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Effect of medical education on the knowledge, attitude and compliance regarding infection control measures among dental students in Makkah

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ABSTRACT

Background: Infectious diseases are the major causes of morbidity and mortality related to clinical, diagnostic and therapeutic procedures. Dentists should apply the guidelines for infection control during practice to prevent cross infection. This study aimed to assess the effect of medical education on the knowledge, attitudes and compliance among dental students regarding infection control measures at the dental teaching hospital faculty, Umm Al-Qura University (UQU), Makkah, Saudi Arabia.

Methods: A cross-sectional comparative study was performed to assess the knowledge, attitude and compliance towards infection control using a structured questionnaire. All students attending dental clinics in the 4th, 5th and 6th grades (n = 186), 94 males and 92 females participated in this study.

Results: Most dental undergraduate students have a knowledge of infection control in dental clinics including sterilization (83%), personal protective equipment (87.1%), proper hand hygiene (86.3%), vaccination (97.9%) and safe disposal of clinical waste (83.9%). More than 90% of UQU dental students were tested for Hepatitis B virus (HBV), performed wrap and disinfection of the dental unit before treating patients and wore personal protective equipment (PPE). The 6th grade dental students have superior knowledge compared to 4th and 5th grade dental students. The attitude and compliance to infection control guidelines within each grade were comparable. However, a between grade comparison showed that the 4th grade students had a better attitude and compliance.

Conclusions: UQU dental students had good levels of knowledge and positive attitudes and compliance towards infection control. This likely reflects the effectiveness of the taught infection control curriculum and the usefulness of student's supervision during daily practice.

1. Introduction

Infection is a major cause of morbidity and mortality worldwide [1]. Infection control is defined by world health organization as "a scientific approach and practical solution designed to prevent harm caused by infection to patients and health care workers (HCWs)". Centers for Disease Control and Prevention (CDC) provide important guidelines for HCWs. These guidelines include vaccination of HCWs, wearing protective equipment, hand hygiene, safe use of sharp instruments and needles, sterilization and disinfection [2].

Cross-infection is spread by harmful microorganisms or contaminated aerosols emissions between patients and health care workers within a clinical environment. Transfer of the disease from a patient to another in the clinics is called "cross-infection", and disease transfer to health care providers are termed "occupationally acquired infectious diseases", both predominantly bloodborne diseases [3,4]. Infection transmission can easily occur in routine dental practice.

In the dental clinic, infections can be transmitted through different ways such as direct blood contact, airborne contaminants or saliva in either splatter droplets or oral and respiratory fluid aerosols for example, spluttering, sneezing, coughing or talking. It can also be transmitted indirectly through contact with contaminated environmental surfaces, instruments or operatory equipment [5,6]. Biofilms can form in the waterline tubing and act as a reservoir that may greatly enhance the number of free-floating microorganisms in water used for dental treatment [7–9]. However, sharp injuries remain the main concern because of the risk of exposure to bloodborne

pathogens such as Hepatitis B virus (HBV), Hepatitis C virus (HCV) and human immunodeficiency virus HIV [10]. The transmission of HBV in the dental clinics is greater than HIV [11]. The risk of a single needle stick exposure to HBV-infected blood ranges from 6% to 30%, depending on the hepatitis B antigen (HBeAg) status or degree of infection of the individual source [12].

Dental health care workers (DHCWs) including students, dentists, technicians and dental assistants should apply the guidelines for infection control during practice to prevent cross infection [13]. Standard precautions are the minimum practices for infection prevention which apply to all patients, to protect both HCWs and patients. Standard precautions involve hand hygiene, sharps safety, use of personal protective equipment (PPE), clean disinfected environmental surfaces, sterile instruments and devices and safe waste disposal [14]. One of the essential elements to prevent cross-infection in any dental procedure is the wearing of PPE including; gowns, masks, eyewear and gloves by dental team members [15,16]. Contaminated hands are a major source of infection. Infected blood can be retained underneath fingernails for up to five days. Without thorough hand hygiene practices, it is difficult to eliminate infected materials from the hands [17,18].

During the use of rotary dental instruments such as a hand piece, ultrasonic scaler or air-water syringe, a visible spray is created which consists of large-particle spatter of water, blood, saliva, microorganisms and other debris. Using a dental dam and high-volume

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evacuator should reduce droplets, spatter and bioaerosols in appropriate work practices [19]

Knowledge, attitude, and compliance are essential elements in effective infection control practices. It is important to have the knowledge, constructive attitude, and compliance towards infection control to provide the proper service to patients [20,21]. Medical education has had a great impact on the infection control practice among students and has improved the knowledge and practices of students in the clinic. It can also help dental students to acquire adequate knowledge toward general infection control measures [22,23].

Compliance with infection control guidelines should reduce the risk of disease transmission in the dental environment from patient to DHCW, from DHCW to patient and from patient to patient. This study aimed to assess knowledge, attitudes and compliances among dental students at the dental teaching hospital faculty, Umm Al-Qura University (UQU), Makkah, Saudi Arabia regarding infection control measures.

2. Materials and Methods

Ethical Approval. This study was approved by the Institutional Review Board (number 145-19) of the Faculty of Dentistry, Umm Al-Qura University.

A cross-sectional comparative study was performed to measure the effect of medical education on knowledge, attitude and compliance with recommended infection control measures among dental students at Umm Al-Qura University teaching dental hospital.

A structured questionnaire was designed to collect data in this study. The questionnaire assessed the knowledge, attitude and compliance towards infection control and comprised of three sections. The first section was consisted of demographic data, the second and third section assessed knowledge, attitude and compliance toward infection control. The questionnaire included 20 questions; the first seven questions assessed the standard precautions of infection control while the remaining questions evaluated attitude and compliance towards infection control practices.

Study Sample: A convenience sample of dental students, in Makkah region, participated in this study and were recruited from students attending the dental clinic in the 4th, 5th, and 6th grades (n = 186). As can be seen in Table 1, out of the total participants, 92 (49.5%) were females and 94 (50.5%) were males, 4th grade students were 57 (30.6%), 5th grade students were 53 (28.5%) and 6th grade students were 76 (40.9%). Each student gave his or her consent to participate in this study as stated on the front page of the questionnaire. Face-to-face interviews using the questionnaire as a guide were conducted by the researchers. A pilot study was conducted with fifteen students to assess their understanding and interpretation of each question. A few modifications in the questionnaire were made on the basis of the results of the pilot study. After the pilot stage, the main study was conducted. Data were collected and analyzed statistically using the Package for the Social Sciences (SPSS) software.

Table 1: Distributions of undergraduate students in different grade levels.

Class	Female		Male		Total	
	No.	%	No.	%	No.	%
4 th grade	28	30.4	29	30.9	57	30.6
5 th grade	30	32.6	23	24.5	53	28.5
6 th grade	34	37	42	44.7	76	40.9
Total	92	49.5	94	50.5	186	100

3. Results

The knowledge of students towards standard precautions in infection control is summarized in Table 2. Approximately 72% of the students had knowledge that killing all microorganisms including bacterial spores is the aim of sterilization and 94% of them considered that autoclaving is the most reliable method. Most students identified biohazard waste (92%) and knew when to wash their hands (97%) and dispose of the sharp container (75%). About 85% of students were familiar with the correct order of removing PPE.

When knowledge of infection control guidelines was compared between grades (table 2), we found that more than 73% of 5th and 6th

grade students knew the aim of sterilization compared with 67.6% of the 4th grade students. The most reliable method of sterilization of instruments was recognized by all 6th grade students and other grades revealed a high result (>87%). About 96% of both 4th and 5th grade students knew that there is a vaccine against the Hepatitis B virus which was higher than the 6th grade students (89.4%). All 6th grade students knew that hand washing must be done before and after touching the patients compared with 4th and 5th grades (94.3, 96.4% respectively). Most participants recognized the correct sequence of removing PPE (>81%). More than 89% of students identified the nature of biohazard waste. The 4th year grade students showed better knowledge about disposal of a sharp container (88.2%) compared to 5th and 6th grade students (67.9, 76.3% respectively).

The data illustrated in Figure 1 showed that the majority of dental undergraduate students have a knowledge of infection control in a dental clinic including sterilization (83%), personal protective equipment (87.1%), proper hand hygiene (86.3%), vaccination (97.9%) and safe disposal of clinical waste (83.9%).

As can be seen in Table 3, almost all students properly wrap the contact surfaces in the clinic before the treatment of patients started and disinfected the dental chair and unit between each patient (97.3%). About 97% of dental students were tested for HBV, but only 66.7% were willing to treat a patient with bloodborne diseases. Almost all students (97%) wrap the dental clinical contact surfaces before treating their patients and disinfect the dental unit between patients. The majority of students wear a gown, mask and gloves when dealing with patients. However, only 56% of students asked patients to wear protective goggles. Around 92% of students used a 'one hand' technique to recap the needle. About 14.5% of students acknowledged experiencing a sharp injury but only 40% of them reported this injury.

The current study showed that attitude to and compliance with infection control guidelines in each grade were comparable (Table 3). All students of the 5th grade were tested for Hepatitis B surface antibody levels which was higher than the 4th and 6th grades (92.9, 98.6% respectively). The 5th grade students were ready to treat patients with bloodborne diseases (73.5%) compared to 4th and 6th grade students (59.6, 68.4% respectively). More than 96% of the participants wrapped contact surfaces of the dental clinic before treating patients. All 4th grade students disinfected the dental unit between patients by comparison with 5th and 6th grade students (92.4, 97.3% respectively). Most 4th grade students removed their jewelry and wristwatch before undertaking a dental procedure (91.2%) while the equivalent levels for 5th and 6th grade students were 81.1, 77.6% respectively. More than 89.4% of 4th grade students washed their hands before wearing gloves compared with 5th and 6th grade students (60.3, 75% respectively). During dental procedures, 5th grade students wore PPE more than other grade students. The 6th year grade students were the lowest in using the 'one hand' technique to recap needles (88.1%), and consequently were the highest in receiving needle stick injuries among all students (18.4%). However, reporting needle stick injury was 55.5% in 5th grade students while in 4th and 6th grade students (33.3, 35.7% respectively).

Table 2. The knowledge of dental students towards infection control guidelines.

Questions	4 th grade (n=57)		5 th grade (n=53)		6 th grade (n=76)		Total (n=186)	
	Correct	%	Correct	%	Correct	%	Correct	%
The aim of sterilization	38	67.6	39	73.5	57	75	134	72
Most reliable method sterilization of instruments	50	87.7	49	92.4	76	100	175	94.1
Vaccine for Hepatitis B virus	55	96.4	51	96.2	68	89.4	174	93.5
Hand wash before and after touching the patients	55	96.4	50	94.3	76	100	181	97.3
The order for removing PPE	48	84.2	43	81.1	68	89.4	159	85.5
Identification of biohazard waste	51	89.4	50	94.3	71	93.4	172	92.5
Disposal of the sharp container when the box	47	88.2	36	67.9	52	76.3	140	75.3

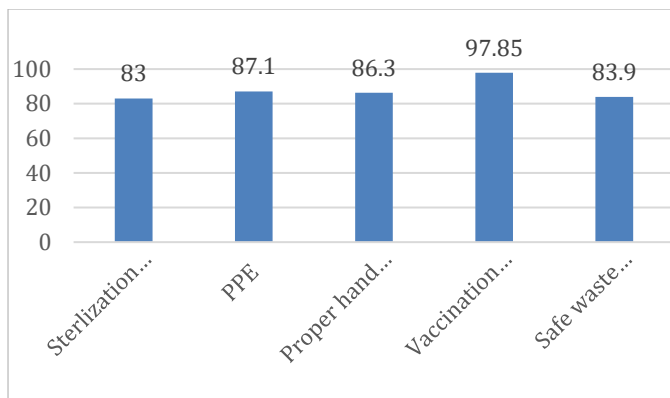


Figure 1. The average of the knowledge of infection control standard precautions

Table 3. The attitude and compliance of dental students towards infection control guidelines.

Questions	4 th grade (n=57)		5 th grade (n=53)		6 th grade (n=76)		Total (n=186)	
	Yes	%	Yes	%	Yes	%	Yes	%
Tested for Hepatitis B surface antibody	53	92.9	53	100	75	98.6	180	96.8
Willingness to treat a patient with bloodborne diseases	34	59.6	39	73.5	52	68.4	124	66.7
Wrapping the dental clinical contact surfaces before treating your patient	57	100	52	98.1	73	96	181	97.3
Disinfection of the dental unit between patients	57	100	49	92.4	74	97.3	180	96.8
Jewelry and watch removal before dental procedure	52	91.2	43	81.1	59	77.6	154	82.8
Wearing mask during treating your patient	57	100	52	98.1	74	97.3	183	98.4
Wearing gown during treating your patient	56	98.2	53	100	72	94.7	181	97.3
Wearing gloves during treating your patient	56	98.2	53	100	74	97.3	183	98.4
Washing hands prior to wearing gloves	51	89.4	32	60.3	57	75	140	75.3
Asking the patient to wear protective goggles	36	63.1	30	56.6	38	50	104	55.9
Using one hand technique to recap the needle	56	98.2	48	90.5	67	88.1	171	91.9
Pricking finger during treating a patient	3	5.2	9	16.9	14	18.4	27	14.5
Reporting the sharp injury incident	1	33.3	5	55.5	5	35.7	11	40.7

4. Discussion

Continuous education about infection control procedures and day to day supervision are essential to improve the knowledge and compliance of dental students regarding infection control. This study showed that UQU dental students have good knowledge ($\geq 83\%$) of infection control standard precautions including sterilization awareness, PPE, proper hand hygiene, vaccination awareness and safe waste disposal. Attitude and compliance levels among UQU dental students were excellent with more than 90% of them having been tested for HBV, wearing PPE and wrapped and disinfected the dental unit before treating patients. This good knowledge and excellent practice regarding infection control measures reflects the continuous infection control education and day to day infection control supervision in the dental clinic by infection control team.

Although all students have a good knowledge of infection control standards, the 6th grade dental students have a better knowledge than 4th and 5th grade dental students. This may be due to gaining more experience than the other grades. However, the 4th grade students showed better attitude and compliance. Other studies have reported variable results. Alharbi et al. reported that attitude and compliance levels among King Saud University dental students were acceptable but the knowledge was fair [24]. On the other hand, a study by Al-Maweri et al. in Saudi Arabia reported good knowledge and attitudes regarding infection control among dental students but that compliance and practice were poor [25]. Studies in India and Yemen have shown that the level of knowledge and practice regarding infection control measures was poor. They attributed this defect to inadequate training

for infection control measures, insufficient supply of personal protective equipment, and poor practice [2,13,26].

This study showed that about 97% of dental students were tested for HBV. Prior to clinical practice, all students in the Faculty of Dentistry at UQU must be tested for HBV and their antigen-HBs levels measured. If the level is less than 10 mIU/mL, they must be vaccinated. Only 66.7% of students are willing to treat a patient with blood borne diseases. This may be due to lack of experience and fear of contracting an infection.

5. Limitations

This study has some limitations. One of these limitations is relying on subjective self-assessment to measure attitude and compliance towards infection control because we could not supervise all students in the clinic during the period of this study, to confirm practices. Another limitation was that the number of questions might not accurately reflect the actual knowledge of the respondents. Nonetheless, we minimized the number of questions to improve the response rate. Despite these limitations, this study provides valuable information about the knowledge, attitude to and compliance of UQU dental students with regard to infection control practices.

6. Conclusion

UQU dental students have good levels of knowledge and a positive attitude to compliance with infection control measures. An effectively taught infection control curriculum in UQU and student's supervision during daily practice are crucial to improve the knowledge and compliance of dental students towards infection control.

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