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The Impact of the COVID-19 Pandemic on Infection Control Protocols in Dentistry: A Questionnaire-based Survey in Iran

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Abstract

Aim: The COVID-19 pandemic has presented significant challenges for healthcare professionals, particularly in the field of dentistry. This study aimed to evaluate the changes in infection control measures in dentistry before and during the pandemic among Iranian dentists.
Methods: An analytical cross-sectional study was conducted from June to December 2020, and included dental healthcare professionals (DHCPs) practicing dentistry in Iran. Participants completed a web-based survey that included demographic profiles, practice-related details, and information on implemented infection control measures. Data were subjected to statistical analysis using the software SPSS v. 26, and a P-value<0.05 was considered statistically significant.
Results: A total of 303 dentists, 200 (66%) of whom practiced specialized dentistry and 103 (34%) were general dentists, responded to the questionnaire. The majority of participating dentists (85.5%) were aware of the importance of patient screening for COVID-19 symptoms. There was a statistically significant rise in adherence to hand hygiene practices. The utilization of personal protective equipment (PPE), such as gloves, masks, and face shields also exhibited significant increases amid the pandemic. Dentists shifted from using surgical masks to N95 respirators (p=0.05) and white coats to disposable gowns (p<0.001). We noted a significantly greater tendency towards adopting air ventilation systems, surface disinfection and prescribing preprocedural mouth rinses among DHCPs.
Conclusion: The study findings indicate increased compliance with infection control protocols during the COVID-19 pandemic among Iranian DHCPs and highlight the modifications made to infection control measures in dentistry.

Keywords*:* COVID-19, Dentistry, Infection Control, Personal Protective Equipment

Background

The very first cases affected by the novel coronavirus, SARS-COV2, were first identified in Wuhan, China in December 2019. This rapidly spreading disease affected all healthcare systems worldwide (1), Iran not being an exception. Like other nations, the Iranian government also enacted preventive measures to contain this rapidly spreading disease. Travel restrictions, quarantining, and social distancing measures were all immediately implemented.

Studies and literature emphasize the increased risk of infection among healthcare professionals during outbreaks of respiratory diseases like COVID-19 (1, 2). Dental healthcare professionals, in particular, are at an increased risk due to their proximity to patients and the potential for aerosol-generating procedures during dental treatments. The nature of dental procedures, which involve direct contact with oral fluids and the generation of droplets and aerosols, heightens the risk of exposure to respiratory pathogens (3, 4).

The COVID-19 pandemic has presented unique challenges for healthcare professionals across various sectors, including dentistry. Dental settings involve proximity to patients, aerosol-generating procedures, and the handling of oral fluids, making

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them potentially high-risk environments for the transmission of infectious diseases (5-8). As a result, stringent infection control measures have become crucial to ensure the safety of both dental practitioners and patients (9, 10).

In response to the pandemic, reputable organizations such as the Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO) have issued guidelines specifically tailored to dental settings (11). These guidelines aim to provide dental professionals with evidence-based recommendations to minimize the risk of COVID-19 transmission and maintain a safe environment for dental care. In this context, several key aspects of infection control in dentistry during the COVID-19 pandemic have emerged as essential considerations. These include the appropriate use of personal protective equipment (PPE), stringent hand hygiene practices, patient screening and triage, strategies to minimize aerosol generation, and environmental cleaning and disinfection procedures (12-14). By implementing these infection control measures, dental professionals can reduce the risk of COVID-19 transmission within their practices, protect the well-being of both patients and staff and contribute to the overall containment of the pandemic. It is important to consult official guidelines and recommendations from relevant health authorities and dental associations for comprehensive and up-to-date information.

A significant body of research has been dedicated to conducting numerous studies across multiple countries, aimed at evaluating and exploring the attitudes and knowledge of dental healthcare professionals (DHCPs) about the COVID-19 pandemic (5, 15). These studies have sought to gain insights into the perceptions, practices, and awareness levels of DHCPs regarding the novel coronavirus, providing valuable information on their preparedness, adherence to infection control protocols, and understanding of the risks associated with dental procedures during this unprecedented global health crisis (16-18).

The primary objective of the present study was to comprehensively assess the changes in infection control measures in dentistry that occurred before and during the COVID-19 pandemic, specifically focusing on the experiences and practices of Iranian DHCPs.

Methods

Sample and Study Design

The protocol of this cross-sectional analytic study was approved by the research and ethics committee of the Mashhad University of Medical Sciences (IR.MUMS.DENTISTRY.REC.1401.10). This study was conducted from June to December 2020. Inclusion criteria consisted of Persian-speaking dental healthcare personnel, including dental hygienists and licensed general or specialized dentists residing in Iran, who were willing to participate in this study. Participants were recruited from across the country based on a non-random convenience sampling method. Dental school faculty members were informed through their e-mail systems, dentists engaged in private practices were identified through rosters of provincial dental associations, and other practitioners were invited to take part in this study through social media platforms.

Data Collection

After providing informed consent, participants gained access to a link and were requested to complete an online survey. Questionnaires contained a total of 43 questions and covered three domains of information: demographic profiles, academic and practice-related details (Table 1), and infection control measures (Table 2). Questionnaires were adapted from a previously conducted study by Mehrnia et al. (19), in which the validity and reliability have been confirmed in an Iranian population. A group of faculty members with over 10 years of clinical experience were asked to review and modify the questions and assess the content validity of the questionnaire. This questionnaire was designed to compare and evaluate dentists' adherence to infection control protocols before and after the COVID-19 outbreak. Test-retest reliability was assessed by distributing the developed questionnaire among an explanatory sample of 20 dentists. One month later, the questionnaire was again responded to by the same group of individuals. Absolute agreement varied from 83.1-100% for different questions, which indicated excellent consistency. Homogeneity reliability was measured using the Kuder-Richardson (K-R20) formula and gave an average value of 0.647, indicating good homogeneity. A sample of the utilized questionnaire is provided in the appendix. Participants were assured that their identity would remain confidential, and the results of the study would be published anonymously.

Statistical analysis and sample size calculation

Data were subjected to statistical analysis using the software SPPS 26 (SPSS, Inc, Chicago, Illinois, USA) and the significance level was set at P-value<0.05. Wilcoxon signed rank test was employed and descriptive statistics for the

frequencies and percentages were used to summarize the data. The sample size was determined using Cochran's formula and Morgan's table. Based on a confidence interval of 95% with a 5% one-tailed type I error rate, the sample size was estimated at 380 participants.

Table 1. Demographic profiles, academic and practice-related details

Demographic variables					
age	**less than 40**	**40-49**	**50-59**	**60-69**	**More than 70**
sex	**Female**			**male**	
Geographical zone	**Region 1**	**Region 2**	**Region 3**	**Region 4**	**Region 5**
Level of academic education	Experimental dentist	General Dentist	Orthodontist	Endodontist	Prosthodontist
	Restorative dentistry specialist	radiologist	pediatrist	periodontist	Dental public health
	Oral medicine	Maxillofacial surgeons	Oral and maxillofacial pathology		
The environment for providing medical services	Private Office	Private clinic	Public clinic	Health centers	
Duration of providing medical services	Every day	Three or more days a week	Less than three days a week		

Table 2. Infection control measures

Infection control variables					
Taking the medical history of patients					
Washing hands before and after the spread of Corona					
The use of latex gloves before and after the spread of Corona	**always**	**Often**	**sometimes**	**rarely**	**never**
Using a mask before and after the coronavirus outbreak					
The usage of shields before and after the coronavirus outbreak					
The use of special clothes before and after the spread of Corona					
Sterilization of equipment before and after the spread of Corona					
Disinfection of surfaces and units before and after the spread of Corona					
The use of mouthwash for patients before and after the spread of Corona					
The rate of disinfection of molds before and after the spread of Corona					
The use of ventilators and ventilation in the workplace before and after the spread of Corona					
The use of ionizing devices before and after the spread of Corona					
The type of mask used before and after the coronavirus outbreak	Three-layer surgical mask	4- layer	5- layer	N 95	N 99
The type of shield used before and after the coronavirus outbreak	face shields	Hat with face shield	Hooded face shield	Glasses	
The special type of clothes before and after the spread of Corona	Simple white robe	Surgical gown	Surgical gown with special pants	Medical space suit	
Methods of disinfection and sterilization of equipment before and after the spread of Corona	autoclave	Dry heat sterilization	Immersion in disinfectant	Disinfection spray	soap and water
The type of mouthwash for patients before and after the outbreak of Corona	Chlorhexidine	Betadine	Hydrogen peroxide	normal saline	
The type of material used in disinfecting impressions before and after the outbreak of Corona	sodium hypochlorite	Deconex	Surfosept quick	others	

Results

Demographic and practice-related data

Although the optimal sample size was calculated to be 380 individuals; unfortunately, due to the enacted social distancing measures during the COVID-19 outbreak, only 303 dentists were able to take part in this study, and recruiting a larger number of participants was not feasible. Sex distribution frequency consisted of 178 (58.7%) females and 125 (41.8%) males. Respondents' age range varied from 28-72 years old, the majority of whom (41.6%) were under 40 years of age. Among the dentists who participated in this study, 200 (66%) practiced specialized dentistry and 103 (34%) were general dentists. Orthodontists comprised 14.5% of the study sample and orthodontics was the most common dentistry specialty in this study. Dental healthcare professionals working in different dental settings, i.e., private dental offices, private clinics, and governmental facilities, were approached across five different districts of the country. Most participants (61%) worked in a private dental office and 61.4% provided dental care for at least three days a week (Table 3).

Infection control protocols

Most dentists (85.5%) always asked their patients about their pertaining medical history and experiencing COVID-related symptoms within the past two weeks, before commencing any sort of dental treatment procedure. When DHCPs were asked about their hand-washing habits, the obtained results revealed a significant difference between hand-washing frequency before and after the pandemic ($p<0.001$). There was also a statistically significant increase in the number of dentists who always wore a pair of latex gloves for performing treatment procedures for each patient (78.9% before versus 88.4% after the pandemic, $p<0.001$). The results showed a significant difference between facemask usage among DHCPs before and after the outbreak of the coronavirus (35.5% before versus 98% after, $p<0.001$). Furthermore, after the pandemic there was a statistically significant change in the type of utilized mask, shifting from using three-layer surgical face masks (92.7%) to using N95 masks (53.8%) instead ($p=0.005$). Using a protective shield became significantly more prevalent after the COVID-19 outbreak (15.2% before versus 68.6% after, $p<0.001$). We also observed a statistically significant increase in the tendency to use personal protective clothing instead of the simple white robe ($p<0.001$).

In the context of disinfection, nearly all respondents always sterilized contaminated dental equipment both before and after the pandemic. However, the sterilization method significantly altered due to the pandemic; autoclave sterilization became significantly more popular throughout the pandemic (11.6% before versus 14.5% after, $p=0.029$). Compliance with disinfecting working surfaces and dental units was significantly greater after COVID-19 (64% before versus 79.2% after, $p<0.001$). The obtained results also showed a significant difference in the tendency to disinfect dental impressions before sending them to the laboratory ($p<0.001$). Deconex became a more frequently used disinfectant after the COVID-19 outbreak (4.2% before versus 40.3% after). A significantly greater number of dentists incorporated an air ventilation system in their working environment after the pandemic (7.6% before and 28.4% after, $p<0.001$). The same goes for using ionization air purification technology in the dental setting (1.7% before versus 3.6% after, $p<0.001$).

Table 3. Demographic and practice-related data

		Frequency (percentage)
Age	less than 40	41.6
	40-49	31.3
	50-59	20.8
	60-69	5.0
	More than 70	0.3
Gender	Female	58.7
	male	41.3
Level of academic education	Experimental dentist	0
	General Dentist	34.0
	Prosthodontist	6.3
	Endodontist	8.6
	Orthodontist	14.5

The number of dentists who obliged patients to use a mouthwash before providing dental care increased after the coronavirus outbreak (2.3% before versus 9.9% after). Dentists prescribed a variety of mouthwashes including chlorohexidine, hydrogen peroxide, 2% betadine, and normal saline. According to Wilcoxon statistics, the number of dentists who agree with the use of mouthwash has significantly changed after the pandemic (p=0.015).

Infection control patterns were not significantly different between different age groups. Using protective shields was significantly more frequent among female DHCPs both before and after the pandemic (p=0.025 and p=0.005, respectively). Female dentists were more likely to wear protective clothing while providing dental care both before and after the pandemic (p<0.001 and p=0.017, respectively). Using latex gloves was significantly more common among female dentists before the coronavirus outbreak (p=0.002). During the pandemic, male dentists were significantly more likely to always wash their hands after each dental procedure (p=0.024).

Discussion

Due to the nature of dental procedures and the high risk for COVID-19 transmission, strict adherence to infection control protocols is mandatory to minimize the chances for cross-infection in the dental setting and to ensure the safety of patients and DHCPs. This emphasizes the need for highlighting dental precautions and resuming a safe reopening of dental clinics during the Coronavirus era. The obtained results showed overall increased compliance with infection control protocols amid the COVID-19 pandemic among Iranian dentists in the year 2020.

In this study, the majority of dentists (85.5%) asked patients about experiencing any sort of COVID-related symptoms within the past two weeks. This indicates that most dentists were aware of the importance of patient screening before providing dental care. Patient triage before arrival in the dental clinic should consist of experiencing any sort of breathing difficulties, persistent coughing, or close contact with a COVID-positive individual within the past two weeks. Temperature readings at arrival can also be beneficial (4).

The use of ionizing devices was relatively low among dentists who participated in this study. This may be because Iranian dentists are still not quite familiar with air-disinfecting devices and their implications in dentistry. This is while systematic reviews have shown that a variety of air-disinfecting techniques have been used in the dental office during the COVID-19 pandemic and employing these procedures are important safety measures (20).

In this study, we noticed a shift from standard attire, as in white robes, to protection gowns and disposable pants in DHCPs during the pandemic. A study by Nordum et al. (21) also reported a similar change among doctors working in hospitals in Ireland, where the majority of hospital staff shifted from professional attire to scrubs. Other similar studies also reported increased usage of medical caps and disposable selves alongside protective clothing, to mitigate the chances for SARS-COV2 transmission in the dental setting (22, 23).

Regarding hand hygiene patterns, the results of the current study indicate that the number of dentists who practiced handwashing before and after the removal of gloves significantly increased after the pandemic (p<0.001). This finding was in contrast to the study of Akbari et al. (22) who reported a decrease in handwashing during the pandemic among dentists in Birjand, another city in Iran. This may be attributable to the fact that their study sample substituted using alcohol-based hand sanitizers instead.

Contrary to the findings of our study, Cheng et al. (23) conducted a similar study in Taiwan and reported no significant difference in the utilization of latex gloves among dentists following the outbreak of the coronavirus. This disparity may be attributable to the overall difference in occupational health compliance levels in Iran and Taiwan.

Our study noted a significant increase in the proportion of dentists who consistently used masks following the pandemic (p<0.001). Before the pandemic, surgical masks were more commonly used by dentists, but after the spread of COVID-19, the majority of dentists shifted towards using N95 respirators. This was also stated in Akbari et al.'s (22) study. However, Cheng et al. (23) did not notice a significant difference in terms of the prevalence of face masking before and after the pandemic among dental practitioners in Taiwan. They also did not state anything about the use of N95 masks. A study by Tokuc and Coskunses (24) evaluated the practice and knowledge of dentists during the Corona pandemic in Turkey. They observed a substantial increase in the utilization of FFP2/N95 respirators (33.9%) and FFP3/N99 respirators (10.9%), while there was a notable reduction in the use of surgical masks (50.7%) during aerosol-generating procedures. This corroborates the findings of the present study.

The use of face shields in dentistry during the COVID-19 pandemic plays a crucial role in providing an additional layer of protection for DHCPs and their patients. Vundavalli et al. (25) conducted a similar study among dentists practicing in India. A total of 1867 dentists responded to the questionnaire and 65.8% of respondents used full face shields when performing aerosol-generating procedures. This was similar to the findings of our study, which established a statistically significant increase in the prevalence of face shield usage following the onset of the COVID-19 pandemic ($p<0.001$).

It has been advised to incorporate the utilization of antiseptic mouthwashes before dental procedures (26, 27). In our study, we observed a statistically significant increase in the proportion of dentists who incorporated the use of mouthwash for patients before initiating treatment following the outbreak of the coronavirus, compared to the period before the outbreak ($p<0.001$). Among the mouthwashes utilized, chlorhexidine was the most commonly employed. Dentists administered chlorhexidine mouthwash as a pre-treatment measure. Similarly, Akbari et.al. (22) also noticed an increased tendency to use pre-procedural antiseptic mouth rinses for each patient, however, they did not specify the type of utilized mouthwash.

Surface disinfection with biocidal agents such as ethanol between 62% and 71% has been advocated in the dental setting (28). According to the present study findings, there was a statistically significant increase in the number of dentists who disinfected surfaces and equipment after the onset of the COVID-19 outbreak, compared to before the outbreak $p<0.001$). The results of studies by Akbari et.al. (22) and Cheng et.al. (23) were in line with the findings of our study. Akbari et.al.(22) also stated an increased number of dentists who sterilized their handpieces after each dental procedure.

If left disinfected, dental impressions can be a potential source for cross-contamination when the patient's saliva and blood come into contact with the impression materials (29). There was a significantly greater inclination towards disinfecting dental impressions before sending them to the laboratory, after the coronavirus outbreak compared to before the pandemic ($p<0.001$). Deconex was mainly the first choice of dentists for disinfecting patients' dental impressions. The findings from the Akbari et al. study (22) revealed an increase in the number of dentists who implemented disinfection protocols for patients' impressions before sending them to the laboratory, as well as those who disinfected prostheses received from the lab following the outbreak of COVID-19. These results align with the outcomes of our study.

Conclusion

Overall, the study highlights the positive trends in infection control practices among Iranian dentists during the COVID-19 pandemic. However, there is room for further improvement, particularly in the utilization of air-disinfecting devices and the awareness of their benefits in dental settings. Continuing education and raising awareness about the importance of infection control protocols, including patient screening, proper use of PPE, and implementation of air-disinfection measures, are essential for ensuring the safety of patients and DHCPs during future similar crises such as the COVID-19 pandemic.

Conflicts of interest: None to declare.

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