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KNOWLEDGE, ATTITUDE AND PRACTICE FOR A GROUP OF EGYPTIAN INTERNS ABOUT INFECTION CONTROL IN DIFFERENT PEDIATRIC DENTAL CLINICS: A CROSS-SECTIONAL STUDY

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ABSTRACT

Aim: This study aimed to evaluate the knowledge, attitude, and practice of pediatric dentistry interns in relation to infection control practices.

Methodology: A printed questionnaire was handed to 400 interns in the department which was composed of two demographic data questions, 14 for knowledge, 6 regarding attitude, and 33 concerning practice.

Results: The majority had good knowledge of cross-infection, 54% were aware that saliva is the most common way for the Hepatitis B virus to spread, while only 29.5% and 13.25% knew tuberculosis and Acquired Immunodeficiency Syndrome carry the same risk. Also, 43.75% knew immediate action in case of direct blood contact with a Human Immunodeficiency Virus patient. The attitude section showed that 83% had a good attitude toward methods of infection prevention, 86.75% were worried about exposure to Human Immunodeficiency Virus patients, and 35.75% believed they had the right to refuse to treat that patient. Concerning practice, 69.25% always washed hands, 12.5% used face masks and gloves, 3.5% wore protective eyewear, and 7.75% wore protective clothing. However, 81.5% claimed using all protective equipment. Less than half always used rubber dam sheets and occasionally used high-volume evacuators. Overall, 6.25% had good knowledge, 24.5% had a positive attitude, and 31% had good practice.

Conclusions: Knowledge is poor, attitude is positive, and practice is good but not as per standards.

KEYWORDS: Attitude, Infection control, Interns, Knowledge, Practice.

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INTRODUCTION

The term "cross-infection" refers to the transmission of infectious agents from one person or item to another between patients and staff in a healthcare environment in a variety of routes including mainly bloodborne and airborne if precautions such as wearing personal protective equipment are not implemented **(Kumar, 2016).** Infection prevention and control (IPC) is defined by the World Health Organization (WHO) as a scientific method and practical solution for preventing infection-related harm to patients and healthcare personnel **(Elshanti et al., 2021).**

Healthcare IPC strategies aim to interrupt the infection cycle at particular points along the transmission chain. Standard precautions are the fundamental IPC strategies that healthcare facilities (HCFs) should always follow. These strategies include hand hygiene, wearing personal protective equipment, coughing, and respiratory hygiene, sharps safety, safe injection techniques, sterilizing and disinfecting patient-care items and devices, and finally environmental infection prevention and control **(Pacific Public Health Surveillance Network, 2021).**

Because certain individuals seem well, exhibiting normal physical examination results and medical background information, standard infection control (IC) protocols must be followed to provide a safe work environment. However, because some exposures are unavoidable and immunization is not always possible, a suitable standard post-exposure care plan is a critical defense mechanism that should be properly understood and performed in the case of accidental exposure **(Mahasneh et al., 2020).**

Studies of occupational injuries and IC practices among students, interns, and healthcare workers (HCWs) are needed to determine the effectiveness of IC training and to support the construction of educational programs that encourage following guidelines and lower the number of injuries **(Gawish and Khalifa, 2016).** So, the present study aimed to evaluate the knowledge, attitude, and practice of a group of pediatric dentistry interns regarding infection control procedures.

MATERIALS AND METHODS

Study design and settings

The current study evaluated dental interns' knowledge, attitudes, and practice of infection control practices using a questionnaire-based cross-sectional survey carried out at the Pediatric Dentistry and Dental Public Health Department, Faculty of Dentistry, Cairo University.

Subject Selection

After removing interns who declined to participate in the study and those who didn't regularly attend, a total of 400 Egyptian interns from both genders, completing their internship program in the Pediatric Dentistry and Dental Public Health Department were chosen to take part in the research.

Informed Consent

Written informed consent was acquired from each individual. After explaining the purpose of the study, a detailed description of the questionnaire, and their benefits in a simple standardized way, and confirming the voluntary and confidential nature of their participation.

Sample size calculation

The sample size was determined using data from **Dagher et al., 2017,** who found that the practice of IC procedures was 54.3%. By adopting a confidence interval of (95%), and a standard deviation of (1.96), the predicted sample size (n) was a total of 400 interns.

Study Registration

This study was registered on clinicaltrail.gov with the identifier NCT03780114.

Data Source and Management

The demographic data section was composed of two questions for gender, and age of the participants. Interns' knowledge of infection control procedures was evaluated using a pre-prepared validated self-administrated English language questionnaire created based on a related study by **Crossley, 2004; Yüzbasioglu et al., 2009; Singh et al., 2011**.

Regarding the knowledge section, The questionnaire consisted of 14 questions including four close-ended binary (yes/ No) questions; nine multiple-choice questions, and finally, one matrix question that evaluated knowledge regarding cross-infection, infectious agents, modes of transmission of Human Immunodeficiency Virus (HIV), oral manifestations of HIV, direct blood contact with an HIV patient, surfaces disinfection, and sterilization regulations.

Interns' attitude towards infection control procedures was evaluated through 6 questions including one multiple-choice question (M.C.Q.), two binary (yes/ No) questions, and finally, three matrix questions assessing evaluating attitude regarding methods for infection control, use of mouth rinse, dealing with HIV patients, dealing with patients at risk, and concerns about accepting HIV patients.

Finally, interns' practice was evaluated by 33 questions including nineteen Likert questions, seven multiple-choice questions, and, seven binary (yes/ No) questions describing practice regarding hand hygiene, Personal protective equipment (PPE), gloves, masks, aerosol control, medical history, vaccination status, Post-exposure prophylaxis (PEP), immersing instruments, sharps management, sterilization, disinfection, and HIV patients. A full detailed questionnaire utilized in the present study was supplemented as shown in appendix no.1.

Knowledge scores ranged from zero to 20 marks, attitude scores ranged from zero to 22 marks, and practice scores ranged from zero to 33 marks where good knowledge, attitude, and practice were considered if the respondents were able to answer 70% or more correctly, while poor knowledge, attitude, and practice were considered if the respondents answered less than 70% according to **Abdela et al., 2016**.

Statistical analysis

The t-test, with a level of significance set at $P \leq 0.05$, was used to assess for significant differences between quantitative data, which were reported as mean and standard deviation values. The Chi-square test was utilized to determine whether there were any significant differences between the qualitative data, with a significance threshold of $P \leq 0.05$. Finally, The qualitative data was represented as frequencies and percentages.

RESULTS

Demographic data

The questionnaire was completed by 400 interns, who had an age range from 22 to 27 years old with a mean age of 23.53±1.55**.** The gender distribution among the study sample was 261 (65.2%) females and 139 (34.8%) males with a statistically significant difference ($p<0.001$).

Knowledge questions

The majority of participants had good knowledge of cross-infection and its consequences. Regarding sterilization, 95% of participants knew that sterilization is essential to avoid the spread of infection while 87.75% of participants were aware of the importance of disinfection for safety, as shown in figure (1).

Regarding the infectious agent that has the highest rate of transmission via saliva, 54% of the participants chose hepatitis B. About 43.75% of the participants knew that anti-HIV immunoglobulins are the immediate action that should be taken in case of direct blood contact with an HIV patient, as shown in figure (2)

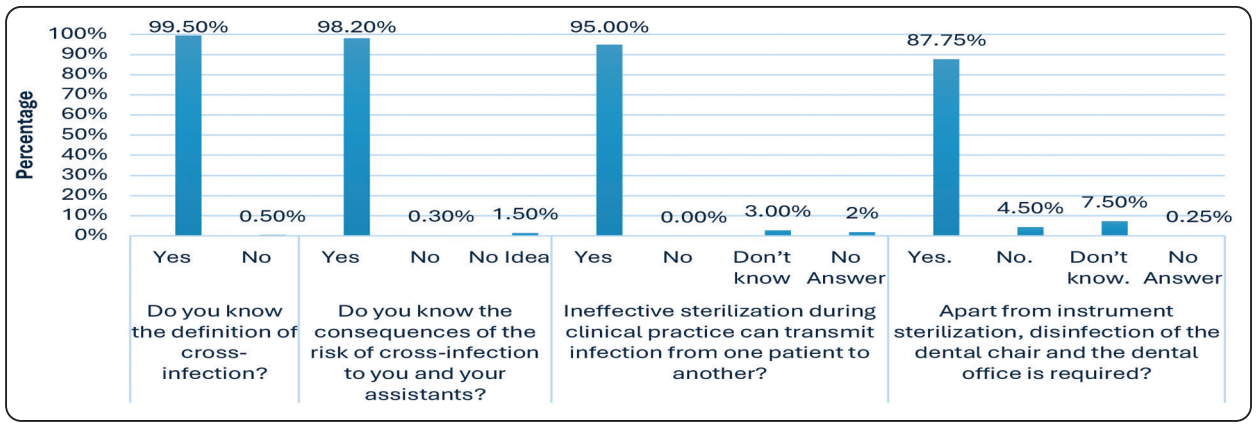

Fig. (1) Knowledge regarding cross infection, sterilization importance, and disinfection.

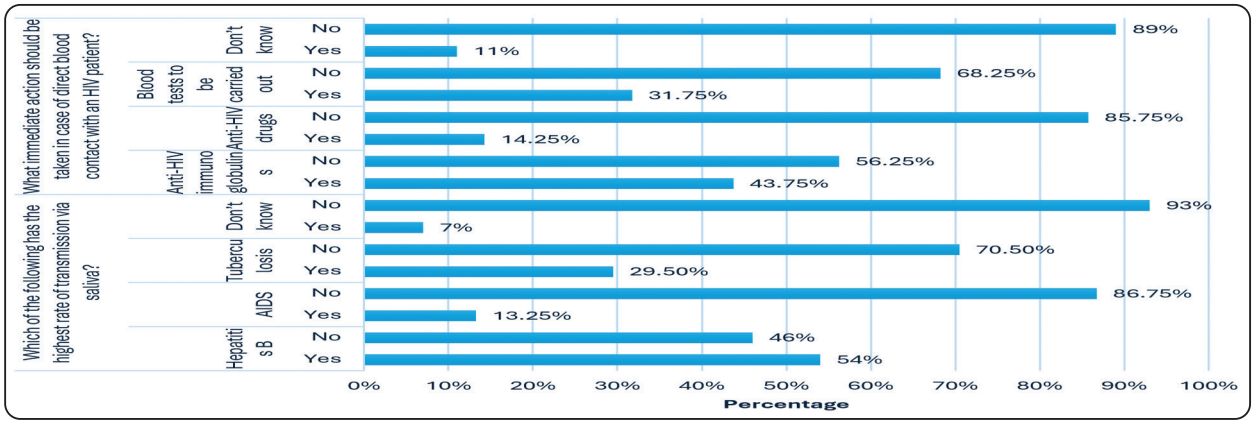

Fig. (2) Knowledge regarding diseases transmitted via saliva, and response to direct contact with HIV infected blood.

Attitude questions:

About 83% of the participants considered the use of universal precautions, mouth rinses, barrier protection, and regular maintenance for waterlines as the best methods to prevent transmission of infection with a statistically significant difference (*P*-value<0.05). When dealing with HIV patients, 89.25% of the participants agreed to the importance of the protection of dental health care professionals (DHCP) from occupational exposures, and 86.75% were worried about exposure as 80.75% believed that dentists are at increased risk of HIV infection and 85.5% agreed that there is an ethical duty to provide patients with the best treatment service.

Concerning the likelihood of disease transmission in dental clinics, 69.5% of the participants responded positively, 72.50% reported that IC measures were adequate in their workplace and 77.5% believed that additional resources should be made available. Only 35.75% of the participants agreed that DHCP should have the right to refuse to treat HIV patients, 40% disagreed, and 13.75% were undecided, as shown in table (1).

Practice questions:

Concerning handwashing, 69.25% always washed their hands before and after patient treatment. As per aerosol control, 47.5% of the participants always used rubber dam sheets and

TABLE (1) Attitude questions regarding infection control procedures.

Question	Answers		n	%	*P*-value
What is your preferred method to prevent the transmission of infections?	Use of universal precautions (Gloves, Masks, Protective eyewear or face shield & gowns)	Yes	57	14.25%	<0.0001
		No	343	85.75%	
	Avoid exposure to sharp devices and contaminated instruments	Yes	51	12.75%	
		No	349	87.25%	
	Preoperative and operative mouth rinses, in addition to the use of high-volume suction and rubber-dam	Yes	17	4.25%	
		No	383	95.75%	
	Improving the quality of dental unit waterlines	Yes	22	5.50%	
		No	378	94.50%	
	Use of barrier protection or cleaning and disinfection of surfaces between appointments	Yes	40	10%	
		No	360	90%	
	Keeping the instruments sterile until usage	Yes	51	12.75%	
		No	349	87.25%	
	All of the above	Yes	332	83%	
		No	68	17%	
Please indicate the response which best describes your opinion in relation to the following statements	The protection of dental workers from occupational exposure to HIV is a high priority for me	Agree	357	89.25%	<0.0001
		Disagree	15	3.75%	
		Undecided	1	0.25%	
		No Answer	27	6.75%	
	I am worried about occupational exposure to HIV infection	Agree	347	86.75%	<0.0001
		Disagree	21	5.25%	
		Undecided	3	0.75%	
		No Answer	29	7.25%	
	As a dentist, I am at increased risk of HIV infection	Agree	323	80.75%	<0.0001
		Disagree	39	9.75%	
		Undecided	6	1.50%	
		No Answer	32	8%	
	HIV transmission in dental clinics is very likely	Agree	278	69.50%	<0.0001
		Disagree	52	13%	
		Undecided	35	8.75%	
		No Answer	35	8.75%	
	The infection control measures in my place of work are adequate to prevent cross-infection of HIV	Agree	290	72.50%	<0.0001
		Disagree	18	4.50%	
		Undecided	67	16.75%	
		No Answer	25	6.25%	
	Additional resources should be made available to treat HIV-infected patients	Agree	310	77.50%	<0.0001
		Disagree	5	1.25%	
		Undecided	44	11%	
		No Answer	41	10.25%	
	As a dentist, I have an ethical responsibility to provide dental care to an HIV-positive person	Agree	342	85.50%	<0.0001
		Disagree	4	1%	
		Undecided	14	3.50%	
		No Answer	40	10%	
	Health professionals should have the right to refuse to provide treatment for an HIV-infected person	Agree	143	35.75%	<0.0001
		Disagree	160	40%	
		Undecided	55	13.75%	
		No Answer	42	10.5%	

43.25% occasionally used high-volume evacuators. For dental unit surfaces, 86.5% of the participants always used surface barriers, as shown in figure (3).

Regarding medical history, 95.25% of the participants routinely took a detailed medical history before performing any treatment on their patients. About 68.75% of interns had an appropriate protocol for emergency treatment in case of NSI and 86% disposed of the sharps in a puncture-resistant container, as shown in figure (4).

Concerning sterilization, 98.5% of the participants used the autoclave for sterilization and when it came to personal protective equipment, 81.5% of the participants claimed wearing protective measures as shown in figure (5).

Regarding knowledge score, 6.25% of interns had good knowledge and 93.75% had poor knowledge while the attitude score was 24.5% and 75.5% for positive and negative attitudes respectively. Finally, the practice score revealed 31% who had good practice and 69% showed malpractice with a statistically significant difference (P-value<0.05). The full set of data generated in the current study was supplemented with full details in Appendix (2).

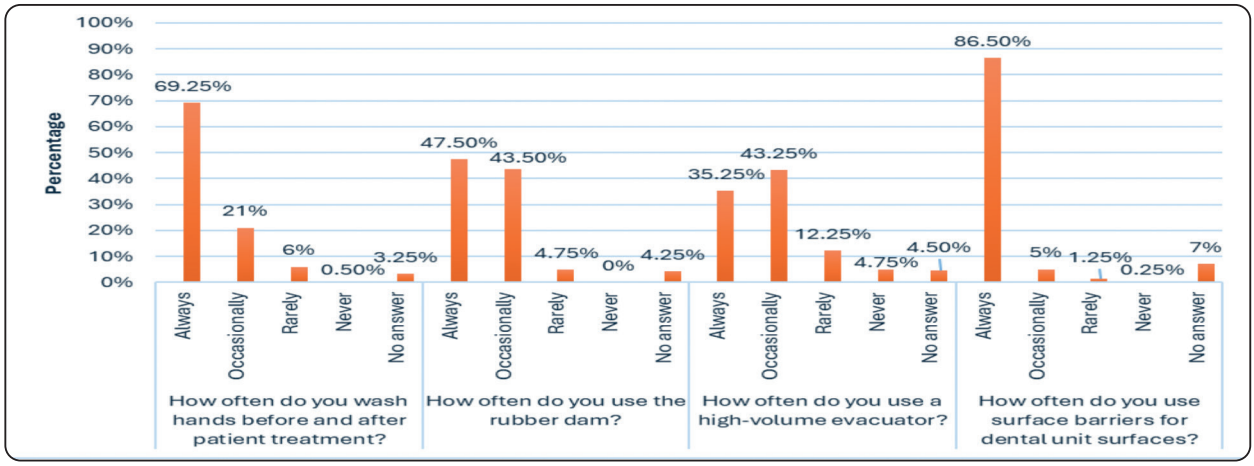

Fig. (3) Practice questions regarding hand hygiene, isolation, and use of surface barriers.

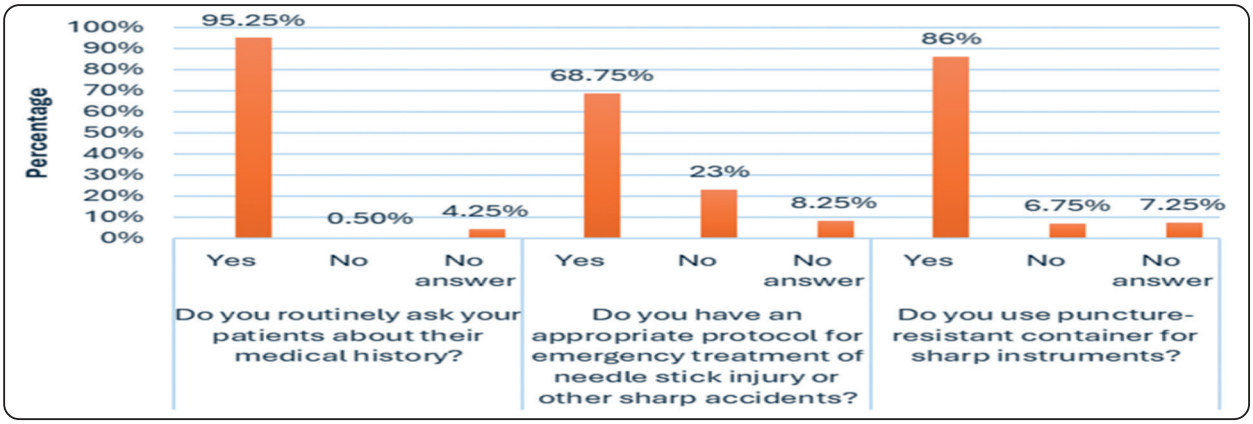

Fig. (4) Practice questions regarding medical history, and emergency practices.

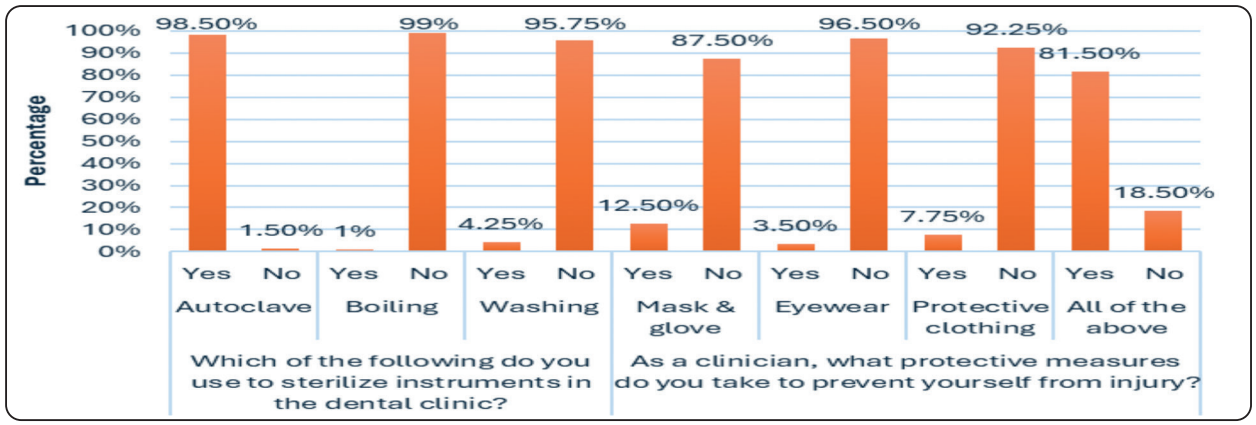

Fig. (5) Practice questions regarding sterilization, and protective measures.

DISCUSSION

In Egypt, there is a scarcity of data on interns' understanding, attitudes, and practices regarding IC measures. As a result, the present study was conducted to assess interns' knowledge, attitudes, and practices regarding the IC measures in the Faculty of Dentistry, Cairo University **(El Dokky and Moheb, 2021).** The current study was conducted on dental interns owing to the risk of acquiring blood-borne diseases when undergoing dental practice training, the negative effects of withholding information, and inadequate monitoring **(Younai et al., 2001; Ansari et al., 2022).**

The mean age of the study sample was 23.53±1.55 years which was in accordance with **Gawish and Khalifa, 2016** and can be attributed to the number of academic years in the Faculty of Dentistry **(Reddy et al., 2013).** About 65.2% of participants were females and 34.8% were males which was in accordance with **Dixit et al., 2020; El Sebaey et al., 2021** given that the percentage of female dentists was more likely to be more than their male counterparts **(Reddy et al., 2013).**

Regarding the knowledge of IC guidelines, the majority of the participants knew the correct definition of cross-infection and the consequences of the risk of cross-infection. This finding contradicted the results of **Yüzbasioglu et al., 2009** who reported that only 43% knew the correct definition and only 74.1% were aware of the consequences of the risk of cross-infection which can be attributed to the adequate and updated IC courses at the Faculty of Dentistry, Cairo University **(El Dokky and Moheb, 2021).**

Regarding knowledge about the diseases with the highest rate of transmission via saliva, 54% had good knowledge about these diseases which was in agreement with **Al-Hindawyta et al., 2021** and can be justified by the majority of dental procedures involving exposure to body fluids like saliva and in some cases blood **(Fallahi et al., 2020).**

When it came to the immediate action that should be done in case of blood contact, 43.75% knew the immediate action that should be done in case of blood contact which was comparable with the results of **Singh et al., 2011; Silva et al., 2018; Alharbi et al., 2019** and can be attributed to the lack of educational reinforcement for the risks of occupational injuries and blood-borne pathogen transmission during clinical practice **(Al-Hindawyta et al., 2021).**

About 87.75% of interns understood how important it was to keep the dentist chair and unit clean to avoid cross-infection with **Malhotra et al., 2017; Ahmed et al., 2020** which can be explained by proper IC courses **(Singh et al., 2011)**.

About 95% of the interns agreed that ineffective sterilization can cause transmission of infection. These findings were in line with **Singh et al., 2011; Silva et al., 2018; Ahmed et al., 2020; Dixit et al., 2020** and can be justified by the early implementation of IC practices in Egyptian dentistry schools **(Dixit et al., 2020).**

Concerning interns' attitudes, 83% of the participants had a positive attitude toward the methods that should be followed to prevent transmission of infection which was in agreement with **Yüzbasioglu et al., 2009** which can be attributed to the role of IC measures in protecting both dentist and patient **(Abdelnaby et al., 2020).**

Most of the participants with a percentage of 89.25% agreed to the importance of the protection of DHCP from occupational exposures when dealing with HIV patients and 86.75% were worried about exposure as they believed that dentists are at increased risk of HIV infection, in addition to 85.5% who believed that there is an ethical duty to provide patients with the best treatment service. These results were in agreement with **Al-Hindawyta et al., 2021; Elagib et al., 2021** and can be related to interns' academic maturity as they progress through their academic and professional lives **(Silva et al., 2018).**

Concerning the likelihood of disease transmission in dental clinics, 69.5% of the participants responded positively, about 72.50% reported that the infection control measures were adequate in their workplace and 77.5% of respondents said that more resources need to be made available to treat people with HIV which were consistent with **Ranjan et al., 2018; Elagib et al., 2021** which can be linked to the fear of contracting the disease **(Abou El Fadl et al., 2019).**

Only 35.75% of the participants agreed that DHCP should have the authority to decline treating people with HIV which can be justified by the fact that HIV is a culturally sensitive disease, especially in conservative communities because of its direct link to sexuality which leads to the discrimination against diseased persons **(Dagher et al., 2017; Abou El Fadl et al., 2019).**

Regarding interns' practice, 69.5% of participants always washed their hands before and after treatment which was in agreement with **AL-Ahrmari et al., 2021** which can be explained by the lack of understanding of the necessity of hand hygiene, which focuses on minimizing probable contamination of gloves and thus minimizing the spread of infection **(Omran et al., 2021).**

In the current study, 81.5% of the interns used all the mentioned PPE which was comparable with the results of **Silva et al., 2018; AlAhdal et al., 2019; Khader et al., 2020** which can be attributed to their role in preventing the transmission and susceptibility to airborne infections during dental treatment **(Omran et al., 2021).**

When it came to aerosol control, 47.5% always used rubber dams during treatment procedures and 43.25% occasionally used high-volume evacuators which was in agreement with **Dagher et al., 2017; Malhotra et al., 2017; AlDakhil et al., 2019; Alharbi et al., 2019** and this can be linked to the use and placement of rubber dam is considered expensive, complicated, time-consuming and painful procedure **(Tanalp et al., 2014).**

Regarding medical history, 95.25% of the participants routinely took a detailed medical history before performing any treatment which was in line with **Malhotra et al., 2017; AlAhdal et al., 2019** which can be attributed to the fact that taking a medical history is an important element of dental therapy that should be done on all patients, regardless of their condition **(Al-Hindawyta et al., 2021).**

About 68.75% of interns had an appropriate protocol for emergency treatment in case of NSIs. On the other hand, the majority dispose of the sharps in a puncture-resistant container. These findings were in agreement with **Dagher et al.,**

2017; AlAhdal et al., 2019; Farahat et al., 2020; Al-Hindawyta et al., 2021 which can be linked to a lack of intern skills, and expertise in sharps handling **(Al-Hindawyta et al., 2021).**

In the current study, 98.5% of the participants used the autoclave for sterilization which was in accordance with **Singh et al., 2011; Dagher et al., 2017** and can be clarified by the fact that autoclaves are the most effective sterilizing equipment available today **(Malhotra et al., 2017; Abobakr et al., 2018).**

For dental unit surfaces, 86.5% of the participants always used surface barriers and 68% always used surface disinfectants for routine wiping which was similar to the outcomes of **Dagher et al., 2017; AlAhdal et al., 2019; Arif et al., 2019** which might be attributed to the lack of understanding of how microbes can survive on surfaces and impressions, as well as limited resources **(El Dokky and Moheb, 2021).**

Regarding knowledge scores, 6.25% of interns had good knowledge which was in agreement with **Yüzbasioglu et al., 2009; Singh et al., 2011; Dagher et al., 2017; El Dokky and Moheb, 2021** and can be attributed to inadequate IC educational content provided over the years of study, suggesting that the IC curriculum should be revised regularly to keep up with current guidelines **(Alharbi et al., 2019; Dixit et al., 2020).**

Also, the attitude score was 24.5% for positive attitude which aligned with **Yüzbasioglu et al., 2009; Singh et al., 2011; Dagher et al., 2017; El Dokky and Moheb, 2021** and this can be attributed to the lack of personal views that standard precautions could jeopardize the health and well-being of all personnel engaged **(Alharbi et al., 2019).** Finally, the practice score revealed that 31% had good practice which was in agreement with **Yüzbasioglu et al., 2009; Singh et al., 2011; Dagher et al., 2017; El Dokky and Moheb, 2021** and can be justified by the lack of or insufficient training on IC, biosecurity, and cross-infection **(Silva et al., 2018).**

Given that the often-examined curricula differ from school to school, our study's limitations include the fact that it was conducted at a single public dentistry school and cannot be applied to all Egyptian dental interns. Furthermore, self-reported bias resulted from our reliance on the respondents' subjective self-evaluation because we were unable to monitor their practices. As a result, it's possible that the answers don't fairly represent the actual knowledge, attitude, and practice.

CONCLUSIONS

Based on the current study's findings, we can conclude that just 6.25% of interns had good knowledge of infection control methods, 24.5% had a favorable attitude, and 31% had excellent practices.

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Conflict of Interest

No conflicts of interest are disclosed by the authors.

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Ethics

The Ethical Committee of the Faculty of Dentistry, Cairo University authorized this study procedure, giving it permission number 19-3-2.

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Appendix (1): The questionnaire utilized in the present study:

Please could you supply some details about yourself:

1) I am:

□ Male. □ Female.

2) I am _____ years of age.

Knowledge Questions

1) Do you know the definition of cross-infection?

□ Yes. □ No.

2) Do you know the Concerns about the risk of cross-infection to you and your dental assistants?

□ Yes. □ No. □ No idea.

3) What are the Infectious agents considered important to take precautions for?

□ HIV. □ *Treponema pallidum*.

□ HBV, HCV. □ *Pseudomonas aeruginosa*.

□ *Mycobacterium tuberculosis*. □ *Legionella pneumophilia*.

□ *Neiserria gonorrhoeae*. □ All the above.

4) Which of the following has the highest rate of transmission via saliva?

□ Hepatitis B. □ AIDS.

□ Tuberculosis. □ Don't know.

5) What immediate action should be taken in case of direct blood contact with an HIV patient?

□ Anti-HIV immunoglobulins.

□ Anti-HIV drugs.

□ Blood tests to be carried out.

□ Don't know.

6) What is the ratio of HIV transmission after a single contaminated needlestick injury?

□ 0.1%–0.4%. □ 10%–40%.

□ 1%–4%. □ 70%–90%.

7) Please tick which of the following oral lesions you would associate with the manifestation of HIV/AIDS (please tick as many as necessary):

□ Kaposi's Sarcoma. □ Xerostomia.

□ Oral candidiasis. □ Aphthous ulceration.

□ Acute ulcerative gingivitis. □ Lichen planus/lichenoid reaction.

□ Hairy leukoplakia. □ All the above.

□ Herpetic infections.

8) Have the following body fluids have been proven as modes of transmission of HIV infection?

	Yes	No	Don't know
Blood	☐	☐	☐
Saliva	☐	☐	☐
Breastmilk	☐	☐	☐
Vaginal secretions	☐	☐	☐
Semen	☐	☐	☐
Mucus	☐	☐	☐
Tears	☐	☐	☐

9) Apart from instrument sterilization, disinfection of dental chair and dental office is required?

□ Yes. □ No. □ Don't know.

10) What are the environmental surfaces that should be protected with barriers for extra protection? (Please tick as many as necessary)

□ Dental unit's table and water trunks.

□ Dental unit's head gear.

□ Dental unit's light handle.

□ Light curing devices.

□ Dental radiograph equipment.

□ Telephones, drawer and drawer handles.

□ All the above.

11) What is the preferred time of use of sterilized, wrapped or packed instruments?

□ One week. □ Twelve weeks.

□ Four weeks. □ More than twelve weeks.

□ Six weeks.

12) Ineffective sterilization during clinical practice can transmit infection from one patient to another?

□ Yes. □ No. □ Don't know.

13) What is the Minimum time required for sterilization in the autoclave?

□ 5 min. □ 10 min. □ 15 min.

14) What is the temperature for sterilization in the autoclave?

□ 100° C. □ 120° C. □ 150° C.

Attitude questions

1) What is your preferred method to prevent the transmission of infections?

(Please tick as many as necessary)

□ Use of universal precautions (gloves, masks, protective eyewear or face shield, and gowns).

□ Avoid exposure to sharp devices and contaminated instruments.

□ Preoperative and operative mouth rinses, in addition to the use of high volume suction and rubber-dam.

□ Improving the quality of dental unit waterlines.

□ Use of barrier protection or cleaning and disinfection of environmental surfaces between appointments.

□ Keeping the instruments sterile until usage.

□ All the above.

2) Do you think isolation is important in infection control?

□ Yes. □ No.

3) Do you prefer oral mouth rinse before commencement of any treatment procedure?

□ Yes. □ No.

4) Please indicate the response which best describes your opinion in relation to the following statements?

	Agree	Disagree	Undecided
The protection of dental workers from occupational exposure to HIV is a high priority for me.	☐	☐	☐
I am worried about occupational exposure to HIV infection.	☐	☐	☐
As a dentist, I am at increased risk of HIV infection.	☐	☐	☐
HIV transmission in dental clinics is very likely.	☐	☐	☐
The infection control measures in my place of work are adequate to prevent cross infection of HIV.	☐	☐	☐
Additional resources should be made available to treat HIV infected patients.	☐	☐	☐
As a dentist, I have an ethical responsibility to provide dental care to an HIV positive person.	☐	☐	☐
Health professionals should have the right to refuse to provide treatment for an HIV infected person.	☐	☐	☐

5) How would you feel about treating the following patients?

	Have no hesitation	Accept the patient with some hesitation	Refer the patient elsewhere
A homosexual/ bisexual man.	☐	☐	☐
A hemophiliac.	☐	☐	☐
An IV drug user.	☐	☐	☐
A patient infected with Hepatitis B virus.	☐	☐	☐
A patient infected with Hepatitis C virus.	☐	☐	☐
A patient infected with aHIV/ AIDS diagnosis.	☐	☐	☐
A recipient of blood and blood products.	☐	☐	☐

6) In treating a HIV/ AIDS patient, how concerned would you be about the following?

	Concerned	Not at all concerned	Undecided
Loss of other patients from the practice.	☐	☐	☐
Dealing with staff fears about patients with HIV/AIDS.	☐	☐	☐
Increase in personal risk due to treating patients with HIV.	☐	☐	☐
The Financial burden for the practice due to increased infection control procedures.	☐	☐	☐

Practice questions

1) How often do you wash hands before and after patient treatment?
□ Always. □ Rarely.
□ Occasionally. □ Never.

2) With what do you wash your hands?
□ Plain soap. □ Antiseptic solution.
□ Detergent.

3) As a clinician, what protective measures do you take to prevent yourself from injury?
□ Face mask and gloves. □ Protective clothing.
□ Eyewear. □ All the above.

4) How often do you wear gloves while performing dental procedures?
□ Always. □ Rarely.
□ Occasionally. □ Never.

5) How often do you change gloves between patients?
□ Always. □ Rarely.
□ Occasionally. □ Never.

6) How often do you use sterile surgical gloves for surgery?
□ Always. □ Rarely.
□ Occasionally. □ Never.

7) After the use of gloves for a patient, what do you do with them?
□ Dispose of them.
□ Reuse them after wash.
□ Reuse them after sterilization.

8) How often do you wear protective eyewear?
□ Always. □ Rarely.
□ Occasionally. □ Never.

9) How often do you wear the mask?
□ Always. □ Rarely.
□ Occasionally. □ Never.

10) How often do you change the mask between patients?
□ Always. □ Rarely.
□ Occasionally. □ Never.

11) How often do you use a head covering?
□ Always. □ Rarely.
□ Occasionally. □ Never.

12) How often do you wear disposable gowns for surgery?
□ Always. □ Rarely.
□ Occasionally. □ Never.

13) How often do you use rubber dam?
□ Always. □ Rarely.
□ Occasionally. □ Never.

14) How often do you use high volume evacuator?
□ Always. □ Rarely.
□ Occasionally. □ Never.

15) How often do you ask your patient to do preoperative mouth rinses?
□ Always. □ Rarely.
□ Occasionally. □ Never.

16) Do you routinely ask your patients about their medical history?
□ Yes. □ No.

17) Are you vaccinated against Hepatitis B?
□ Yes. □ No.

18) Did you take your booster shot?
□ Yes. □ No.

19) Do you have an appropriate protocol for emergency treatment of needle stick injury or other sharp accidents?
□ Yes. □ No.

20) Do you keep detailed records of these accidents?
□ Yes. □ No.

21) Do you use puncture-resistant container for sharp instruments?
□ Yes. □ No.

22) How often do you do you immerse the used instruments in decontaminant solutions?
□ Always. □ Rarely.
□ Occasionally. □ Never.

23) When do you immerse the used instruments in decontaminant solutions?
◊ Before washing and cleaning.
◊ After

24) Which of the following do you use to sterilize instruments in the dental clinic?
□ Autoclave. □ Boiling.
□ Washing.

25) How do you clean dental handpieces and other devices attached to air and waterlines?

□ Cleaning with surface disinfectant solutions.

□ Run for 30 s before dental treatment.

□ Autoclaving.

□ No preferred procedure.

26) How often do you use heat sterilization for burs?

□ Always. □ Rarely.

□ Occasionally. □ Never.

27) How often do you use heat sterilization for endodontic files?

□ Always. □ Rarely.

□ Occasionally. □ Never.

28) How often do you use wrapping bags for instruments sterilization?

□ Always. □ Rarely.

□ Occasionally. □ Never.

29) How often do you use surface barriers for dental unit surfaces?

□ Always. □ Rarely.

□ Occasionally. □ Never.

30) How often do you use surface disinfectants for routine wiping?

□ Always. □ Rarely.

□ Occasionally. □ Never.

31) How often do you chemically disinfect impressions before sending them to the laboratory?

□ Always. □ Rarely.

□ Occasionally. □ Never.

32) Have you ever treated an HIV-positive patient?

□ Yes. □ No.

33) To your knowledge, how many HIV-positive have you treated within the past 6 months?

ÿ6 or more ÿ3–5.

ÿ1–2. ÿNone.

Appendix (2): The full set of data generated in the current study:

I. **Knowledge section:**

No.	Question	Answers		N.	%	*P*-Value
Q.1	Do you know the definition of cross-infection?	Yes		398	99.50%	<0.0001
		No		2	0.50%	
Q.2	Do you know the consequences of the risk of cross-infection to you and your dental assistants?	Yes		391	97.75%	
		No		1	0.25%	
		No Idea		8	2%	<0.0001
Q.3	What are the infectious agents considered important to take precautions for?	HIV	Yes	118	29.50%	<0.0001
			No	282	70.50%	
		HBV, HCV	Yes	125	31.25%	
			No	275	68.75%	
		Mycobacterium tuberculosis	Yes	81	20.25%	
			No	319	79.75%	
		Neisseria gonorrhoeae	Yes	2	0.50%	
			No	398	99.50%	
		Treponema pallidum	Yes	26	6.50%	
			No	374	93.50%	
		Pseudomonas aeruginosa	Yes	12	3%	
			No	388	97%	
		Legionella pneumophilia	Yes	0	0%	
			No	400	100%	
		All of the above	Yes	255	63.75%	
			No	145	36.25%	
Q. 4	Which of the following has the highest rate of transmission via saliva?	Hepatitis B	Yes	216	54%	<0.0001
			No	184	46%	
		AIDS	Yes	53	13.25%	
			No	347	86.75%	
		Tuberculosis	Yes	118	29.50%	
			No	282	70.50%	
		Don't know	Yes	28	7%	
			No	372	93%	
Q. 5	What immediate action should be taken in case of direct blood contact with an HIV patient?	Anti-HIV immunoglobulins	Yes	175	43.75%	<0.0001
			No	225	56.25%	
		Anti-HIV drugs	Yes	57	14.25%	
			No	343	85.75%	
		Blood tests to be carried out	Yes	127	31.75%	
			No	273	68.25%	
		Don't know	Yes	44	11%	
			No	356	89%	
Q. 6	What is the ratio of HIV transmission after a single contaminated needle stick injury?	0.1%–0.4%	Yes	117	29.25%	<0.0001
			No	283	70.75%	
		1%–4%	Yes	147	36.75%	
			No	253	63.25%	
		10%–40%	Yes	69	17.25%	
			No	331	82.75%	
		70%–90%	Yes	19	4.75%	
			No	381	95.25%	

Q. 7	Please tick which of the following oral lesions you would associate with the manifestation of HIV/AIDS (please tick as many as necessary)	Kaposi's Sarcoma	Yes	218	54.50%	<0.0001
			No	182	45.50%	
		Oral candidiasis	Yes	242	60.50%	
			No	158	39.50%	
		Acute ulcerative gingivitis	Yes	135	33.75%	
			No	265	66.25%	
		Hairy leukoplakia	Yes	144	36%	
			No	256	64%	
		Herpetic infections	Yes	145	36.25%	
			No	255	63.75%	
		Xerostomia	Yes	110	27.50%	
			No	290	72.50%	
		Aphthous ulceration	Yes	96	24%	
			No	304	76%	
		Lichen planus/ lichenoid reaction	Yes	83	20.75%	
			No	317	79.25%	
		All the above	Yes	70	17.50%	
			No	330	82.50%	
Q. 8	Have the following body fluids have been proven as modes of transmission of HIV infection?	Blood	Yes	377	94.25%	<0.0001
			No	2	0.50%	
			Don`t Know	1	0.25%	
			No Answer	20	5%	
		Saliva	Yes	196	49%	
			No	64	16%	
			Don`t Know	11	2.75%	
			No Answer	129	32.25%	
		Breastmilk	Yes	86	21.50%	
			No	83	20.75%	
			Don`t Know	96	24%	
			No Answer	135	33.75%	
		Vaginal secretions	Yes	319	79.75%	
			No	21	5.25%	
			Don`t Know	37	9.25%	
			No Answer	23	5.75%	
		Semen	Yes	258	64.5%	
			No	41	10.25%	
			Don`t Know	48	12%	
			No Answer	53	13.25%	
		Mucus	Yes	143	35.75%	
			No	80	20%	
			Don`t Know	54	13.50%	
			No Answer	123	30.75%	
		Tears	Yes	42	10.50%	
			No	128	32%	
			Don`t Know	88	22%	
			No Answer	142	35.50%	
Q. 9	Apart from instrument sterilization, disinfection of the dental chair and the dental office is required?		Yes.	351	87.75%	<0.0001
			18	4.50%		
	No.		30	7.50%		
	Don't know.No Answer		1	0.25%		

Q.10	What are the environmental surfaces that should be covered with protective barriers?	Dental unit's table and water trunks	Yes	86	21.50%	<0.0001
			No	314	78.50%	
		Dental unit's headgear	Yes	85	21.25%	
			No	315	78.75%	
		Dental unit's light handle	Yes	93	23.25%	
			No	307	76.75%	
		Light curing devices	Yes	64	16%	
			No	336	84%	
		Dental radiograph equipment	Yes	60	15%	
			No	340	85%	
		Telephones, drawer, and drawer handles	Yes	1	0.25%	
			No	399	99.75%	
		All the above	Yes	286	71.50%	
			No	114	28.50%	
Q. 11	What is the preferred time of use of sterilized, wrapped, or packed instruments?		One Week	164	41%	<0.0001
	Four Weeks		124	31%		
	Six Weeks		50	12.50%		
	Twelve Weeks		28	7%		
	More than Twelve Weeks		10	2.50%		
	No Answer		24	6%		
Q. 12	Ineffective sterilization during clinical practice can transmit infection from one patient to another?		Yes	380	95%	<0.0001
	No		0	0%		
	Don't know		12	3%		
	No Answer		8	2%		
Q. 13	What is the minimum time required for sterilization in the autoclave?		5 min	33	8.25%	<0.0001
	10 min		47	11.75%		
	15 min		303	75.75%		
	No Answer		17	4.25%		
Q. 14	What is the temperature for sterilization in the autoclave?		100° C	27	<0.0001 6.75%	
	120° C		303	75.75%		
	150° C		46	11.50%		
	No Answer		24	6%		

I. **Attitude section:**

No.	Question	Answers		N.	%	*P*-Value
Q.1	What is your preferred method to prevent the transmission of infections?	Use of universal precautions (Gloves, Masks, Protective eyewear or face shield & gowns)	Yes	57	14.25%	<0.0001
			No	343	85.75%	
		Avoid exposure to sharp devices and contaminated instruments	Yes	51	12.75%	
			No	349	87.25%	
		Preoperative and operative mouth rinses, in addition to the use of high-volume suction and rubber-dam	Yes	17	4.25%	
			No	383	95.75%	
		Improving the quality of dental unit waterlines	Yes	22	5.50%	
			No	378	94.50%	
		Use of barrier protection or cleaning and disinfection of environmental surfaces between appointments	Yes	40	10%	
			No	360	90%	
		Keeping the instruments sterile until usage	Yes	51	12.75%	
			No	349	87.25%	
		All of the above	Yes	332	83%	
			No	68	17%	
Q.2	Do you think isolation is important in infection control?		Yes	364	91%	<0.0001
			No 35	8.75%		
			No answer 1	0.25%		
Q.3	Do you prefer oral mouth rinse before the commencement of any treatment procedure?		Yes	303	75.75%	<0.0001
			No 96	24%		
			No answer 1	0.25%		
Q.4	Please indicate the response which best describes your opinion in relation to the following statements	The protection of dental workers from occupational exposure to HIV is a high priority for me	Agree	357	89.25%	<0.0001
			Disagree	15	3.75%	
			Undecided	1	0.25%	
			No Answer	27	6.75%	
	I am worried about occupational exposure to HIV infection		Agree	347	86.75%	<0.0001
			Disagree	21	5.25%	
			Undecided	3	0.75%	
			No Answer	29	7.25%	
	As a dentist, I am at increased risk of HIV infection		Agree	323	80.75%	<0.0001
			Disagree	39	9.75%	
			Undecided	6	1.50%	
			No Answer	32	8%	
	HIV transmission in dental clinics is very likely		Agree	278	69.50%	<0.0001
			Disagree	52	13%	
			Undecided	35	8.75%	
			No Answer	35	8.75%	
	The infection control measures in my place of work are adequate to prevent cross-infection of HIV		Agree	290	72.50%	<0.0001
			Disagree	18	4.50%	
			Undecided	67	16.75%	
			No Answer	25	6.25%	
	Additional resources should be made available to treat HIV-infected patients		Agree	310	77.50%	<0.0001
			Disagree	5	1.25%	
			Undecided	44	11%	
			No Answer	41	10.25%	
	As a dentist, I have ethical responsibility to provide dental care to an HIV-positive person		Agree	342	85.50%	<0.0001
			Disagree	4	1%	
			Undecided	14	3.50%	
			No Answer	40	10%	
	Health professionals should have the right to refuse to provide treatment for an HIV-infected person		Agree	143	35.75%	<0.0001
			Disagree	160	40%	
			Undecided	55	13.75%	
			No Answer	42	10.5%	

Q.5	How would you feel toward treating the following patients? A homosexual/ bisexual man	No hesitation	183	45.75%	<0.0001
		Some hesitation	95	23.75%	
		Referral	67	16.75%	
		No answer	55	13.75%	
	A hemophiliac	No hesitation	175	43.75%	<0.0001
		Some hesitation	63	15.75%	
		Referral	117	29.25%	
		No answer	45	11.25%	
	An IV drug user	No hesitation	151	37.75%	<0.0001
		Some hesitation	144	36%	
		Referral	51	12.75%	
		No answer	54	13.50%	
	A patient infected with Hepatitis B virus	No hesitation	221	55.25%	<0.0001
		Some hesitation	124	31%	
		Referral	14	3.50%	
		No answer	41	10.25%	
	A patient infected with Hepatitis C virus	No hesitation	202	50.50%	<0.0001
		Some hesitation	142	35.50%	
		Referral	13	3.25%	
		No answer	43	10.75%	
	A patient infected with an HIV/ AIDS diagnosis	No hesitation	149	37.25%	<0.0001
		Some hesitation	175	43.75%	
		Referral	35	8.75%	
		No answer	41	10.25%	
	A recipient of blood and blood products	No hesitation	175	43.75%	<0.0001
		Some hesitation	115	28.75%	
		Referral	67	16.75%	
		No answer	43	10.75%	
Q.6	In treating a HIV/ AIDS patient, how concerned would you be about the following? Loss of other patients from the practice	Concerned	184	46%	<0.0001
		Not at all concerned	87	21.75%	
		Undecided	78	19.50%	
		No Answer	51	12.75%	
	Dealing with staff fears about patients with HIV/ AIDS	Concerned	232	58%	<0.0001
		Not at all concerned	103	25.75%	
		Undecided	23	5.75%	
		No Answer	42	10.50%	
	Increase in personal risk due to treating patients with HIV	Concerned	307	76.75%	<0.0001
		Not at all concerned	19	4.75%	
		Undecided	32	8%	
		No Answer	42	10.50%	
	The financial burden for the practice due to increased infection control procedures	Concerned	156	39%	<0.0001
		Not at all concerned	130	32.50%	
		Undecided	69	17.25%	
		No answer	45	11.25%	

II. **Practice section:**

No.	Question	Answers		N.	%	*P*-Value
Q.1	How often do you wash hands before and after patient treatment?	Always		277	69.25%	<0.0001
		Occasionally		84	21%	
		Rarely		24	6%	
		Never		2	0.50%	
		No answer		13	3.25%	
Q.2	With what do you wash your hands?	Plain soap	Yes	179	44.75%	<0.0001
			No	221	55.25%	
		Detergent	Yes	58	14.50%	
			No	342	85.50%	
		Antiseptic	Yes	228	57%	
			No	172	43%	

Q.3	As a clinician, what protective measures do you take to prevent yourself from injury?	Mask & glove	Yes	50	12.50%	<0.0001
			No	350	87.50%	
		Eyewear	Yes	14	3.50%	
			No	386	96.50%	
		Protective clothing	Yes	31	7.75%	
			No	369	92.25%	
		All of the above	Yes	326	81.50%	
			No	74	18.50%	
Q.4	How often do you wear gloves while performing dental procedures?	Always		373	93.25%	<0.0001
		Occasionally		5	1.25%	
		Rarely		3	0.75%	
		Never		0	0%	
		No answer		19	4.75%	
Q.5	How often do you change gloves between patients?	Always		368	92%	<0.0001
		Occasionally		11	2.75%	
		Rarely		4	1%	
		Never		0	0%	
		No answer		17	4.25%	
Q.6	How often do you use sterile surgical gloves for surgery?	Always		241	60.25%	<0.0001
		Occasionally		35	8.75%	
		Rarely		11	2.75%	
		Never		76	19%	
		No answer		37	9.25%	
Q.7	After the use of gloves for a patient, what do you do with them?	Dispose of them		376	94%	<0.0001
		Reuse them after washing		4	1%	
		Reuse after sterilization		0	0%	
		No answer		20	5%	
Q.8	How often do you wear protective eyewear?	Always		85	21.25%	<0.0001
		Occasionally		178	44.50%	
		Rarely		92	23%	
		Never		35	8.75%	
		No answer		10	2.50%	
Q.9	How often do you wear the mask?	Always		368	92%	<0.0001
		Occasionally		18	4.50%	
		Rarely		4	1%	
		Never		0	0%	
		No answer		10	2.50%	
Q.10	How often do you change the mask between patients?	Always		232	58%	<0.0001
		Occasionally		110	27.50%	
		Rarely		44	11%	
		Never		4	1%	
		No answer		10	2.50%	
Q.11	How often do you use a head covering?	Always		110	27.50%	0.1217
		Occasionally		91	22.75%	
		Rarely		92	23%	
		Never		91	22.75%	
		No answer		16	4%	

Q.12	How often do you wear disposable gowns for surgery?	Always		147	36.75%	<0.0001
		Occasionally		59	14.75%	
		Rarely		79	19.75%	
		Never		90	22.50%	
		No answer		25	6.25%	
Q.13	How often do you use the rubber dam?	Always		190	47.50%	<0.0001
		Occasionally		174	43.50%	
		Rarely		19	4.75%	
		Never		0	0%	
		No answer		17	4.25%	
Q.14	How often do you use a high-volume evacuator?	Always		141	35.25%	<0.0001
		Occasionally		173	43.25%	
		Rarely		49	12.25%	
		Never		19	4.75%	
		No answer		18	4.50%	
Q.15	How often do you ask your patient to do preoperative mouth rinsing?	Always		107	26.75%	<0.0001
		Occasionally		121	30.25%	
		Rarely		106	26.50%	
		Never		50	12.50%	
		No Answer		16	4%	
Q.16	Do you routinely ask your patients about their medical history?	Yes		381	95.25%	<0.0001
		No		2	0.50%	
		No answer		17	4.25%	
Q.17	Are you vaccinated against Hepatitis B?	Yes		355	88.75%	<0.0001
		No		28	7%	
		No Answer		17	4.25%	
Q.18	Did you take your booster shot?	Yes		218	54.50%	<0.0001
		No		162	40.50%	
		No Answer		20	5%	
Q.19	Do you have an appropriate protocol for emergency treatment of needle stick injury or other sharp accidents?	Yes		275	68.75%	<0.0001
		No		92	23%	
		No answer		33	8.25%	
Q.20	Do you keep detailed records of these accidents?	Yes		212	53%	<0.0001
		No		142	35.50%	
		No answer		46	11.50%	
Q.21	Do you use puncture-resistant container for sharp instruments?	Yes		344	86%	<0.0001
		No		27	6.75%	
		No answer		29	7.25%	
Q.22	How often do you immerse the used instruments in decontaminant solutions?	Always	Yes	223	55.75%	<0.0001
			No	177	44.25%	
		Occasionally	Yes	111	27.75%	
			No	289	72.25%	
		Rarely	Yes	24	6%	
			No	376	94%	
		Never	Yes	8	2%	
			No	392	98	

Q.23	When do you immerse the used instruments in decontaminant solutions?	Before washing and cleaning		182	45.50%	0.3187
		After washing and cleaning		168	42%	
		No answer		50	12.50%	
Q.24	Which of the following do you use to sterilize instruments in the dental clinic?	Autoclave	Yes	394	98.50%	<0.0001
			No	6	1.50%	
		Boiling	Yes	4	1%	
			No	396	99%	
		Washing	Yes	17	4.25%	
			No	383	95.75%	
Q.25	How do you clean dental handpieces and other devices attached to air and waterlines?	Cleaning with surface disinfectant	Yes	94	23.50%	<0.0001
			No	306	76.50%	
		Run 30 seconds before treatment	Yes	68	17%	
			No	332	83%	
		Autoclaving	Yes	321	80.25%	
			No	79	19.75%	
		No preferred procedure	Yes	2	0.50%	
			No	398	99.50%	
Q.26	How often do you use heat sterilization for burs?	Always		311	77.75%	<0.0001
		Occasionally		13	3.25%	
		Rarely		8	2%	
		Never		34	8.50%	
		No answer		34	8.50%	
Q.27	How often do you use heat sterilization for endodontic files?	Always		316	79%	<0.0001
		Occasionally		10	2.50%	
		Rarely		2	0.50%	
		Never		38	9.50%	
		No answer		34	8.50%	
Q.28	How often do you use wrapping bags for instruments sterilization?	Always		339	84.75%	<0.0001
		Occasionally		17	4.25%	
		Rarely		3	0.75%	
		Never		4	1%	
		No answer		37	9.25%	
Q.29	How often do you use surface barriers for dental unit surfaces?	Always		346	86.50%	<0.0001
		Occasionally		20	5%	
		Rarely		5	1.25%	
		Never		1	0.25%	
		No answer		28	7%	
Q.30	How often do you use surface disinfectants for routine wiping?	Always		272	68%	<0.0001
		Occasionally		74	18.50%	
		Rarely		22	5.50%	
		Never		5	1.25%	
		No answer		27	6.75%	

Q.31	How often do you chemically disinfect impressions before sending them to the laboratory?	Always		173	43.25%	<0.0001
		Occasionally		108	27%	
		Rarely		60	15%	
		Never		43	10.75%	
		No answer		16	4%	
Q.32	Have you ever treated an HIV-positive patient?	Yes		111	27.75%	<0.0001
		No		275	68.75%	
		No answer		14	3.50%	
Q.33	To your knowledge, how many HIV-positive have you treated within the past 6 months?	6 or more	Yes	21	5.25%	<0.0001
			No	379	94.75%	
		3–5	Yes	18	4.50%	
			No	382	95.50%	
		1–2	Yes	63	15.75%	
			No	337	84.25%	
		None	Yes	266	66.50%	