

Original Research Article

Dental technician's and assistant's infection control knowledge and practice in dental laboratories/clinics of Saudi Arabia – A cross-sectional survey

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Abstract

Background: Despite the fact that numerous regulations have been issued and periodically changed, many dental laboratories still practise subpar cleanliness, indicating the necessity for stricter regulatory methods. Therefore, the purpose of the current study was to examine the practises and knowledge of dental technicians and dental assistants, both trained professionals and students, in dental clinics and laboratories in Saudi Arabia.

Materials and Methods: To evaluate the understanding and use of infection control procedures, including the usage of gloves, safety goggles, taking lab impressions, and disinfecting impressions of the targeted population, a self-administered, closed-ended questionnaire was created, and 500 people made up the estimated sample, which was determined using the results of the pilot study and previously published studies.

Results: Nearly all participants reported following infection control practices, such as wearing gloves, mouth masks, and protective eye shields, as well as using proper disposal systems for waste. A high percentage (96.4%) reported having received vaccination against the hepatitis B virus. A majority of participants reported disinfecting the prosthesis/denture before sending it to the clinic (96.4%) and using disinfectant in the pumice slurry (96.9%). However, a small number of participants (2.4-3.6%) reported not following certain infection control practices. The number of impressions received per week varied across the different age ranges, and the majority of participants used plastic bags to carry impressions from the dental clinic to the laboratory. The most common method of disinfection was immersion, with over 90% of participants reporting this practice.

Conclusion: The majority of participants said they were aware of the various infection control strategies that should be used, and most said they were putting them into practise every day at work. However, some participants claimed they did not adhere to certain infection control procedures, which is worrying. Particularly for individuals who reported not adhering to specific infection control practises, these findings may be helpful in developing policies aimed at enhancing infection control procedures in dentistry laboratories.

Keywords: Dental technician, Dental assistant, Infection control, Dental laboratory.

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1. Introduction

Infection control is an overbearing issue in dental practice. It is reported that 1 ml of a saliva sample from the mouth of an average healthy person contains about 750 million microorganisms; therefore, it is one of the most discussed topics in dentistry and has become an integral part of the practice that dental health workers no longer question its necessity.¹ There are many routes of infection transmission

in the dental office, including blood, bodily fluids, droplets, needle-stick injury, contaminated water sources from the dental units, and aerosols as well as indirect transmission which occurs through contact with contaminated surfaces and^{2,3,4} infection control is rigidly performed in dental operatories, especially surgical operatories, but dental laboratories are often ignored and overlooked. This could lead to cross-infection among dental technicians from pathogenic microorganisms attained by infected impressions,

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prosthesis, and clinical material received.^{2,5} The principal route of transmission of infection from the patient to the dental technician is through materials as they are in direct contact with the patient's mouth, saliva, and possibly blood.

It has further been documented that dental personnel have a 5–10-fold chance of acquiring hepatitis B infection than the general population.^{5,6,7} Infection control in dental laboratories was first suggested by American Dental Association (ADA) by following guidelines of the Centers for Disease Control (CDC) for "Universal Protection" for healthcare workers and patients from pathogenic infections in 1987. It was published first in 1986 and revised in 1993.⁸

Although many guidelines have been issued and revised from time to time, regrettably hygiene in many dental laboratories continues to be substandard, suggesting the need for more stringent control measures. It is important to evaluate the knowledge of dental technicians and dental assistants regarding disinfection and personal protection along with their motivation for the implementation of the same. Therefore, the aim of the present investigation was to investigate the knowledge and practices pertaining to infection control of dental technicians and dental assistants, both qualified and students, in dental laboratories and clinics in Saudi Arabia. The study also aimed to identify gaps in knowledge and practice among the study population, with a measurable outcome based on self-reporting.

2. Materials and Methods

2.1. Ethical protocol

The research study protocol was submitted for ethical committee clearance from the Institutional review board (IRB) of Riyadh Elm University (REU), and the IRB number FUGRP/2023/304/924/832 was provided to this investigation after deeming it to be in accordance with the ethical guidelines of the institution.

2.2. Hypotheses and research question

The null hypothesis was that there would be no difference in knowledge and practice towards infection control at dental laboratories/clinics between dental technicians and dental assistants. The alternate hypothesis was that there would be a difference in knowledge and practice towards infection control at dental laboratories/clinics between dental technicians and dental assistants. The study aimed to provide insights into the current infection control practices among dental technicians and dental assistants in Saudi Arabia and identify areas where improvement is needed. The research questions for the study were as follows: 1). Did dental technicians and dental assistants, both qualified and students, have optimal knowledge and practice towards infection control in dental laboratories and clinics in Saudi Arabia? 2). was there a gap in knowledge and practice among the study population? 3) Could knowledge and practice towards

infection control at dental laboratories/clinics be comparable between dental technicians and dental assistants?

2.3. Study area

The presented study was conducted in Saudi Arabia.

2.4. Targeted population

Dental technicians qualified & students in 3rd year/interns and dental Assistants qualified & students in 3rd year/ interns in Saudi Arabia were the sampling units. The Undergraduate Dental Technicians/ Assistants studying in 3rd year/interns and qualified Dental Technicians/Assistants Registered health practitioners in the Saudi Commission for Health Specialties either working in dental college, dental clinics, dental Laboratories, or both in Government as well as private settings in Saudi Arabia were included in the sampling frame for this study.

2.5. Study design

The online, close-ended questionnaire was distributed electronically using a link generated in Google Docs format. The questionnaire for the present study was developed from a previous study,¹¹ conducted on similar objectives besides expert opinion and the validity of the questionnaire was done by the pilot study. The survey instrument had been pilot studied through questionnaires with dental technicians, Dental assistants from the Department of Prosthodontics. Responses from the pilot study have analyzed the clarity and relevance of the questions. Necessary modifications were carried out on the feedback from pilot test participants. The sample size was estimated to be 500, which was derived based on the previously reported studies and pilot study.^{9,10} A probability sampling method was employed by Stratified Cluster Sample Design. The primary sampling units, or clusters, were study groups of Dental assistants and dental technicians in Saudi Arabia. The list of all study groups in each cluster was stratified by grade level as qualified and students. From each grade level, a sample of 125 study units was randomly selected so as to attain a total sample size of 500. The study subjects' voluntary participation and confidentiality were ensured.

2.6. Study period

After obtaining approval from the Institutional Review Board (IRB) Riyadh Elm University (REU), the investigation began from the month of February 2023 and was conducted till the targeted response sample was obtained, which was around the month of April 2023.

2.7. Inclusion criteria

1. Undergraduate dental technicians/assistants studying in 3rd years or interns, as well as qualified dental technicians/assistants who were registered health practitioners in the Saudi Commission for Health Specialties and worked in dental colleges, clinics,

laboratories, or both in government and private settings in Saudi Arabia.

2. The sampling frame was established based on these criteria. Students who volunteered to participate were included in the study, ensuring confidentiality.

2.8. Exclusion criteria

1. Dental technicians/assistants who were not willing to participate in the study, those who were not registered with the Saudi Commission for Health Specialties, and those who did not meet the criteria for being an undergraduate or qualified dental technician/assistant.
2. Individuals with any medical conditions or disabilities that might interfere with their ability to complete the questionnaire were excluded from the study.

The inclusion and exclusion criteria were designed to ensure that the sample consisted of qualified dental technicians/assistants who were actively engaged in the field and able to provide accurate and relevant information on their knowledge and practices of infection control measures.

2.9. Data management and statistical methods

The data was entered and analysed using Statistical Package for Social Sciences (SPSS), IBM SPSS Statistics for Windows, version 25.0. Armonk, NY; IBM Corp. A descriptive analysis of data was followed by inferential statistics and secondary outcomes were measured. Chi-square and Fisher's exact tests were used for the comparison of categorical data. A p-value of ≤ 0.05 at 95% CI was considered statistically significant.

3. Results

As represented in

Table 1, in this cross-sectional study, a total of 553 participants were included. The age of the participants ranged from 18 to 54 years, with the highest percentage (41.0%) being in the 18-25 age group, followed by 26-35 age group (35.8%). The least number of participants were in the 46-54 age group (6.9%). In terms of gender, 44.3% were male and 55.7% were female. Regarding the profession of the participants, the majority (51.5%) were Dental Technician Students or Qualified Dental Technicians, while the rest were Dental Assistant Students or Qualified Dental Assistants. Specifically, 25.5% were Dental Lab Technician Students, and 22.8% were Qualified Dental Technicians. The highest percentage (29.7%) were Qualified Dental Assistants, followed by Dental Assistant Students (22.1%).

Table 2 provides a frequency distribution of practice responses based on gender and personnel. The practice items include the number of impressions received per week, how the impressions are carried from the clinic to the laboratory, how the personnel receive impressions or prosthesis in the laboratory, whether the impressions are disinfected, the mode

of disinfection, the duration of the immersion method applied to disinfect, and the mode of disinfecting the prosthesis/denture in the laboratory. The data reveal that the majority of the personnel, regardless of gender, receive less than 20 impressions per week. However, the distribution of impressions received per week varies across personnel type. For instance, the qualified dental technician (QDT) and dental assistant students (DSA) receive the least number of impressions per week, with 6.3 and 26.2%, respectively, receiving less than 20 impressions. In contrast, 64.5% of dental lab technician students (DLTS) receive more than 20 impressions per week. Regarding how the impressions are carried from the clinic to the laboratory, the data indicate that the majority of the personnel use plastic bags to carry impressions. In particular, 91.8% of DSA personnel and 97.0% of QDA personnel use plastic bags. The use of containers is minimal, with only 3.0% of QDA personnel and 8.2% of DSA personnel using them. In terms of receiving impressions or prosthesis in the laboratory, the vast majority of personnel across all gender types wear gloves. In particular, 99.4% of QDA personnel wear gloves, while 95.0% of DLTS personnel wear gloves. The data also reveal that the majority of personnel disinfect impressions, with 94.3% of all personnel disinfecting the impressions. However, a small percentage of personnel disinfect few or none of the impressions they receive, with 5.3% and 0.4% of male personnel and 6.5% and 2.3% of female personnel disinfecting few or none of the impressions, respectively. Regarding the mode of disinfection, the data show that the majority of personnel use the immersion method to disinfect impressions, with 91.3% of QDT personnel and 97.6% of QDA personnel using the method. The majority of personnel also apply the immersion method for 10 minutes. However, a small percentage of personnel, particularly DSA personnel, apply the immersion method for more than 10 minutes. Lastly, the data show that the majority of personnel across all gender types use the immersion method to disinfect prosthesis/denture in the laboratory. In particular, 96.3% of QDA personnel use the immersion method. The use of spraying disinfectant is minimal, with only 3.3% of DSA personnel and 6.3% of QDT personnel using it. Represents the graphical representation of the practice responses based on gender and personnel based on the findings shown in **Table 2**. **Figure 1** is the graphical representation of respondents' knowledge about infection control and its related facets.

In **Table 3**, the practice-related variables of the participants are presented. The number of impressions received per week was recorded, and it was found that 36.2% of the participants received less than 20 impressions, while 42.0% received 20-30 impressions per week. 96.9% of the participants used gloves while receiving an impression or prosthesis in the laboratory, whereas only 3.1% used bare hands. Plastic bags were the most commonly used mode to carry impressions from the dental clinic to the laboratory, with 90.6% of the participants reporting this practice.

Moreover, 92.6% of the participants reported disinfecting all the impressions, while 6.0% reported disinfecting only a few impressions, and 1.4% reported not disinfecting the impressions at all. The most commonly used mode of disinfection for impressions was immersion, with 93.9% of the participants reporting this practice. Among those who used the immersion method, 90.6% reported using it for 10 minutes. Furthermore, 94.0% of the participants reported immersion in disinfectant as the mode of disinfecting the prosthesis/denture in the laboratory, whereas only 6.0% reported spraying of disinfectant.

Table 4 provides information about the distribution of practice responses based on age. The table is divided into two categories, the number of impressions received per week, and the mode of disinfection of impressions and prostheses. The categories are then analyzed based on four age ranges - 18-25, 26-35, 36-45, and 46-54. The table shows that the number of impressions received per week varied across the different age ranges. For instance, those aged 18-25 received a lower number of impressions per week with 54.6% receiving fewer than 20 impressions per week, while those aged 30-50 received a higher number of impressions per week with 62.2% receiving between 30-50 impressions per week. The mode of carrying impressions from the dental clinic to the laboratory was mostly via a plastic bag, with the percentage being higher across all age ranges, ranging from 84.6% in the 18-25 age range to 97.4% in the 36-45 and 46-54 age ranges. Regarding the mode of disinfection, the majority of participants from all age ranges (over 90%) disinfect all their impressions. There was a slight variation in the method of disinfection, with immersion being the most commonly used method across all age ranges, ranging from 93.8% in the 18-25 age range to 97.4% in the 36-45 age range. Similarly, immersion in disinfectant was the most commonly used

method for disinfecting prostheses and dentures, ranging from 92.4% in the 26-35 age range to 97.4% in the 36-45 and 46-54 age ranges.

Table 5 presents the frequency distribution of practice responses across different types of personnel, including Qualified Dental Technicians, Dental Lab Technician Students, Qualified Dental Assistants, and Dental Assistant Students. The table displays the number of impressions received by the personnel per week, the method of carrying impressions from the dental clinic to the laboratory, the method of receiving impressions or prosthesis in the laboratory, and the disinfection practices related to impressions and prosthesis/denture. In terms of the number of impressions received per week, the highest proportion of QDTs and DA students received 30-50 impressions, while the highest proportion of DLTS and QDAs received less than 20 impressions per week. The highest proportion of QDTs and DA students used plastic bags to carry impressions from the dental clinic to the laboratory, while the highest proportion of DLTS and QDAs used containers for the same purpose. Regarding the disinfection of impressions, the highest proportion of all types of personnel disinfect the impressions, with QDTs having the highest percentage of 96%. The majority of personnel used the immersion method for disinfection, with QDAs having the highest percentage of 97.6%. In terms of the duration of the immersion method applied to disinfect impressions, the majority of personnel used the 10-minute duration, with QDTs having the highest percentage of 91.3%. Furthermore, all types of personnel wore gloves when receiving impressions or prosthesis in the laboratory, with QDTs having the highest percentage of 96%. In terms of the disinfection method for prosthesis/denture, the majority of personnel used the immersion method, with QDTs having the highest percentage of 93.7%.

Table 1: General information of the study participants

Variables		n	%
Age (Years)	18-25	227	41.0
	26-35	198	35.8
	36-45	90	16.3
	46-54	38	6.9
	Total	553	100.0
Gender	Male	245	44.3
	Female	308	55.7
	Total	553	100.0
Are You	Qualified Dental technician (QDT)	126	22.8
	Dental Lab Technician Student (DLTS)	141	25.5
	Qualified Dental Assistant (QDA)	164	29.7
	Dental Assistant Student (DAS)	122	22.1
	Total	553	100.0

Table 2: Frequency distribution of the practice responses based on gender and personnel

Practice items		Gender		Personnel			
		Male	Female	QDT	DLTS	QDA	DSA
Number of impressions received/week	<20	34.7	37.3	6.3	64.5	42.1	26.2
	20-30	29.0	52.3	21.4	32.6	56.1	54.9
	30-50	34.3	9.7	68.3	1.4	1.8	18.9
	<50	2.0	0.6	4.0	1.4	0.0	0.0
Carry impression clinic to Lab	Plastic Bag	89.4	91.6	93.7	79.4	97.0	91.8
	Container	10.6	8.4	6.3	20.6	3.0	8.2
Receive an impression/prosthesis in Lab	Bare hands	2.4	3.6	4.0	5.0	0.6	3.3
	Gloves	97.6	96.4	96.0	95.0	99.4	96.7
Do you disinfect impressions	All	94.3	91.2	96.0	90.8	90.2	94.3
	Few	5.3	6.5	3.2	7.8	7.9	4.1
	None	0.4	2.3	0.8	1.4	1.8	1.6
Mode of disinfection	Immersion	95.5	92.5	91.3	90.1	97.6	95.9
	Spraying	4.5	7.5	8.7	9.9	2.4	4.1
Immersion Duration	<10 min	3.3	5.8	7.9	6.4	1.8	3.3
	10 min	94.3	87.7	91.3	92.2	89.0	90.2
	>10 min	2.4	6.5	0.8	1.4	9.1	6.6
Disinfecting the prosthesis/denture Lab	Immersion	96.7	91.9	93.7	89.4	96.3	96.7
	Spraying	3.3	8.1	6.3	10.6	3.7	3.3

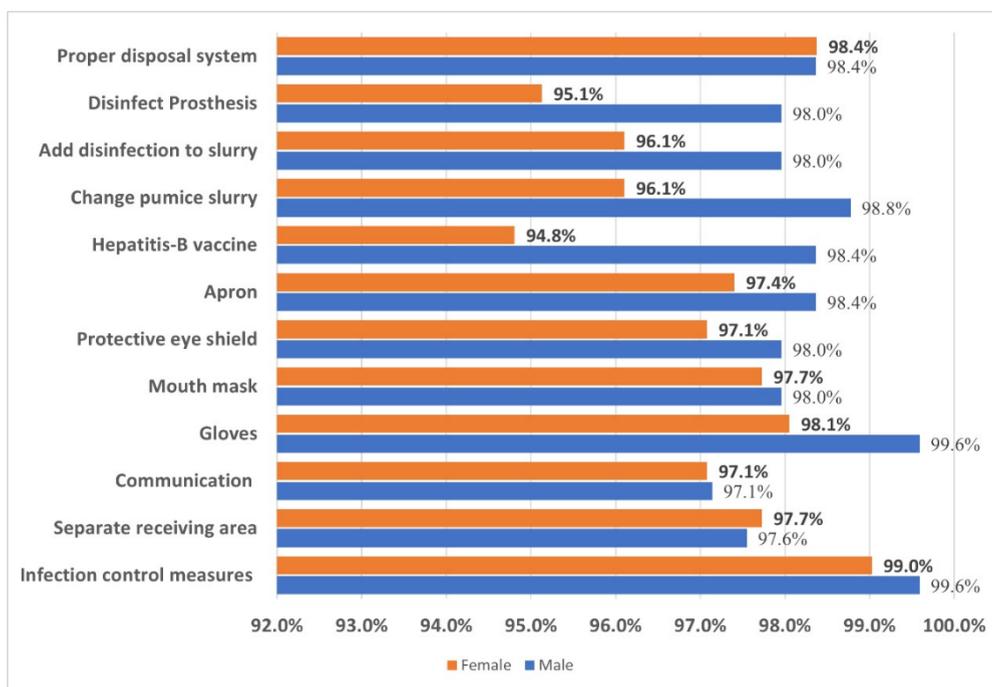


Figure 1: Graphical representation of respondents' knowledge about infection control

Table 3: Practice related variables

Practices		n	%
Number of impressions received/week	<20	200	36.2%
	20-30	232	42.0%
	30-50	114	20.6%
	<50	7	1.3%
Carry impression from the dental clinic to the laboratory	Plastic Bag	501	90.6%
	Container	52	9.4%
Receive an impression or prosthesis in the laboratory	Bare hands	17	3.1%

	Gloves	536	96.9%
	Others	0	0.0%
Disinfect the impressions	All	512	92.6%
	Few	33	6.0%
	None	8	1.4%
Mode of disinfection of the impressions	Immersion	519	93.9%
	Spraying	34	6.1%
	Others	0	0.0%
Immersion method duration applied to disinfect	<10 min	26	4.7%
	10 min	501	90.6%
	>10 min	26	4.7%
Mode of disinfecting the prosthesis/denture in the laboratory	Immersion in disinfectant	520	94.0%
	Spraying of disinfectant	33	6.0%

Table 4: Distribution of the practice responses based on age

Variable analysed	Category	Age ranges analysed			
		18-25	26-35	36-45	46-54
Number of impressions received/week	<20	54.6	28.8	20.0	2.6
	20-30	37.9	64.1	17.8	7.9
	30-50	7.0	5.1	62.2	84.2
	<50	0.4	2.0	0.0	5.3
Carry impression from the dental clinic to the laboratory	Plastic Bag	84.6	93.4	96.7	97.4
	Container	15.4	6.6	3.3	2.6
Receive an impression or prosthesis in the laboratory	Bare hands	3.5	4.0	1.1	0.0
	Gloves	96.5	96.0	98.9	100.0
Disinfect the impressions	All	92.1	91.9	92.2	100.0
	Few	6.6	6.1	6.7	0.0
	None	1.3	2.0	1.1	0.0
Mode of disinfection of the impressions	Immersion	93.8	92.4	95.6	97.4
	Spraying	6.2	7.6	4.4	2.6
Immersion method duration applied to disinfect	<10 min	4.8	6.1	2.2	2.6
	10 min	91.2	90.4	87.8	94.7
	>10 min	4.0	3.5	10.0	2.6
Mode of disinfecting the prosthesis/denture in the laboratory	Immersion in disinfectant	93.8	92.4	96.7	97.4
	Spraying of disinfectant	6.2	7.6	3.3	2.6

Table 5: Practice responses across types of personnel

Variables analysed		Qualified Dental technician	Dental Lab Technician Student	Qualified Dental Assistant	Dental Assistant Student
Number of impressions received/week	<20	6.3	64.5	42.1	26.2
	20-30	21.4	32.6	56.1	54.9
	30-50	68.3	1.4	1.8	18.9
	<50	4.0	1.4	0.0	0.0
Carry impression from the dental clinic to the laboratory	Plastic Bag	93.7	79.4	97.0	91.8
	Container	6.3	20.6	3.0	8.2
Receive an impression or prosthesis in the laboratory	Bare hands	4.0	5.0	0.6	3.3
	Gloves	96.0	95.0	99.4	96.7
Disinfect the impressions	All	96.0	90.8	90.2	94.3
	Few	3.2	7.8	7.9	4.1
	None	0.8	1.4	1.8	1.6
Mode of disinfection of the impressions	Immersion	91.3	90.1	97.6	95.9
	Spraying	8.7	9.9	2.4	4.1
	<10 min	7.9	6.4	1.8	3.3
	10 min	91.3	92.2	89.0	90.2

Immersion method duration applied to disinfect	>10 min	0.8	1.4	9.1	6.6
Mode of disinfecting the prosthesis/denture in the laboratory	Immersion in disinfectant	93.7	89.4	96.3	96.7
	Spraying of disinfectant	6.3	10.6	3.7	3.3

4. Discussion

This study provides insight into the infection control practices of dental technicians and assistants in the laboratory setting. The study found that the majority of participants were aware of and practiced proper infection control measures, including wearing gloves, masks, eye shields, and aprons, changing pumice slurry, using a proper waste disposal system, and disinfecting the prosthesis/denture before sending it to the clinic. However, a small number of participants did not follow certain infection control practices, such as disinfecting the prosthesis/denture before sending it to the clinic or communicating with the dentist regarding disinfection of the impression/prosthesis received in the laboratory. The study also found that the majority of participants received less than 20 impressions per week and used plastic bags to carry impressions from the dental clinic to the laboratory. Additionally, immersion in disinfectant was the most commonly used method for disinfecting impressions and prostheses/dentures in the laboratory. The study fills a gap in the literature regarding infection control practices in dental laboratories and highlights areas for improvement in order to ensure proper infection control measures are being implemented. The future implications of this study are significant, as the findings can be used to improve infection control practices in dental laboratories. The study identifies areas for improvement, such as increasing communication between dental technicians and dentists regarding disinfection protocols, and ensuring all impressions are properly disinfected. Additionally, the study's findings can inform the development of training programs for dental technicians and assistants to ensure they are aware of and follow proper infection control practices. Improved infection control practices in dental laboratories can lead to a reduction in the transmission of infectious diseases, improving the safety and health of dental professionals and patients alike.

Cross-contamination risk can be reduced by using efficient infection control techniques in the dental office and dental laboratory.¹² Therefore, dental technicians must closely follow the recommended safety measures in order to create a secure environment for both patients and employees.¹³ The ability to comprehend the necessity of this dynamic notion with the right implication of method and knowledge is essential for the successful practise of infection control.^{14,15} It's critical to comprehend the level of dental technicians' knowledge and attitudes towards infection control methods, as this information can be used to assess the current situation, manage infection, and foster a healthy environment in dental laboratories. More people responded to our survey than in studies done in North India or Nigeria

respectively.^{11,16} With a response rate of more than 90%. However, this rate was lower than that of Jordan and Saudi Arabia.^{17,18} This high incidence is probably caused by the significance of the infection problem in dental laboratories and the fact that technicians understand how crucial it is for dental laboratories to follow infection control procedures in order to provide a safe environment. Sharps injuries are the most generally acknowledged occupational risk for blood exposure and the spread of blood-borne illnesses on a global scale.^{19,20} According to another study, there is a significant risk of injury for dental technicians.¹³ The clinical goods that dental lab technicians receive and handle from dental offices put them at an increased risk of cross-contamination.²⁰ It's crucial to take precautions in order to avoid contracting this sickness. Therefore, a dental technician or technologist should always wear personal protection equipment, such as gloves, masks, goggles, and lab coats, while working in the dental laboratory.^{21,22} According to the study's findings, practically all of the technicians who work in private laboratories are aware that PPE is required for every task in the lab. The response rate we received was higher than the Riyadh study's reported figure of 42%.²³ This can be as a result of their ignorance of the significance of wearing protective gear in preventing infection during dental procedures. In the event that the dental laboratory and dental practise work well together, disinfecting prosthetic goods is a crucial step in preventing the spread of illnesses.^{16,23,24,25}

Some limitations of the study need to be addressed despite the significance it presents. One limitation is the relatively small sample size, which could affect the statistical power of the study and limit the representativeness of the findings. Additionally, the study relied on self-report measures, which may be subject to bias or inaccuracies in reporting, potentially affecting the validity of the data collected. Moreover, the study focused on dental personnel in one specific geographic region, which may limit the generalizability of the findings to other regions or countries with different infection control protocols or healthcare systems.

5. Conclusion

This study provides valuable insights into the infection control practices employed by dental technicians and assistants in their laboratories. The majority of participants reported being aware of the various infection control measures that should be taken into practice, and most reported implementing them in their daily work routine. However, some participants reported not following certain infection control practices, which is a cause for concern. The

data also reveal that the number of impressions received per week varies across age ranges and personnel types, with dental lab technician students receiving the highest number of impressions per week. The mode of carrying impressions from the dental clinic to the laboratory is mostly via plastic bags, and immersion is the most commonly used method for disinfecting impressions and prostheses. These findings could be useful in formulating policies aimed at improving infection control practices in dental laboratories, especially for those who reported not following certain infection control practices.

6. Sources of Funding

None.

7. Conflict of Interest

None.

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