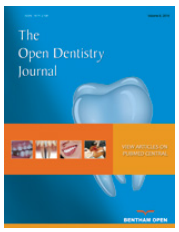

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RESEARCH ARTICLE

Evaluation of Knowledge, Awareness, Preparedness, and Measures among Dental Technicians Attending COVID-19 in Jordan

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Abstract:

Introduction:

During the pandemic of COVID-19, Jordan imposed strict measures and abandoned selected medical procedures. Due to the high risk of cross-infection among dental team members, dental clinics and laboratories were subjected to definite regulations before being allowed back to work.

Aims:

This survey aims to assess the knowledge, awareness and preparedness of dental technicians in Jordan regarding COVID-19. Also, to investigate prevention measures for dental technicians working during the COVID-19 pandemic.

Methods:

A cross-sectional self-administered online survey was distributed electronically as a Google form *via* social media platforms. The study population consisted of registered dental technicians working in public and private laboratories in Jordan. The questionnaire consisted of a series of questions; demographic characteristics; knowledge and awareness about COVID-19, and the preparedness and measures to practice dental laboratory procedures during the pandemic.

Results:

This study included a total of 90 dental technicians (31 females and 59 males); their ages ranged from 22-60 years old. Almost all the participants (90%) were found knowledgeable about COVID-19. Governmental organizations, and visual and social media were the main sources of information. The majority of participants (>85%) encouraged drifting to digital dental technology protocols during COVID-19 pandemic. More than 65% of the participants reported COVID-19 very dangerous and considered themselves in a high risk of COVID-19 transmission.

Conclusion:

Most dental technicians have sufficient knowledge about COVID-19. However, most of them are not prepared to deal with impressions, restorations, and dentures of infected/suspected cases. Educational and training programs regarding COVID-19 among dental technicians are significantly needed.

Keywords: Dental technicians, Covid -19, Knowledge, Cross infection measures, Awareness, Preparedness, Infection control, SARs-CoV-2.

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1. INTRODUCTION

In early 2020, a pandemic of the 2019 coronavirus disease (COVID-19) began, and a virus originating from China started to blow out worldwide. The rapid increase in confirmed cases made the prevention and control of COVID-19 extremely serious. Also, the lack of information about the transmission methods and measures of protection against COVID-19 thrust many countries to take strict preventive measures; Jordan imposed a firm lockdown for a long time.

Although COVID-19 vaccinations became available in late 2020, World Health Organization (WHO) announced emerging of different variants of SARS-COV-2 in early 2021, the Delta variant, which was described as a 'very high' global risk according to (WHO) due to its severe disease course and

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reduced effectiveness of treatment which result in high fatalities around the world [1]. Most recently, the virus has spread worldwide as an Omicron variant; this is a heavily mutated variant of SARS-COV-2 with a high transmissibility rate but reduced severity of the disease [2].

In dental practice, many reports concluded that dental team members are at high risk of transmitting microbes and pathogens due to frequent contact with the patient's blood and saliva during different dental procedures [3]. Regarding COVID-19, direct contact with human saliva means contact with salivary gland excretions, food residues, serum components, microorganisms and their metabolites, and epithelial and white blood cell residues. According to some studies, the main targets of SARS-CoV-2 are cells expressing the angiotensin-converting enzyme 2 (ACE 2). Salivary gland epithelial cells express ACE2.5. Thus, after the entry of the virus into the body, the salivary gland can get infected, and the saliva produced by these glands can be an important source of cross-infection [4].

Moreover, indirect contact between dental team members and patients through contaminated sharp instruments, acrylic debris, dental impressions, gypsum models, restorations, and non-disinfected dental appliances was reported as cross-contamination vehicles in dental clinics and dental laboratories, which oppose health hazards to members of the dental team and patients [5, 6].

Awareness of cross-infection is very important to the dental team; it is also necessary for dentists and dental technicians to adapt their knowledge and adherence to infection control [7]. However, there are practical guidelines recommended for dentists and dental staff by the Centers for Disease Control and Prevention (CDC), the American Dental Association (ADA), and the World Health Organization to control the spread of COVID-19 [8, 9]

Measures practiced by healthcare personnel to reduce the risks of transmission of infectious agents to patients and the healthcare staff generally include proper hand hygiene, scrupulous work practices, and the use of personal protective equipment (PPE). The personal protective equipment (PPE) at dental clinics includes disposable caps, gowns, gloves, face masks and the use of protective eyewear. They are recommended to be used at all times when treating patients or dealing with patients' impressions and restorations [10]. During the Pandemic, some studies concluded more specific measures where they highlighted the importance of using Na5-type masks which allow <0.3 μm particles to pass, rather than ordinary surgical face masks [11]. Also, using face shield to protect the whole face from aerosol and debris rather than using eyewear only was recommended [12].

Various studies in the field of dentistry are in progress, but there are few studies on dental laboratories and dental technicians [13, 14]. In Jordan and up to the best of our knowledge, there is no studies assessing the knowledge, awareness, and measures of dental technicians attending the COVID-19 pandemic. Therefore, the aim of the current survey is to assess the level of knowledge among dental technicians in Jordan in regard to COVID-19, to assess the awareness of cross-infection control, and the precautions among dental technicians in Jordan in regard to COVID-19. Also, to investigate the measures and attitudes that help in protecting dental technicians while dealing with cases throughout the COVID-19 pandemic.

2. METHODOLOGY

2.1. Study Population

The study population consisted of dental technicians who work in public and private dental laboratories in Jordan. Participants were contacted using social media applications such as Facebook and WhatsApp. Only actively registered dental technicians in the Jordanian Dental Technology Association were contacted through the official WhatsApp and Facebook groups, and their responses were considered. In order to achieve a national survey, the participants were selected from the north, middle and south parts of Jordan.

3. QUESTIONNAIRE DEVELOPMENT, ADMINISTRATION, AND DESIGN

A questionnaire consists of six sections and 40 questions overall. It's self-designed to evaluate the knowledge, preparedness, awareness, and infection control measures regarding COVID-19 and practicing dental laboratory procedures during the pandemic amongst the population of the study. Participants in this survey involve dental technicians who are currently working in public and private dental laboratories in Jordan.

The tool utilized for data collection was specifically designed as an online Google Forms questionnaire. Forty close and open-ended questions were divided into six main categories.

The questionnaire was validated, and a consent form was sent to participants. Participants should be legally registered dental technicians. The questionnaire was validated by several experts in the field and pre-tested by 10 dental technicians, which were not included in the analysis.

4. ETHICAL APPROVAL

The questionnaire was anonymous to maintain the privacy and confidentiality of all information collected in the study. All procedures performed in the study were in accordance with the ethical standards of the institutional research committee. The ethics approval for conducting this study was granted by the Institutional Review Board (IRB) committee at the Jordan University of Science and Technology.

5. DATA ANALYSIS

Data were analyzed using the Statistical Package for Social Sciences (SPSS) software version 20 (SPSS®: Inc., Chicago, IL, USA). Data were described using means, standard deviations (SD), and percentages.

6. RESULTS

This study included a total of 90 dental technicians (31 females and 59 males), forming a response rate of about 26%.

Their age ranged from 22-60 years old, with 62% of them being younger than 40 years old. More demographic characteristics of the current study population are shown in Table **1**.

A big majority of the participants were able to identify common symptoms of COVID-19. Most participants reported shortness of breath, coughing, and fever as the most common symptoms of the infection. These were followed by sore throat, muscle and joint pain. More than half (86.7%) of participants reported that COVID-19 may not present any symptoms.

Knowledge about very well-known general vehicles like touching surfaces, coughing, and handshaking was reported by more than 95% of participants. However, transmission ways related to dental clinics and dental laboratories, like impression tray handles, handpieces, and contaminated instruments, were also highly reported by participants (>90%) (Table **2**).

Table 1. Demographic characteristics.

Gender	-	N	%
	Female	31	34.4
	Male	59	65.6
Age	30-39 years old	24	26.7
	40-49 years old	27	30.0
	50 years or older	7	7.8
	Younger than 30 years old (20-29)	32	35.6
Years of practice	6 to 10 years	20	22.2
	Less than 5 years	21	23.3
	More than 10 years	49	54.4
Working sector	Academia	18	20.0
	Military	4	4.4
	Private sector	58	64.4
	Public sector	10	11.1

Table 2. Knowledge of dental technicians about symptoms, transmission modes and protractive measures of COVID-19.

Variable		**N**	**%**
Symptoms of the COVID-19 Infection	Fever	83	92.2
	Cough	86	95.6
	Runny nose	30	33.3
	Sore Throat	71	78.9
	Shortness of breath	87	96.7
	Joint / Muscle Pain	58	64.4
	Red eyes	20	22.2
	Diarrhea	53	58.9
	May not present symptoms	78	86.7
Ways of COVID-19 Transmission	Coughing and Sneezing	87	96.7
	Hand Shaking	87	96.7
	Touching surfaces, as door knobs and tables	88	97.8
	From air	39	43.3
	Plastic bags containing impressions	84	93.3
	Impression trays' handles	84	93.3
	Contaminated instruments	85	94.4
	Lab form received from clinic	83	92.2
	Sharing lab coat between technicians	81	90.0
	Handpiece	84	93.3
	Stone cast prepared from contaminated impressions	83	92.2

(Table 2) contd.....

Variable		N	%
Measures should be taken to Prevent Transmission from known or Suspected COVID-19 Patients	Frequently clean hands by using alcohol-based hand rub or soap and water	90	100.0
	Put facemask all the time during work	88	97.8
	Change face masks and gloves between cases	81	90.0
	All dental laboratory staff members wear protective clothing	85	94.4
	Avoid sharing instruments between dental laboratory staff members	83	92.2
	Routinely clean and disinfect surfaces in contact with impression, models and restorations	87	96.7
	Accept impressions that sustain delay pouring	57	63.3
	Encourage dentist to send digital impressions	80	88.9
	Accept only approved sterilized impressions, restorations and prosthesis from clinic	80	88.9
	Prevent any patient from entering the laboratory premises	87	96.7
	Disinfect impressions by immersion in recommended	88	97.8
Sources of Information	Media (newspaper, television, radio, *etc*.)	81	90.0
	Social network (Facebook, Twitter, blog, *etc*.)	66	73.3
	Academic Training Courses	26	28.9
	Colleagues	36	40.0
	Government Organization such as Ministry of Health	87	96.7
	others	43	47.8

Table 3. Preparedness of dental technicians to work attending COVID-19.

Variable	N	%
Received training in infection control in dental laboratories	46	51.1
Attended training regarding COVID-19	9	10.0
I prefer to avoid working with impression for a patient who is a suspect of COVID-19	78	86.7
In case you received a case from a clinic for a patient who is suspect of COVID-19, would you accept the case?	29	32.2
In case you know that the dentist you received cases from is a suspect of COVID-19, would you accept the work	27	30.0
I believe that asking dentists to send digital impressions instead of conventional impressions is necessary and significantly reduce the possible transmission of COVID 19 to lab personnel?	81	90.0
Do you consider yourself prepared for the COVID-19 outbreak?	55	61.1
Do you know who to contact in a situation where there has been an unprotected exposure to a known or suspected COVID-19 patient?	73	81.1
Do you know what to do if you have signs or symptoms of suspected COVID-19 infection?	84	93.3

Most of the participants were aware of the protective measures that should be taken to protect themselves from the infection. The majority of participants (88.9%) reported encouraging dentists to use digital impressions and accepting only approved sterilized impressions as a key protractive measure among dental staff in particular. However, accepting impressions that sustain delayed pouring was only reported by 63% of participants.

The majority of participants, 80 (94.8%), had up-to-date information about COVID-19; when the participants were asked about the source of information regarding the virus, 87 (96.7%) reported that government organizations, such as the Ministry of Health, were the main source of information. Social media platforms were reported by 90% of participants as their second trusted source of information and statistics about COVID-19.

Almost half the participants (51%) declared that they had received training regarding infection control in dental laboratories, but only 10% had attended the training or received lectures about COVID-19 in specific.

More than half the participants (61.1) considered themselves prepared to work after the COVID-19 outbreak. Less than half of the dental technicians reported that they could receive impressions for suspected patients (32.2%) or from suspected dentists (30%). So, the majority of the participants (90%) believe that asking dentists to send digital impressions instead of conventional impressions is necessary and will significantly reduce the possible transmission of the COVID-19 virus. Nevertheless, 73 (81.1%) dental technicians knew who to contact in case of unprotected exposure; also, 93.3% knew how to act if they felt any symptoms of the virus (Table **3**).

More than half of the participants, 59 (65.6%), perceived COVID-19 as very dangerous, while only 1 dental technician considered COVID-19 as non-dangerous. In regard to the transmission risk to dentists and dental technicians, 68.9% found that it is a high risk for dentists, and 42.2% stated that there is a very high risk of transmission to dental technicians.

Table 4. Awareness of dental technicians regarding COVID-19.

Perception of the risk of COVID-19 Transmission to Dentists		**N**	**%**
-	High Risk	24	26.7
	Moderate Risk	3	3.3
	No risk	1	1.1
	Very high risk	62	68.9
Perception of the risk of COVID-19 transmission to Dental Technicians			
-	High Risk	32	35.6
	Low risk	5	5.5
	Moderate Risk	12	13.3
	No risk	3	3.3
	Very high risk	38	42.2
The extent to which the technician is confident in handling an impression for a COVID-19 patient			
-	Not at all	21	23.3
	To a considerable extent	18	20.0
	To a great extent	15	16.7
	To a little extent	11	12.2
	To some extent	25	27.8
The extent to which the technician is confident in handling a restoration (crown/bridge) for a COVID-19 patient			
-	Not at all	20	22.2
	To a considerable extent	24	26.7
	To a great extent	12	13.3
	To a little extent	9	10.0
	To some extent	25	27.8
The extent to which the technician is confident in handling denture (for repair or reline) for a COVID-19 patient			
-	Not at all	25	27.8
	To a considerable extent	16	17.8
	To a great extent	13	14.4
	To a little extent	9	10.0
	To some extent	27	30.0
Perceived importance to change both masks and gloves to decrease the possibility of transmitting infections to patients and to myself			
-	Important	8	8.9
	Little important	1	1.1
	Very important	81	90.0
Perceived seriousness of COVID-19			
	Moderately dangerous	30	33.3
	Not dangerous	1	1.1
	Very dangerous	59	65.6

Table 5. Behavior and measures toward managing suspects/confirmed cases of COVID-19 attending dental laboratories.

Behaviors Engaged in to Prevent COVID-19 Transmission	**N**	**%**
Buying masks.	74	82.2
Buying an air doctor	11	12.2
Wearing a face mask.	79	87.8
Wash hands regularly.	90	100.0
Use disinfectants.	87	96.7
Pay more attention to personal hygiene.	87	96.7
Avoid contacting with certain groups of population.	87	96.7
Pay attention to balanced diet.	52	57.8
Cleaning/disinfecting my phone (screen).	82	91.1
Avoid public gatherings.	87	96.7
Stay at home as much as possible.	90	100.0
Avoid eating outside.	82	91.1

(Table 5) contd.....

Behaviors Engaged in to Prevent COVID-19 Transmission	N	%
Avoid shaking hands when greeting others.	85	94.4
Avoid kissing others when greeting them.	87	96.7
Avoid using public transportation.	84	93.3
Get sufficient sleep.	66	73.3
Closely monitor personal physical health.	70	77.8
Closely monitor the physical health of the people around you.	64	71.1
Persuade people around you to following the precautionary guidance.	83	92.2
Follow social distancing procedures.	87	96.7
Increase fluid intake	72	80.0
Measures should be taken to prevent transmission from known or suspected COVID-19 patients or contaminated dental clinics		
Accept digital impressions only	77	85.6
Accept disinfected impression in a sealed plastic bag	85	94.4
Avoid doing denture repair procedure	67	74.4
Avoid doing denture reline procedure	69	76.7
Accept disinfected restorations in sealed plastic bag.	84	93.3
Allow maximum 2-3 of the laboratory staff to work daily.	89	98.9
Cover the metal surfaces with cardboard or papers.	78	86.7
Use sterilized instruments (burs, carvers, knifes) for each case.	87	96.7
Avoid sharing benches and handpieces with other technicians.	84	93.3
Routinely clean and disinfect surfaces in contact with impressions.	88	97.8

In terms of dealing with impressions, restorations and dentures for confirmed cases/suspects of COVID-19 at dental laboratories, 22-27% of dental technicians considered themselves not confident at all in dealing with such cases. Most dental technicians, 81 (90%), reported that they perceived the importance of changing both masks and gloves to decrease the possibility of transmitting the virus to patients and to themselves (Table **4**).

Despite the general behaviors and cross-infection control protocols, which include washing hands, wearing face masks, using disinfectants, and other measures which were reported by almost all the participants. Special measures were adopted to reduce the transmission/spread of the infection at dental laboratories, as well as between the dental clinic and dental laboratory, such as; using sterilized instruments 96.7%, routinely disinfecting the surfaces in contact with the impressions 97.8%, and reduce the staff members working in the laboratory at the same time to be maximum 3 persons 98.9% (Table **5**).

7. DISCUSSION

Dental health professionals, including dentists, dental hygienists, dental assistants, and dental technicians, are more likely at high risk of having COVID-19. Dental procedures used for dental treatment in dental office and dental laboratories increase the risk of transmission between dental professionals and patients [14].

This study aimed to assess Jordanian dental technicians' knowledge about COVID-19, awareness about infection control protocols relating to COVID-19, and infection management measures that help them while dealing with cases during the pandemic.

The current survey included a sample of Jordanian dental technicians. Males were predominant in this sample, which might be explained by the number of male dental technicians in Jordan being higher than the number of female dental technicians based on The Jordanian Dental Technician Association. A similar observation was noted in a study conducted among Libyan clinical dental technicians [15].

The majority of Jordanian dental technicians reported most of the COVID-19 symptoms. Many participants reported fever, cough, and respiratory problems as the main symptoms of COVID-19, which reflect the ability to recognize the suspected cases and take the required precautions and follow the guidelines that lessen the spread of the disease [1, 10]. The ability of dental health professionals to report most of the COVID-19 symptoms was in agreement with previous studies [15 - 17]. However, the most known COVID-19 symptom, according to Jordanian dental technicians in the current study, was shortness of breath, which disagrees with Mansour *et al.* (2021), where sore throat was the most common symptom reported by Libyan clinical dental technicians [15]. Also disagrees with Khader *et.al,* where Jordanian dentists stated that fever was the most common symptom of COVID-19 [17].

The most known mode of COVID-19 transmission as reported by Jordanian dental technicians, was touching surfaces. This is contrary to a study conducted among Libyan clinical dental technicians, where handshaking was the most reported mode of transmission [15]. Consequently, these professionals are less likely to increase the transmission risk for others due to their solid knowledge of COVID-19 transmission modes. Thus, dental technicians are capable of controlling the spread of the disease to help in shrinking the possibility of having new cases of COVID-19.

The most reported protective measure among Jordanian dental technicians was washing hands using alcohol-based hand rub or soap and water regularly. However, the most reported measures employed in the dental lab were cleaning and disinfecting surfaces in contact with the impression,

models, and restorations regularly. These results agree with the review study conducted two years ago in China stating the prevention measures employed in Chinese dental institutions [18]. Furthermore, similar results were reported recently by Indian dental technicians working in armed forces hospitals where the same common measures were mentioned [19].

Regarding the source of information, government organizations were the main source. This might be explained because the Jordanian Ministry of Health was actively working toward preventing and controlling COVID-19 spreading *via* training courses, educational videos, and brochures for both healthcare professionals and the general population [20]. However, evidence-based guidelines, training, or treatment specifically in dental settings worldwide have not been provided until late 2020 [7]. According to the Australian Dental Association, the first risk management principles for dentistry during the COVID-19 pandemic were published on 22 October 2021 [21]. Preventing and controlling the spread of the disease was *via* controlling the source of infection, using prevention measures, isolation, and providing supportive care for patients [22].

Social media was the second source of information regarding COVID-19. According to Sahni & Sharma 2020, social media during the COVID-19 pandemic has different roles; beneficial, destructive, or reconstructive. Social media has positive and negative impacts on the general population and health professionals [23, 24]. Social media has a significant role in disseminating information, increasing awareness, education, and health care during the COVID-19 crisis with preserving social distancing [24]. On the other hand, the negative impact of social media should not be neglected, which includes sharing inaccurate medical information and fake material without professional supervision that enables users to distinguish between true and false information. However, "if used wisely and prudently, social media serves as a powerful tool for changing people's behavior and to promote the well-being of individual and public health." [23].

Several dental technicians reported preparedness to work attending COVID-19, which might be explained since about half of the participants in this study received general training in infection control in dental laboratories and some focused training sessions regarding COVID-19. However, the majority would prefer to avoid working with suspected COVID-19 cases; this might be explained by the 95.6% of the dental technicians in the current study listed the risk of COVID-19 transmission as high to very high and the perceived seriousness of COVID-19 as very dangerous. A different observation was noted in a previous study where participants perceived COVID-19 as moderately dangerous. However, most of the Jordanian dental technicians prefer not to work with suspected cases to reduce the risk of having COVID-19 which is in agreement with previous findings By Mansour *et al.* 2020 [15].

The perception of the disease's seriousness was reflected by the response of dental technicians to dealing with impressions, restorations, and dentures. The participants perceived low confidence in dealing with COVID-19 cases/suspected cases. This perception of this disease is not surprising due to its threat; there were many cases of COVID-19 in Jordan at the time of data collection.

Due to the fear of high-risk transmission, dental technicians perceived the importance of using new masks and gloves between patients to lower the risk of disease transmission. The use of personal protective equipment and changing the masks and gloves is recommended by WHO to prevent infection when COVID-19 is suspected. The COVID-19 virus remains on hard surfaces, including dental devices and benches, for hours and days and then can be transferred to the hands and faces of the dental team members [25]. Dental health professionals are recommended to follow these guidelines to reduce the risk of transmission and decrease dental procedures that may increase dental aerosols and droplets.

Dental technicians in this study have reported different behaviors that are considered, from their perspective, necessary to control and manage the spread of the disease. Regarding Jordanian dental technicians' behavior toward protective measures, the majority reported that conventional personal protective equipment (PPE), such as masks, gloves, safety glasses, and lab coats, are needed to prevent the transmission of COVID-19. Disinfection, sanitation, and social distance procedures were reported by the participants to reduce the risk of disease transmission [22]. A similar observation was noted in a study conducted among Poland dental practitioners who considered these behaviors as necessities in dental practices during COVID-19 [26]. Chu *et al.* analyzed 172 studies' results regarding protective measures against COVID-19; all 172 studies confirmed that physical distancing of 1m or more and wearing face masks by healthcare workers and people in the community were very effective in reducing transmission of the virus and eye protection added benefit [12]. These results are similar to previous studies where dentists and dental technicians changed their patient protocol to reduce the risk of transmission [14, 26].

Although, a few dental technicians in the current study reported that they thoroughly disinfect the conventional dental impressions, which, as in a previous study by Meng *et al.* 2020 [14]. Extra protective measures should be adopted to minimize the risk of COVID-19 transmission through conventional impressions and non-sterilized dental appliances and restorations. Subsequently, digital dentistry employment was highly recommended by Jordanian dental technicians to reduce the risk of virus transmission.

A scoped review by Markarian *et al*. (2020) on the clinical relevance of digital dentistry during the COVID-19 pandemic has identified many advantages of digital workflows in different fields of dentistry compared to the conventional techniques in treating patients during the COVID-19 pandemic. For example, in prosthodontics, the field of study, using CAD-CAM procedures result in a reduction in chairside time and the number of appointments. Another example is implant dentistry, in which using prosthetically-driven guided surgery results in decreasing surgical time and the number of appointments. This review emphasizes the importance of using digital dentistry to increase safety and reduce COVID-19 transmission [27].

Furthermore, dental technicians are encouraged to use

digital dentistry, such as using digital impressions and avoiding conventional impressions that have biological materials that might increase the risk of disease transmission [28]. Additionally, dental laboratory workflow consumes less time and a smaller number of workers [27].

According to Stoeva *et al.*, the implantation of such protective measures provides a safe environment and safe care to the staff in dental offices and laboratories [28]. According to CDC, these actions might reflect on the participants' understanding of how the transmission of COVID-19 occurs; through direct contact between contaminated hands and mucus membranes [10]. In addition, it might reflect an awareness of the evidence-based guidelines and recommendations which were established by the CDC to guide infection prevention and control of COVID-19 transmission. A well-informed dental health professional on COVID-19 might be a good source to disseminate the correct knowledge and information in the community to create a safe environment for patients and the dental team.

Despite the valuable information gathered, the current study had a few limitations. The validity and reliability of this study may be affected by the following: the response rate was relatively low, which resulted in a relatively smaller sample size than expected; therefore, findings may be generalized only to similar populations; the study results were self□reported responses and may have participant bias; active participants on social media had the chance to be part in this study, which might be resulting in a selection bias that effects generalizability of the study results.

CONCLUSION

In conclusion, within the limitations of the current study, most Jordanian dental technicians have sufficient knowledge about COVID-19 and showed knowledge of the disease in terms of symptoms, mode of transmission and preventive measures to deal with infected or suspected cases. However, most of them were found not confident or prepared to deal with impressions, restorations, and dentures of suspected cases. Educational and training programs regarding COVID-19 among dental technicians are significantly needed.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The ethics approval for conducting this study was granted by the Institutional Review Board (IRB) committee at the Jordan University of Science and Technology.

HUMAN AND ANIMAL RIGHTS

No animals were used in this research. All procedures performed in studies involving human participants were in accordance with the ethical standards of institutional and/or research committees and with the 1975 Declaration of Helsinki, as revised in 2013.

CONSENT FOR PUBLICATION

The questionnaire was validated, and a consent form was sent to participants. Participants should be legally registered dental technicians.

STANDARDS OF REPORTING

STROBE guidelines were followed.

AVAILABILITY OF DATA AND MATERIALS

The data supporting the findings of the article is available in the Zenodo repository at https://zenodo.org/deposit/7940292, reference number 95636ecbde2c46a0461a3561cdf3d1e.

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CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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REFERENCES

[1] Infection prevention and control in the context of coronavirus disease (COVID-19): a living guideline, 25 April 2022. World health Organization 2022.

[2] Al Jazeera. 2021. Available from: https://wwwaljazeeracom/news/2021/11/29/who-covid-omicron-variant-very-high-global-risk (Accessed on: December 13,2021).

[3] Jaber MA. A survey of needle sticks and other sharp injuries among dental undergraduate students. Int J Infect Control 2011; 7(3): 7. [http://dx.doi.org/10.3396/ijic.V7i3.022.11]

[4] Casillas SMA, Velázquez DFA, Sámano VC, *et al.* Saliva: What dental practitioners should know about the role of this biofluid in the transmission and diagnostic of SARS-CoV-2. Medicina 2021; 57(4): 349. [http://dx.doi.org/10.3390/medicina57040349] [PMID: 33917276]

[5] Chaudhary P, Goyal K, Singh MP. Occupational Hazard (Hepatitis B & C). Arch Hepat Res 2016; 2(1): 005-14.

[6] Abichandani S, Nadiger R. Cross-contamination in dentistry: A comprehensive overview. Chronicles of Young Scientists 2013; 4(1): 51-8. [http://dx.doi.org/10.4103/2229-5186.108807]

[7] Clinical management of severe acute respiratory infection when COVID-19 is suspected. World Health Organization 2020.

[8] CDC recommendation: postpone non-urgent dental procedures, surgeries, and visits. Centers for Disease Control and Prevention 2020.

[9] Coronavirus frequently asked questions. The American Dental Association 2020.

[10] Centers for Disease Control and Prevention. How COVID-19 Spreads. 2022.

[11] Izzetti R, Nisi M, Gabriele M, Graziani F. COVID-19 transmission in dental practice: Brief review of preventive measures in Italy. J Dent Res 2020; 99(9): 1030-8. [http://dx.doi.org/10.1177/0022034520920580] [PMID: 32302257]

[12] Chu DK, Akl EA, Duda S, *et al.* Physical distancing, face masks, and eye protection to prevent person-to-person transmission of SARS-CoV-2 and COVID-19: A systematic review and meta-analysis. Lancet 2020; 395(10242): 1973-87. [http://dx.doi.org/10.1016/S0140-6736(20)31142-9] [PMID: 32497510]

[13] Peng X, Xu X, Li Y, Cheng L, Zhou X, Ren B. Transmission routes of 2019-nCoV and controls in dental practice. Int J Oral Sci 2020; 12(1): 9. [http://dx.doi.org/10.1038/s41368-020-0075-9] [PMID: 32127517]

[14] Meng L, Hua F, Bian Z. Coronavirus Disease 2019 (COVID-19): Emerging and future challenges for dental and oral medicine. J Dent Res 2020; 99(5): 481-7. [http://dx.doi.org/10.1177/0022034520914246] [PMID: 32162995]

[15] Mansour YS, Ibrahim NA, Rabee AA. Awareness and attitudes regarding COVID-19 among clinical dental technicians in Albayda, Libya. J Pharm Biol Sci 2020; 23: 01-6.

[16] Ajanović M, Pošković ST, Kožul K, *et al.* Knowledge of coronavirus

2019 and stress with oral health-care personnel of the Faculty of dentistry in Sarajevo: A cross-sectional study. J HEALTH Sci 2021; 11(1): 47-52.

[17] Khader Y, Al Nsour M, Al-Batayneh OB, *et al.* Dentists' awareness, perception, and attitude regarding COVID-19 and infection control: Cross-sectional study among Jordanian dentists. JMIR Public Health Surveill 2020; 6(2): e18798. [http://dx.doi.org/10.2196/18798] [PMID: 32250959]

[18] Zhang W, Jiang X. Measures and suggestions for the prevention and control of the novel coronavirus in dental institutions. Front Oral Maxillofac Med 2020; 2: 4. [http://dx.doi.org/10.21037/fomm.2020.02.01]

[19] Gowda EM, Awasthi P, Sahoo NK. COVID-19 preparedness and response plan for the dental laboratory workplace in armed forces. J Dent Def Sect 2021; 15(1): 92. [http://dx.doi.org/10.4103/jodd.jodd_66_20]

[20] Ministry Of Health /Jordan/. Available from: https://corona.moh.gov.jo/en

[21] Available from: https://www.ada.org.au/COVID-19-Portal/Dental - Professionals

[22] Wang Y, Tian H, Zhang L, *et al.* Reduction of secondary transmission of SARS-CoV-2 in households by face mask use, disinfection and social distancing: A cohort study in Beijing, China. BMJ Glob Health 2020; 5(5): e002794. [http://dx.doi.org/10.1136/bmjgh-2020-002794] [PMID: 32467353]

[23] Sahni H, Sharma H. Role of social media during the COVID-19 pandemic: Beneficial, destructive, or reconstructive? Int J Acad Med 2020; 6(2): 70-5.

[24] Erdem B. The role of social media in the times of the COVID-19 pandemic. Soc Sci 2021; 4(2): 19.

[25] Lewis D. COVID-19 rarely spreads through surfaces. So why are we still deep cleaning? Nature 2021; 590(7844): 26-8. [http://dx.doi.org/10.1038/d41586-021-00251-4] [PMID: 33514939]

[26] Tysiąc-Miśta M. The attitudes and professional approaches of dental practitioners during the COVID-19 outbreak in Poland: A cross-sectional survey. Int J Environ Res Public Health 2020; 17(13): 4703. [http://dx.doi.org/10.3390/ijerph17134703]

[27] Batista AUD, Silva PLP, Melo LA, Carreiro AFP. Prosthodontic practice during the COVID-19 pandemic: Prevention and implications. Braz Oral Res 2021; 35: e049. [http://dx.doi.org/10.1590/1807-3107bor-2021.vol35.0049] [PMID: 33729299]

[28] Markarian RA, Silva RLB, Burgoa S, Pinhata-Baptista OH, No-Cortes J, Cortes ARG. Clinical relevance of digital dentistry during COVID-19 outbreak. Braz J Oral Sci 2021; 19: e200201. [http://dx.doi.org/10.20396/bjos.v19i00.8660201]

[29] Stoeva V, Bozhkova T, Atanasovski A, Kondeva V. Study of compliance with the rules for prevention of infections related to dental care among dental students during a pandemic of SARS-2-COV/COVID-19. Trakia J Sci 2022; 20(1): 54-9. [http://dx.doi.org/10.15547/tjs.2022.01.008]