Comparison of Two Educational Methods to Improve Emergency Management Among Dentists

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Abstract- The efficacy of different educational methods needs to be evaluated in dental courses. The main objective of the present study was to compare the effectiveness of two educational methods in the improvement of medical emergencies management among dentists in terms of knowledge, diagnosis, practice, and availability of necessary drugs and equipment. The target population of this randomized controlled trial study was all the dentists working in public and private offices in the city of Tehran, Iran. Baseline data collection through a designed and piloted questionnaire was conducted among 210 randomly selected dentists. The dentists were then randomly assigned to one of the one-day workshop program (W), flipchart (F), and control (C) groups. One month after interventions the follow-up data collection using the same questionnaire was performed. Chi-square, non-parametric Kruskal Wallis, and Wilcoxon Signed Ranks were used to compare outcome variables among the three groups before and after the interventions. The total response rate was 61.5%. No statistical differences existed among the three groups regarding the background at baseline. Diagnosis, practice, and knowledge score before and after the intervention improved significantly among the participants in W group ($P=0.02$, $P<0.001$ and $P<0.001$, respectively). In both F and C group, improvement occurred in practice scores ($P=0.03$ and $P<0.001$, respectively). Continuing education in the form of attending workshop seemed to be superior to receiving educational flipchart in the enhancement of the self-reported knowledge and practice of practicing dentists. None of these educational methods seemed to have significant effect on the availability of necessary equipment and drugs to manage medical emergencies in dental offices.

Introduction

Medical emergencies occurring in dental offices are rare, but they can be life-threatening for the patients if the dentist does not possess essential knowledge and skills to manage them and if the required drugs and equipment are not available in the office. Knowledgeable and skillful dental workforce, as well as the availability of required drugs and equipment in the dental office, is of pivotal importance in managing medical emergencies (1). Prevalence of medical emergencies in dental offices in Iran has been estimated to be 0.75 cases per dentist per year (2). Since currently, 25000 dentists work in Iran (3), annually more than 18500 patients are at risk of a medical emergency situation in dental offices.

Previous studies in Britain (4,5), India (6), Brazil (7,8) and Fiji Islands (9) have shown that some deficiencies exist in knowledge, attitudes, and behavior of dentists regarding management of medical emergencies. For example, in Britain, more than half of the dentists surveyed believed that they could not manage myocardial infarction or anaphylaxis (4) and two-thirds of the Indian dentists evaluated themselves as incompetent in the management of medical emergencies (6). Required equipment to manage medical emergencies also have not been completely available as only one-fourth of Indian dentists (6), and

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less than one-third of Australian dentists (10) reported to possess necessary equipment and drugs. Studies on Iranian dentists have shown similar results: the dentists in Isfahan acquired about 50% of the total knowledge score regarding medical emergencies (11), 86.5% of dentists in Tabriz felt that they should receive more training on the subject (12), and only 40% of dentists in Karaj had 1-4 items of necessary drugs and equipment available in their offices (13). These studies have advocated a need for better preparedness of the Iranian dentists regarding medical emergencies management (2,11-13).

To enhance the knowledge and skills of the practicing dentists for management of medical emergencies previous studies mainly have emphasized the importance of continuing education programs (1,4,7,11-14). To our knowledge, however, the effectiveness of various forms of continuing education programs has not been investigated in Iran, and the previous studies have been done mainly in descriptive design.

The main objective of the present study was to compare the effectiveness of two educational methods in the improvement of medical emergencies management among dentists in terms of knowledge, diagnosis, practice, and availability of necessary drugs and equipment.

Materials and Methods

Subjects and sampling

Ethical clearance was granted by WHO Research Ethics Review Committee (WHO ERC) by protocol ID: RPC340 and the Ethics Committee of Tehran University of Medical Sciences (research project number: 88-04-70-9631). The survey was voluntary, and the responses were confidential. The target population of the present project was all dentists working in public and private offices in the city of Tehran in 2010. In Iran, only 10% of the dentists work solely in public service, and about 79% have private practice (15). Thus, most of the dentists who are working in public sector, work simultaneously in private sector. In cities, more than 80% of the oral health services are delivered by the private sector (16). The inclusion criteria included working as a general practitioner in an office, and delivering a variety of dental services. Thus, the specialists delivering only specific services, or the general dentists working only in one discipline (for example pediatric dentistry) were excluded because there might be differences in their exposure to

emergencies and their experiences in emergency management compared to general dentists practicing all disciplines.

The main objective of this project was to compare the effectiveness of two educational methods in the improvement of Knowledge and self-reported practice of public or private dentists working individually. Thus, the dental clinics in which more than one dentist was working at the same time, and the clinics delivering medical services in addition to dental services were excluded.

Based on previous studies on effectiveness of various types of education on dentists' (17-22) and physicians' knowledge, and also previous studies in Iran indicating deficient knowledge of emergency management among Iranian dentists (11-13), the researchers came to a consensus that 30% increase in the dentists' knowledge through the interventions would be acceptable. With $\alpha=0.05$ and $\beta=0.1$, applying the formula for sample size estimation to compare proportions, the sample size would be 55 participants in each group. To overcome a 20% possible loss, the sample size was determined to be 70 participants in each group or totally 210 participants.

A list of the cell phone numbers of all dentists working in Tehran was prepared. Through a systematic random sampling, each 15th dentist in the list was selected. We made phone call to each selected dentist explaining about the project. If he/she agreed, we included his/her name in our sample. If he/she refused, the name was replaced with the next number in the list. We continued in this way till we could get the agreement of 210 randomly selected dentists. These dentists were randomly assigned to either the one-day workshop program (W), flipchart (F), and control (C) groups.

Questionnaire development

As the data collection instrument, a confidential, anonymous, self-administered questionnaire was used. In a pilot test-retest study on a convenient sample of the dentists, the validity and the reliability of the questionnaire was evaluated. The kappa coefficient for knowledge questions was 0.79, and for practice questions was 0.83, meaning that about 80% agreement existed between the pre- and post-test answers of the respondents to the same questions, showing that the questionnaire was both valid and reliable (23).

The first part of the questionnaire, in addition to age and gender, requested information on personal and professional characteristics of dentists including total

experience in dentistry and experience as a private dentist in terms of months, number of working hours in a week, and number of patients in a month. In addition, the questionnaire contained questions on diagnosis, self-reported practice, knowledge, and availability of requires drugs and equipment to manage medical emergencies.

Diagnosis and self-reported practice

To assess self-reported practice, eight cases representing various emergency situations were presented, and the participants were asked to first make a diagnosis, and then describe and prioritize the actions that should be performed to manage the situation. The score for correct diagnosis was 1 and for incorrect diagnosis was 0. By summing the scores for eight cases, we calculated the final diagnosis scores varying from 0 (no correct diagnoses) to 8 (correct diagnosis for all the cases).

In an expert panel, guidelines for scoring the response for management of the cases were extracted. Two calibrated members of the research team determined the score of each participant separately for each of the cases based on his/her responses. In case of disagreement on rating any item, they discussed again the case separately. By summing the scores, the final practice scores, with the possible range of 0 (no correct answer) to 40 (correct answers for all the cases) were calculated.

Knowledge

To assess knowledge, the respondents were asked to react to 12 statements regarding various aspects of medical emergencies management on a five-point Likert scale ranging from completely agrees to completely disagree. The responses were then scored from one to five according to the degree of the respondent's knowledge. The scores were summed in order to calculate final knowledge scores varying from 12 (no correct answers) to 60 (correct answers to all the questions).

Availability of the drugs and equipment: In the last part of the questionnaire, the availability of drugs and equipment was evaluated through completing an 11-item checklist). If an item was available, the score was 1. Otherwise, the score was 0.

Interventions

The 210 randomly selected dentists were assigned randomly to one of the following groups:

Workshop group (W)

A one-day workshop was designed. The workshop comprised 4 hours theoretical (lecture) and 3-hours practical education (simulation). The content of the workshop included establishing and maintenance of airway, breathing, and circulation (ABC); establishing and maintenance of intravenous (IV) line, cardio-pulmonary resuscitation (CPR); and the diagnosis and management of the most prevalent medical emergencies in dental offices (syncope, hypoglycemia, choking, hyperventilation syndrome, myocardial infarction, cardiac arrest, asthma, and adrenal crisis). The participant in the workshop had the opportunity to practice ABC, CPR and IV-line skills on phantoms under the supervision of experts in emergency medicine. In practical sessions, demonstrations were done on simulators for small groups of participants, and after that, the participants had the opportunity to practice the maneuvers by themselves.

The lecturers were all specialists in medical emergencies working as academic staff members in Department of Emergency Medicine, School of Medicine.

The 70 dentists in workshop group were divided into two equal groups, 35 dentists each, and two similar workshops in two different days were held for them. Three days before the workshop, we reminded them about their participation in the workshop. However, in the first workshop, only 22 and in second workshop only 23 dentists participated. To complete our sample, we sent a message through cell phones to another sample of 200 randomly selected dentists. The volunteer dentists, up to 30 dentists, were registered. Of these 30, 23 dentists actually participated in another similar workshop held for them.

Flipchart group

A flipchart schematically illustrating the management of medical emergencies was designed. The content of the educational flipchart was the same as the workshop except that it included the diagnosis and management of more conditions compared to the workshop. The design of the flipchart was in a way that the dentist could use it easily and rapidly in case of emergency.

The research team explained about the flipchart to the dentists through phone, and then a peon distributed the flipcharts among the dentists.

The control group (C)

The dentists in this group received no intervention.

When the dentists in this group completed the follow-up questionnaire, they received the flipchart as a benefit of participating in the study.

Baseline and follow up data collection

The dentists in the W group filled the questionnaire at the date of workshop program before the program started. One month after the programs, the participants were invited to the university to get their certificate of workshop attendance and to fill in the follow-up questionnaire.

The dentists in the F group were invited to the university for another educational program (a lecture) on ergonomics (a topic which was totally different from emergencies) to complete the questionnaire. Averagely one month after the distribution of the flipchart, the peon again visited the dentists to distribute and collect the follow-up questionnaires.

The questionnaires were distributed among the dentists in the C group by a peon visiting their offices. These dentists were visited by the peon averagely one month after baseline data collection and completed the follow-up questionnaire.

Statistical analysis

SPSS software served for statistical analysis. Chi-square, non-parametric Kruskal Wallis, and Wilcoxon Signed Ranks were used to compare outcome variables among the three groups before and after the interventions.

Results

In baseline data collection, totally 177 dentists (68 in workshop group, 64 in flipchart group, and 44 in control group), and in follow-up data collection, totally 110 dentists (44 in workshop group, 32 in flipchart group, and 34 in control group) completed the questionnaire. The total response rate was 61.5%. Table 1 demonstrates dental practice-related characteristics of the dentists in the three groups of the study. No statistical differences existed among the three groups regarding the background variables such as age, gender, work characteristics, attending CE courses on medical emergencies, and studying various information sources ($P>0.05$). Non-parametric Kruskal Wallis test showed no statistically significant differences in the mean of final diagnosis, practice and knowledge scores among the three groups ($P>0.05$) (Table 2).

The participants in F group were less likely to report the presence of oxygen and aspirin compared to the other groups ($P=0.02$ and $P=0.005$, respectively; Chi-square test). The mean score for the availability of necessary drugs and equipment to manage medical emergencies before the intervention in W, F and C groups was 5.2, 4.4, and 5.8 respectively, without statistically significant difference ($P=0.16$).

Table 3 shows the mean of final diagnosis, practice and knowledge scores acquired by the dentists in the three groups at follow up data collection.

Table 1. Dental practice-related characteristics of the dentists (n=177[†]) in the three groups of the study

Study group		Min.	Max.	Mean	SD
Workshop n= 68	**Total experience in dentistry in terms of months**	36.00	504.00	181.05	93.32
	Experience as a private dentist in terms of months	1.00	480.00	148.67	97.12
	Number of working hours in a week	5.00	100.00	31.13	15.88
	Number of patients in a month	15.00	400.00	94.95	83.98
Flipchart n=64	**Total experience in dentistry in terms of months**	3.00	360.00	155.16	86.95
	Experience as a private dentist in terms of months	1.00	336.00	100.86	79.67
	Number of working hours in a week	8.00	100.00	35.11	17.76
	Number of patients in a month	2.00	520.00	135.72	104.76
Control n=44	**Total experience in dentistry in terms of months**	60.00	435.00	194.61	85.58
	Experience as a private dentist in terms of months	1.00	396.00	154.70	94.79
	Number of working hours in a week	4.00	70.00	29.50	15.09
	Number of patients in a month	5.00	1000.00	160.24	214.44

[†]One participant did not respond to the questions on dental practice-related characteristics

Table 2. The mean of final diagnosis, practice and knowledge scores acquired by the dentists (n=177[†]) in the three groups at baseline data collection

Study group		N	Min.	Max.	Mean	Std. Deviation
	Final diagnosis score	69	0.00	8.00	4.70	2.01
Workshop n= 68	Final practice score	69	0.00	26.00	8.30	4.80
	Final knowledge score	49	35.00	56.00	47.20	4.30
	Final diagnosis score	64	0.00	7.00	3.89	2.20
Flipchart n= 64	Final practice score	63	0.00	18.00	6.63	4.69
	Final knowledge score	41	35.00	56.00	46.02	4.58
	Final diagnosis score	45	0.00	8.00	4.73	2.20
Control n= 44	Final practice score	39	0.00	22.00	8.87	4.89
	Final knowledge score	32	40.00	60.00	49.17	5.27

†One participant did not respond to the questions on cases

Regarding the comparison of the final diagnosis, practice and knowledge score before and after the intervention, these scores improved significantly among the participants in W group after the intervention (*P*=0.02, *P*<0.001 and *P*<0.001, respectively; Wilcoxon Signed Ranks test) (Table 4).

In both F and C group, improvement occurred in practice scores after the intervention (*P*=0.03 and *P*<0.001, respectively) (Table 4). The difference between group F and the other two groups in reporting the presence of oxygen and aspirin disappeared in the follow-up data collection. After the intervention, the score of availability of necessary drugs and equipment to manage medical emergencies in W, F and C groups was 5.6, 5.4, and 4.9 respectively, again with no statistically significant difference (*P*=0.73).

Table 3. The mean of final diagnosis, practice and knowledge scores acquired by the dentists (n=110) in the three groups at follow up data collection

Study group		N	Min.	Max.	Mean	SD
	Final diagnosis score	44	0.00	8.00	5.14	2.26
Workshopn= 44	Final practice score	43	4.00	24.00	13.12	5.05
	Final knowledge score	43	41.00	60.00	49.88	5.77
	Final diagnosis score	32	0.00	8.00	4.84	2.23
Flipchartn=32	Final practice score	32	0.00	24.00	9.66	5.82
	Final knowledge score	31	35.00	59.00	47.10	5.86
	Final diagnosis score	34	0.00	8.00	4.91	2.19
Control n=34	Final practice score	34	3.00	26.00	12.71	5.52
	Final knowledge score	34	35.00	60.00	48.21	6.51

Table 4. Comparison of final diagnosis, practice and knowledge scores between baseline and follow up data collection in the three groups of study

Study group		Diagnosis (baseline-follow-up)	Practice (baseline-follow-up)	Knowledge (baseline-follow-up)
Workshop	Z	-2.38(b)	-4.93(b)	-3.52(b)
	P	0.02	<0.001	<0.001
Flipchart	Z	-1.33(b)	-2.19 (b)	-.49 (b)
	P	0.18	0.03	0.62
Control	Z	-.033(b)	-3.29 (b)	-.54(a)
	P	0.97	<0.001	0.59

Wilcoxon Signed Ranks test
a Based on positive ranks.
b Based on negative ranks.

Discussion

The present study compared the effectiveness of two educational methods in the improvement of medical emergencies management among dentists in terms of knowledge, diagnosis, practice, and availability of necessary drugs and equipment. Educational workshop seemed to be more effective in improvement of diagnosis and knowledge scores of the dentists compared to educational flipchart.

As previously reported, the knowledge and skills of dentists regarding management of medical emergencies in Iran (11-13), and elsewhere (4-9) score of 4.7 from a range of 0 to 8, and a practice score of 8.3 from a range of 0 to 40. This deficiency probably comes from insufficient education in the national dental curriculum, as well as in continuing dental education programs. A study on Belgian dentists also reported that almost half of the dentists never attended any basic life support (BLS) training during their undergraduate education (24). Another study in Nigeria showed that only around 43% of dental surgeons had previous knowledge of BLS training (25).

Regarding the comparison of the final diagnosis, practice and knowledge score before and after the intervention, these scores improved significantly among the participants in workshop group. Continuing education in the form of a workshop seemed to be superior to the educational flipchart in the enhancement of the self-reported knowledge and practice of practicing dentists. None of these educational methods seemed to have significant effect on the availability of necessary equipment and drugs to manage medical emergencies in dental offices. However, the flipchart showed a small positive effect in this regard. These results, coming from a short-term evaluation should be interpreted cautiously.

Although many previous studies have emphasized on the necessity of development of training programs for dentists and dental students in order to improve their practice regarding medical emergency management (1,4,5,7,8,11-14), studies on development and evaluation of such programs are scarce. Moreover, these studies mainly have not shown positive results. For example, a study in the UK evaluated an on-site training scheme on CPR conducted in dental practices and reported poor CPR-related practice after 6 months among the dental staff attending the scheme (26). The study emphasized the importance of periodical supervised re-training. Another study assessing acquisition of CPR skills among Spanish dental students after attending a total of 10 hours practical training over a period of 2 months

reported that just about half of the students were able to properly perform CPR maneuvers (27). It should be noted that the study benefited from a manikin for assessment of students' skills, and used direct observation method to assess the participants' skills (27) while we used a self-report questionnaire for this purpose. Moreover, the follow-up interval in the UK study was 6 months (26) and in Spain study was 2 months (27), which in both cases was more than that in our study. These findings call for the implementation of innovative methods when designing educational program to improve medical emergency management among dental professionals; what we tried to do in the present study. Trying to develop innovative educational methods, a UK study on efficacy of a peer-led tuition model for training healthcare students (including dental students) in basic life support compared to tuition delivered by clinical tutors concluded that the model of peer-led undergraduate training provided a quality of education which is at least as good as that provided by clinical staff, while offering advantages in terms of reliability (28).

The superiority of the workshop over flipchart can be considered as a result of its good design and content, the opportunity for practical exercise by the participants, and good experience of the teachers who were all specialists in emergency medicine. The workshop was held in Center for Clinical Skills Education, Tehran University of Medical Sciences, which is one of the well-equipped centers in the country. These kinds of workshops to educate management of medical emergencies to dentists have been rare. Based on the feedback received from the participating dentists and lecturers in the workshop, a two-day workshop might be better than the one-day workshop since there would be enough time to cover more details. Although the flipchart was not as effective as workshop, it can serve as a practical, easily accessible, and immediate guide in case of occurrence an emergency situation in dental offices. This was noted by many of the participants receiving the flipchart. The improvement in the practice score in the control group can be attributed to the Hawthorne or observer effect (29).

The most important challenge in the present study was the response rate of the dentists. At baseline data collection, the average response rate in the three groups was 73%. Of those participating in baseline data collocation, 65%, 50%, and 77% participated in the follow-up data collection in workshop, flipchart and control groups, respectively. Although the overall response rate of 61.5% is normal when working with

such busy professional group, it is less than what expected at the beginning. The main reason for this was lack of time among the dentists. Since this factor was not the result of the intervention, and no difference existed between the three groups in this regard, this response rate seemed not to have significant effect on the results. It also should be noted that the sample size of 70 dentists in each study group had been determined based on 20% loss to follow-up in the sample. Anyway, this remains as one of the weaknesses of the present study. Moreover, due to limitations in our study, we could evaluate only short-term (one-month) effects of our educational methods. On the other hand, complete random selection of the dentists for baseline data collection and preparing a valid and reliable instrument for the data collection enhance the validity of the results. All of the participants of the study were oral health professionals. This homogeneity reduces the probability of biases related to misconceptions and errors (30), and to non-responses and incorrect answers (31), which have been reported to exist in studies using self-administered questionnaires with lay populations. In order to get accurate responses, an effort was made to provide a wide range of possible answers. This variation was obtained by implementing a five-point Likert scale for knowledge questions.

Continuing education in the form of a workshop seemed to be superior to the educational flipchart in the enhancement of the self-reported knowledge and practice of practicing dentists.

Continuing education in the form a practical workshop including supervised practical exercise on phantoms can be recommended as an effective method to enhance dentists' skills for management of medical emergencies. An educational flipchart also can be suggested as an immediate guide to manage the emergency situation in dental practice.

Acknowledgements

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