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Knowledge and awareness of dental practitioners, interns, students and assistants towards mercury hazards in dental amalgam

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Abstract

Objectives: Recently, an increase in the replacement of dental amalgam with other restorations due to its hazards and non-esthetic properties. This study aimed to assess the basic knowledge of dental practitioners, assistants, interns, and students (at the collage of dentistry in king Saud university, Riyadh, Saudi Arabia) towards the level of which dental amalgam can be considered hazardous and its proper handling.

Methods: A questionnaire-based cross-sectional study, Surveys were distributed among dental practitioners, interns, assistants, and students in both campuses of the dental collage at King Saud University (male and female campuses) in Riyadh 2018.

Results: Out of 404 responses, dental assistants were significantly higher in knowledge than other groups with regard to mercury-related hazardous issues ($p < 0.003$), and daily handling of dental amalgam ($p < 0.001$). With proper handling of amalgam during restorative treatment, dentists were found significantly higher in knowledge and awareness than students.

Conclusion: It was concluded that dental students had the least amount of information and knowledge regarding amalgam handling and characteristics and therefore, more information should be provided.

Keywords: Mercury, toxicity, amalgam, knowledge, awareness, dental

Introduction

Dental amalgam has been used for more than 150 years and still frequently used up-to-date. Dental amalgam is well known for its durability as a restorative material of posterior teeth [1-3]. Besides being easily manipulated and inexpensive compared to other restorations used in dentistry, it has a low creep, high strength, low resistance to wear, high longevity, and goes through minimal dimensional changes with time. In addition, it is less technique sensitive compared to other restorations and can tolerate clinical placement conditions [4, 5].

The American Dental Association (ADA) refers to dental amalgam as an alloy that contains several different elements, including silver, mercury, tin, copper, and others, to enhance its physical and mechanical properties. Due to the presence of 40-55% concentration of mercury in amalgam, concerns have been raised [6, 7]. There are three different types of mercury: organic, inorganic and metallic [6]. The inorganic form can cause adverse effects such as loss of the gastrointestinal tract lining and renal failure [2]. On the other hand, the metallic form of mercury which is used in dental amalgam shows less side effects [3]. In the oral cavity, occasional allergic reactions can be seen as a local adverse effect of dental amalgam filling including clinical features characteristic of lichen planus, but the incidence is low and usually readily managed [3]. It was reported that the highest exposure to mercury from dental amalgam occurs during placement or removal of restoration in the tooth [8-10]. Once the reaction is complete the amount of mercury released is less, which is considered far below the current health standard. Furthermore, if the recommended mercury hygiene procedures are followed, the risks of adverse health effects could be minimized. The acquired evidence indicates that dental amalgam is considered safe and efficient [8].

Although Amalgam is still well accepted by both dentists and patients in some countries especially for posterior teeth^[11, 12], a recent evidence has shown an increase in the replacement of silver amalgam during the last ten years to different types of restorations due to the presence of hazardous mercury in the amalgam filling material and partially because of their non-aesthetic properties^[13, 14]. For that reason, this study aimed to assess the basic knowledge of dental practitioners, interns, students, and assistants toward the hazardous mercury contained dental amalgam and its proper clinical handling.

Materials and methods

The study was performed by distributing questionnaires manually to dental practitioners, interns, students and assistants in King Saud University and King Khaled University Hospital (KKUH) in Riyadh, Saudi Arabia, in 2018. The questionnaire comprised of three sections; the first section included a demographic data of the respondents including gender and occupation: dental practitioners, interns, students (clinical practice or preclinical), and assistants. The second section included close-ended questions on the contents and physical properties of dental amalgam and its hazardous-related issues. The third section comprised of series of questions testing the respondents' knowledge regarding mercury toxicity in dental amalgam on how it enters the body, in what form, and what might be the adverse health problems that could be produced, and its clinical handling issues that can release hazardous mercury (e.g. placement of freshly mixed amalgam, removal, and finishing and polishing of existing amalgam restorations). The question is answered by giving one of their opinions as: (agree, disagree, or I don't know).

Statistical analysis

Statistical T-test and one-way ANOVA were used ($\alpha=0.05$).

Results

Out of 500 distributed surveys, we received 404 responses (80.8%). They were classified according to their occupation, as shown in Table 1.

Occupation

By using one-way ANOVA (95% confidence interval), among all the responses ($n=404$), it was found that dentists had more basic knowledge of dental amalgam, including its advantages, chemical contents, toxic ingredients, and the Hg chemical status that is considered harmful, than other groups, although the difference was insignificant (>0.05). However, dental assistants were found to have significantly higher (<0.05) knowledge than all other groups (dentists, interns, and dental students) regarding the hazardous issues related to Hg vapor, the way that Hg enters the body, sources of Hg exposure in the dental office, and daily practice of dental amalgam that could release Hg vapor. Considering knowledge of the proper handling of dental amalgam in the office during restorative treatment, the data showed that dentists and dental assistants were significantly higher in knowledge than

students and interns, as shown in Table 3 and Fig. 2.

Discussion

Dental amalgam is well known for its durability, and cost-effectiveness, though it is appropriate for posterior teeth only, as it is not a tooth-colored restoration^[1, 2, 15]. Previous studies have shown different clinical effects of amalgam on patients' health, as previously mentioned^[16]. Dental amalgam is still well accepted by dentists despite their awareness of its controversy and they would not recommend an alternative to amalgam^[11, 18, 19]. In contrast, other studies assessing attitudes to dental amalgam among dentist in other countries had reported increasing in the rate of using alternative restorative material like composite for posterior teeth. The author stated that their preference was influenced mainly by the prevailing trend and was not based on scientific evidence^[20]. In Saudi Arabia, a study reported that dentists found dental amalgam safe to be used up to date^[17] which reflected their noticeable knowledge of all the controversial hazardous issues related to mercury contained amalgam. Their finding came along with the results of the present study where the basic knowledge level: including advantages of dental amalgam as a restoration, its chemical contents, toxic ingredients, and the Hg chemical status that is considered harmful, were acceptable for all the groups in the study whereas the practitioners were the highest although it was not significant. Potential health risks to the dental workers from mercury exist if insufficient knowledge and improper handling during and after dental procedure are not followed^[13].

In the present study, basic knowledge regarding daily practice of dental amalgam that could release Hg vapor, hazardous issues, the way that Hg enters the body, and sources of Hg exposure in the dental office were found to be significantly higher among dental assistants than other groups. This might be due to their higher exposure to the procedure of amalgam restoration in the clinic.

Proper handling of amalgam during dental procedures is the key factor to reduce the chances of Hg contamination; consequently, health complications are decreased. In a study reported in south India by (Ramesh *et al.*)^[19] stated that only a minor section of practitioners that are still prefer dental amalgam as a restorative material were found to be aware of the global changes in the guidelines pertaining to the handling and disposal of amalgam. Additionally, Safe Mercury Amalgam Removal Technique (SMART), amalgam safety rules, and amalgam-free practice should be a part of the academic curriculum and continuing dental education. Another study conducted in Kurdistan by (Faraj *et al.*)^[21] had reported low level of awareness of mercury toxicity in dental amalgam among the dentists studied. On the other hand, the data in the present study showed that dental practitioners and assistants had more knowledge on how properly dental amalgam should be handled in the office during restorative treatment. They had significantly higher knowledge than interns and dental students, which was compatible with the findings of (Ramesh *et al.*). These findings might be explained by the more clinical experience they usually have compared to the interns and the students.

Table 1: Demographic classification

Factor	Level	N (%)
Gender	Male	112 (27.7)
	Female	292 (72.3)
Occupation	Practitioners	41 (10.2)
	Intern	42 (10.4)
	Student	268 (66.5)
	Dental assistant	52 (12.9)
Dental practitioner: Years of practice	1-5	22 (51.2)
	6-10	8 (18.6)
	11-15	6 (14)
	16-20	2 (4.7)
	21-above	5 (11.6)
Dental student	1 (pre-clinical)	43 (16)
	2 (pre-clinical)	97 (36.2)
	3 (clinical)	43 (16)
	4 (clinical)	46 (17.2)
	5 (clinical)	39 (14.6)
Dental assistant (years of practice)	1-5	25 (45.5)
	6-10	17 (30.9)
	11-15	4 (7.3)
	16-20	4 (7.3)
	21 and above	5 (9.1)

Table 3: Occupation-related factors

Factor	Occupation	N	Mean	Std. deviation	ANOVAP-value <0.05	95% Confidence interval for mean		Multiple comparison test			
						Lower bound	Upper bound	Dentist	Intern	Student	Dental assistant
Basic knowledge of dental amalgam including the following: (physical properties, chemical contents, toxic ingredients, Hg chemical status that is considered harmful)	Practitioners	41	74.34	8.604	0.328	71.63	77.06	1			
	Intern	42	70.71	10.395		67.47	73.95	NS	1		
	Student	268	73.20	9.850		72.01	74.38	NS	NS	1	
	Dental assistant	52	72.60	7.293		70.57	74.63	NS	NS	NS	1
Knowledge regarding hazardous issues	Practitioners	41	37.171	23.592	0.002	29.724	44.617	1			
	Intern	42	34.690	27.958		25.978	43.403	0.978	1		
	Student	268	42.000	24.801		39.017	44.983	0.731	0.389	1	
	Dental assistant	52	53.365	26.984		45.853	60.878	0.026	0.006	0.034	1
Knowledge regarding the way that Hg enters the body	Practitioners	41	40.244	21.620	0.000	33.420	47.068	1			
	Intern	42	33.571	20.341		27.233	39.910	0.547	1		
	Student	268	34.030	20.920		31.514	36.546	0.369	0.999	1	
	Dental assistant	52	60.192	20.243		54.557	65.828	0.000	0.000	0.000	1
Knowledge regarding the daily practice of dental amalgam that could release Hg vapor	Practitioners	41	51.220	17.492	0.001	45.698	56.741	1			
	Intern	42	45.952	19.885		39.756	52.149	0.856	1		
	Student	268	45.784	16.864		43.755	47.812	0.823	0.999	1	
	Dental assistant	52	56.154	18.487		51.007	61.301	0.982	0.049	0.002	1
Knowledge of sources of Hg exposure in the dental office	Dentist	41	54.634	31.313	0.000	44.751	64.518	1			
	Intern	42	45.714	35.140		34.764	56.665	0.669	1		
	Student	268	46.418	32.485		42.511	50.325	0.520	0.999	1	
	Dental assistant	52	75.769	31.768		66.925	84.613	0.023	0.000	0.000	1
Knowledge of proper handling of dental amalgam in the office during restorative treatment	Dentist	41	53.683	24.082	0.000	46.082	61.284	1			
	Intern	42	40.286	22.987		33.122	47.449	0.047	1		
	Student	268	42.705	21.894		40.072	45.338	0.027	0.928	1	
	Dental assistant	52	57.288	15.456		52.986	61.591	0.887	0.003	0.000	1
Total	Dentist	41	60.585	10.230	0.000	57.356	63.814	1			
	Intern	42	54.810	13.151		50.712	58.908	0.137	1		
	Student	268	57.142	11.426		55.768	58.516	0.337	0.663	1	
	Dental assistant	52	65.654	8.317		63.338	67.969	0.194	0.000	0.000	1

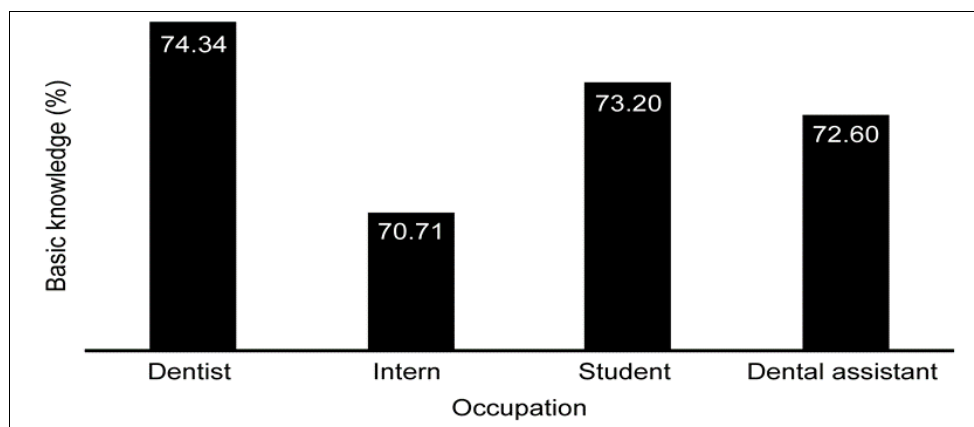


Fig 1: Basic knowledge of dental amalgam, including the following: advantages, chemical contents, toxic ingredients, Hg chemical status that is considered harmful

Conclusion

Within the limitation of this study, it is concluded that scientific information on mercury-containing dental amalgam should be emphasized to undergraduate dental students, as well as the proper clinical protocol for placement, removal and discarding its waste. Moreover, further future studies should be conducted on assessing the knowledge level of dental amalgam safety among dental workers.

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Conflict of interest

We know of no conflicts of interest associated with this publication, NO affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

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