saliva contaminated tissue	512.4	126
	Saliva soaked gauzes and cotton	383.4	87.3
	Blood soaked gauzes and cotton	442.1	49.5
	Nylon glove	445.2	118.5
	latex glove	1400	410
	Suction tips	680.3	117
	Used ampoules	273.8	39.1
	Abs lung	503	30
	Needles	512	61.4
	Plastic syringes	216	47
	Others	541.9	116.8
	Total (kg)	5909	1202.5
Domestic- type waste	Dry tissue	48.8	158.5
	Paper and cardboard	636.8	118.5
	Tissue box	217.8	75.3
	Disposable cup	109.5	105
	Gypsum	1269	96.8
	Food residues	51.5	78.8
	Metals	65.9	41.9
	Nylon	642.6	289
	Plastic	771.4	115.7
	Glass	496.4	120
	others	412	287.7
	Total (kg)	5021.5	1487
Pharmaceutical and chemical waste	Impression materials	400	100.5
	Other chemical materials	433.8	32.2
	Total (kg)	833.8	132.7
Toxic waste	Amalgam contaminated wastes	24.2	2.3
	Radiography film	4.7	1.4
	Radiography film covers	35.7	5.6
	Total (kg)	64.6	9.3

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Discussion

The results of the present study showed that total solid wastes generated by total dental offices in babol city were 14661 kg/year. Totally, 11829.5 kg (81%) and 2831.5 kg (19%) of these solid wastes belonged to general and specialized offices, respectively. In this study, the infectious wastes generated in specialized dental centers (50%) were more than general dental offices (42.5%) caused by great variety of activities and treatments in these places. [19] Komilis et al. in 2009 reported that the domestic-type, infectious and potentially infectious waste, and non-infectious toxic waste comprised approximately 74%, 26%, and less than 0.5% of the total dental wastes weight produced, respectively. [20] In another study, infectious and potentially infectious wastes were 24.3%, and domestic-type waste was 27.6%. [19] Bazrafshan et al. in 2014 suggested that the generation rate of potentially infectious wastes in Sistan and Baluchestan province was 80.3%. [21] In this study, the highest components of infectious wastes in general and specialized dental offices were latex gloves (about 30%). Therefore, more attention should be concentrated on the source reduction, separation and recycle of this component. Ozbek and Sanin in 2004 reported that used gloves were 35% in terms of the weight of total dental solid wastes. [14] In this study, pharmaceutical and toxic wastes in the general dental offices were 4.7% and 0.3% and in the specialized centers were 7% and 0.5%, respectively. Bazrafshan et al. reported that the pharmaceutical and toxic wastes in dental centers of Sistan and Baluchestan were 6.3% and 1.7%, respectively. [21] Their study is consistent with this current study.

Amouei et al. in 2013 determined that the pharmaceutical and chemical wastes contained 2.38 % in terms of the weight of the total dental solid wastes. [15] In this study, pharmaceutical and toxic wastes in general dental offices consist of radiography film covers (55.29%), amalgam contaminated wastes (37.39%) and radiography film (7.32%); and in specialized offices contain radiography film covers (60.22%), amalgam contaminated wastes (24.47%) and radiography film (15.31%) which comprise more than 50 % of toxic wastes. Kulivand et al. in 2009 suggested that the dental impression materials had the highest percent (4.21%) in terms of weight among chemical and pharmaceutical wastes in all studied dental offices. [12] This result agrees with the findings of the present study. In this study, nearly 50% of total dental solid wastes generated in general dental offices (42.5%) and specialized centers (52.5%) belonged to domestic-type waste.

Major components of domestic- type wastes in general dental offices were gypsum (25.27%), plastic items (19.5 %), paper items (18%), glass (9.88%), and metals (1.3%); and in specialized dental offices were plastic items (38.60%), Paper items (14.5%), glass (8.07%), gypsum (6.51%), and metals (2.81%), which contained more than 70% of dental solid wastes produced by these centers. Therefore, the integrated management of dental solid wastes generated in general and specialized dental centers including source separation, source reduction and recovery of domestic-type waste components such as plastics, paper and cardboards, glass and metal items are necessary. Nabizadeh et al. in 2012 showed that there was no effective activity for waste minimization, separation, reuse, and recycling in dental offices and management of sharps, potentially infectious waste and other hazardous waste was poor .[22]

Conclusion

Considering the high percentage of plastic, paper and glass items in the domestic-type and infectious solid wastes generated in general and specialized dental centers, the integrated management of domestic-type and infectious wastes including reduction source, separation and recovery of valuable items and environmental conservation should be considered.

Conflict of interest: The authors declare that they have no conflict of interest.

Authors' Contributions

The study was designed by Abdoliman Amouei. The study data were collected by Hossein Faraji and the Literature search and manuscript were prepared by Amid Khosravi Samani. Analysis and interpretation of data and manuscript editing were conducted by Mahmood Khosravi Samani. Critical revision of the manuscript for important intellectual content and supervision of the study were performed by Abdoliman Amouei.

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