



# Infection Control Measures in Dental Clinics during Coronavirus Disease-19 Pandemic in Kingdom of Saudi Arabia: A Pilot Study

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## Abstract

Edited by: Filip Koneski

**Citation:** Abdelrahim RK, Abdoun HAE, Koppolu P, Swapna LA. Infection Control Measures in Dental Clinics during Coronavirus Disease-19 Pandemic in Kingdom of Saudi Arabia: A Pilot Study. Open Access Maced J Med Sci. 2021 Apr 21; 9(D):61-67.

<https://doi.org/10.3889/oamjms.2021.5898>

**Keywords:** Coronavirus disease-19; Personal protective equipment; Dental clinics; Infection control; Saudi Arabia

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Received: 07-Feb-2021

Revised: 09-Mar-2021

Accepted: 14-Apr-2021

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**Funding:** This research did not receive any financial support

**Competing Interest:** The authors have declared that no competing interest exists

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**BACKGROUND:** Coronavirus disease (COVID)-19 is an infectious respiratory disease causing different symptoms ranging from mild to more complicated cases. In dental clinics, there is a potential risk of cross-infection between dental health worker and patients. Therefore, new infection prevention measures have been recommended to minimize spread of COVID-19 in dental clinics.

**AIM:** The aim of this study is to get an insight into the infection control measures followed by dentists and modification done in personal protective equipment (PPE) to combat spread of infection during COVID-19 in Kingdom of Saudi Arabia.

**METHODS:** A cross-sectional data using online Google survey. The sample included dentists working in either private or government from different regions in Kingdom of Saudi Arabia. Chi-square test was used to investigate the association between categorical variables ( $p < 0.05$ )

**RESULTS:** Seventy dentists included in the study of which 40% are working in Riyadh. Dental clinics are undertaken respiratory triage and reduce number of patients in waiting area (91% and 98%, respectively). Increased usage of PPE (head cap, face shield, and N95 mask) during the pandemic was observed in the study sample ( $p = 0.001$ ). Working hours and number of patients were reduced during COVID-19.

**CONCLUSION:** Evidence shows that majority of dentists working in KSA are following recommended measures to minimize the spread of COVID-19. Some dentists modified their PPE during the pandemic. However, further research is required to investigate adherence to infection control measures by dentists.

## Introduction

By the end of 2019, an emerging disease was detected named as coronavirus (CoV) disease (COVID-19) [1], [2]. The disease is caused by severe acute respiratory syndrome CoV-2 (SARS-CoV) which belongs to the family of CoVs. The CoV is known to cause other respiratory infections such as SARS-CoV and Middle East respiratory syndrome (MERS-CoV) [3]. The virus was reported to be from zoonotic origin meaning that they can be transmitted from animals to humans [4], [5].

The first cases were identified in Wuhan, China, in December 2019 as an acute respiratory illness of unknown etiology [6], [7]. The disease continued spreading to rest of China and to other countries leading the World Health Organization to announce it as "public health emergency of international concern" in January 2020 [8]. By March 11, 2020, due to the rapid spread of the diseases and the increasing numbers of cases and deaths worldwide, COVID-19 was considered as pandemic [2], [9].

COVID-19 has no specific symptoms; it can range from asymptomatic or mild symptoms to severe and critical symptoms [10]. The most commonly reported signs and symptoms are fever, respiratory symptoms (shortness of breath and cough) and fatigue. Less reported symptoms are headache, nausea or vomiting, sneezing, diarrhea, and loss of taste and smell [4], [11], [12], [13]. In addition to that, the virus has been reported to cause more advanced and fatal cases including pneumonia and organ failure [14], [15].

According to evidence, COVID-19 has several transmission modes [10]. It can occur directly when someone is in close distance with infected person, through the inhalation of respiratory droplets produced during coughing, sneezing, or talking to the infected person. The indirect mode of transmission through contacting or touching fomite [16], [17], [18], or through airborne transmission by inhalation of air suspended particles released during aerosol-generating procedures [17], [19].

Dental settings carry a potential risk of cross-infection between patient and dental health worker [20]. Transmission in dental practice may occur

by contaminated aerosols generated during dental procedures requiring the use of high-speed handpiece and ultrasonic scaler [21]. The dental health workers usually work in close proximity to the patient, this may lead to nasal or conjunctival mucosal contamination with droplets. In addition, transmission may occur due to contact with contaminated surfaces or instruments in dental clinic [22], [23]. Based on COVID-19 modes of transmission and due to the nature of dental procedures, new guidelines and infection prevention measures have been recommended by the Ministry of Health of Kingdom of Saudi Arabia [24].

The aim of the study is to investigate the infection control measures followed by dentists and modification done in personal protective equipment (PPE) to combat spread of infection during COVID-19 pandemic in Kingdom of Saudi Arabia.

## Materials and Methodology

### Data source and collection

This cross-sectional study was conducted among dentists working in Kingdom of Saudi Arabia between June 7, 2020, and July 4, 2020. The survey assesses the infection control measures and modification done in dental clinics during COVID-19 pandemic. The study was targeted on general dentists, specialists, and consultants, working either in private, government, or university dental clinics. Interns and board students were excluded from the study. To ensure inclusion of a representative sample, random clinics were selected from different provinces (Central, Northern, Southern, Eastern, and Western provinces). The clinics/hospitals were selected randomly based on a Google search for each province separately. The clinics were contacted through phone call to invite them to take part in the study. In case of dental centers, the permission of survey distribution to dentist was obtained from the administration (clinical manager) or from the dentist directly if it was private dental clinic. The data were collected using the Google Forms and a link of the structured questionnaire was sent to selected clinics.

The questionnaire was developed based on the cross-infection preventive measures published by Ministry of Health "Dental Emergency Protocol during COVID-19 Pandemic" and "Guidelines for reopening June 5" [24]. The survey was in English language using multiple-choice and checkboxes questions. It consisted of 23 questions, the first part aimed to inquire about demographics (age, sex, and province) and about professional-related information (years of experience, type of practice, and designation). The respondents are to select from the multiple choices provided in each questions. The second part of survey

was multiple-choice questions as well, inquiring about clinic activity before and during COVID-19, for example, working hours, number of patients treated daily, and procedure provided. Finally, the third section focused on questions related to cross-infection protocols carried out before and during COVID-19 (modified from Consolo, Bellini) [25]. These questions included checkboxes allowing the respondent to choose more than 1 answer. One question was added to identify difficulties faced by dentist during the pandemic "During the COVID-19 restrictions did you find difficulties in obtaining PPE and other infection control materials?" and they were asked to specify. A short overview and aim of the study were explained at the beginning of the survey as well as verbally during the phone call. The participants were also informed that their responses are anonymous and information will remain confidential.

### Statistical analysis

Statistical analysis was used performed using Statistical Package for the Social Sciences version 20 (SPSS 20). For the demographic and professional related data, we used descriptive analysis (percentage and frequency). To investigate the association between categorical variables, Chi-square test was used (statistical significance set at  $p < 0.05$ ). On the other hand to find the modification between post and pre COVID-19 in PPE we used other variables. McNemar statistical test was performed to determine if there are any differences on the dichotomous dependent variable between two related groups.

## Results

Data from 70 dentists working in Saudi Arabia were analyzed, among which 68.6% were male (Table 1). Thirty-six of the participants were specialists (51.4%), 27 were general dentists, and only 7 were consultants. Most of participants located in the Central province (40%) and higher percentage were working in private clinics (41.1%).

Table 2 presents the association between infection prevention measures followed by dental clinics during COVID-19 and other variables.

When comparing number of working hours and number of treated cases during and pre-COVID-19 time (Table 3), Wilcoxon sign-rank test revealed that there is a statistically significant reduction in both variables ( $p = 0.039$  and  $p = 0.001$ , respectively).

Chi-square analysis showed a statistically significant association between PPE and types of clinics, but not for other parameters. The government dental practice commonly used surgical mask (89%),

face shield (86%), and disposable gown (86%) type of PPE while performing any dental procedure during COVID-19. The private dental practice frequently used face shield (100%) and disposable gowns (97%) type of PPE. Whereas university clinic/hospital frequently used disposable gowns (92%) type of PPE. Among all the types of dental practices, protective suits and shoe cover were least used (<20%), Table 4.

The differences in PPE usage before and during COVID-19 are presented in Table 5. It was observed increased use of head cap during COVID-19 to 73% compared to 37% before COVID-19 ( $p = 0.001$ ). Similarly, eye protection (face shield) displays statistically significant ( $p = 0.001$ ) higher usage during COVID-19. A parallel result noted in case of N95 mask usage and

disposable gowns which was statistically significant ( $p = 0.001$ ). However, differences were not significant in case of surgical gloves and goggles.

## Discussion

The new emerging infectious diseases COVID-19 can lead to a range of different symptoms including complicated cases. The disease can be transmitted from one individual to another through various routes, it spreads through droplets, airborne transmission, or fomites [10]. In dental clinics, there is a risk of cross-infection between dental health worker and patients which may occur through direct contact with contaminated body fluids or airborne transmission [26]. Increased risk of COVID-19 transmission in dental clinics is because of several factors. First, the dentists work in the close proximity to the patients. Second, several dental procedures generate aerosols that stay for long time in the air. Finally, contaminated surfaces and instruments play a very crucial role in disease transmission. Therefore, having a strict preventive measures and adequate PPE will minimize the cross-infection in dental settings [22], [27]. Due to the unique nature of the dental procedures and the different transmission routes of corona virus, there was a need to articulate new recommendations for dental clinics to reduce the spread of diseases [24].

This study gives an insight into the infection control measures and modification done in dental clinics to prevent the spread of COVID-19. Data were collected from the dentists working in different regions in Saudi Arabia using an online questionnaire.

**Table 1: Distribution of demographics and professional-related data of the study subjects**

| Group                      | Frequency | Percentage |
|----------------------------|-----------|------------|
| Age group                  |           |            |
| <35 years old              | 32        | 45.7       |
| 35–45 years old            | 28        | 40         |
| 45–54 years old            | 9         | 12.86      |
| >54 years old              | 1         | 1.43       |
| Gender                     |           |            |
| Female                     | 22        | 31.4       |
| Male                       | 48        | 68.6       |
| Province                   |           |            |
| Central                    | 28        | 40         |
| Eastern                    | 10        | 14.3       |
| Northern                   | 11        | 15.7       |
| Southern                   | 13        | 18.6       |
| Western                    | 8         | 11.4       |
| Designation                |           |            |
| Consultant                 | 7         | 10         |
| General dentist            | 27        | 38.6       |
| Specialist                 | 36        | 51.4       |
| Type of dental practice    |           |            |
| Government                 | 28        | 40         |
| Private clinic             | 29        | 41.4       |
| University clinic/hospital | 13        | 18.6       |
| Experience                 |           |            |
| >15 years                  | 20        | 28.6       |
| 1–5 years                  | 22        | 31.4       |
| 11–15 years                | 17        | 24.3       |
| 6–10 years                 | 11        | 15.7       |

**Table 2: Association of types of infection control and prevention measures following in the clinic during COVID-19 among different parameters**

| Group                      | Patient screened for COVID-19 triage question | Patient and staff's body temperature | Reduced number of patients in the waiting room | Hand sanitization | PPE | Disinfection of waiting area and facility areas | Fumigating the clinic | p-value |
|----------------------------|---|--------------------------------------|--|-------------------|-----|---|-----------------------|---------|
| Age                        |   |                                      |  |                   |     |   |                       |         |
| <35 years old              | 29  | 31                                   | 28   | 29                | 29  | 25  | 12                    | 0.954   |
| >54 years old              | 1   | 1                                    | 1  | 1                 | 1   | 0   | 0                     |         |
| 35–44 years old            | 26  | 27                                   | 27   | 25                | 23  | 20  | 11                    |         |
| 45–54 years old            | 8   | 9                                    | 8  | 9                 | 9   | 9   | 3                     |         |
| Sex                        |   |                                      |  |                   |     |   |                       |         |
| Female                     | 21  | 22                                   | 19   | 22                | 21  | 16  | 10                    | 0.309   |
| Male                       | 43  | 46                                   | 45   | 42                | 41  | 38  | 16                    |         |
| Province                   |   |                                      |  |                   |     |   |                       |         |
| Central                    | 25  | 28                                   | 27   | 25                | 24  | 22  | 10                    | 0.113   |
| Eastern                    | 10  | 10                                   | 10   | 10                | 10  | 8   | 6                     |         |
| Northern                   | 10  | 10                                   | 7  | 10                | 10  | 8   | 5                     |         |
| Southern                   | 12  | 13                                   | 13   | 12                | 11  | 10  | 2                     |         |
| Western                    | 7   | 7                                    | 7  | 7                 | 7   | 6   | 3                     |         |
| Designation                |   |                                      |  |                   |     |   |                       |         |
| Consultant                 | 5   | 7                                    | 6  | 7                 | 6   | 5   | 1                     | 0.486   |
| General dentist            | 25  | 26                                   | 23   | 26                | 25  | 22  | 8                     |         |
| Specialist                 | 34  | 35                                   | 35   | 31                | 31  | 27  | 17                    |         |
| Type of dental practice    |   |                                      |  |                   |     |   |                       |         |
| Government                 | 24  | 26                                   | 26   | 23                | 24  | 21  | 9                     | 0.118   |
| Private clinic             | 28  | 29                                   | 26   | 28                | 25  | 20  | 10                    |         |
| University clinic/hospital | 12  | 13                                   | 12   | 13                | 13  | 13  | 7                     |         |
| Experience                 |   |                                      |  |                   |     |   |                       |         |
| >15 years                  | 13  | 12                                   | 11   | 12                | 12  | 11  | 3                     | 0.227   |
| 1–5 years                  | 15  | 18                                   | 18   | 16                | 15  | 16  | 9                     |         |
| 11–15 years                | 15  | 17                                   | 17   | 16                | 15  | 12  | 4                     |         |
| 6–10 years                 | 21  | 21                                   | 18   | 20                | 20  | 15  | 10                    |         |
| 2–3 years                  | 15  | 15                                   | 15   | 14                | 14  | 10  | 3                     |         |

The findings of this study revealed that majority of dental clinics are following the preventive measures recommended. About 91% of clinics screened patients for respiratory triage (travel history and primary contact in the past 14 days) and 98% measured temperature for both patients and staffs. However, 91% of the clinics reduced the number of patients in the waiting area, this could be explained by the fact that some clinics were providing only emergency treatments. Moreover, reduced number of patients treated daily during

COVID-19 may indicate that clinics are having less patients in waiting area as well as having more time to ventilate and disinfecting the clinics between patients.

Regarding PPE results showed statistical difference in the type of PPE used by dentist pre and during the pandemic. There was variation in type of PPE used by dentist, especially across different types of dental clinics. Overall, there was a noticeable increase in the use of face shield (90% during COVID-19 compared to 47% pre-COVID), head caps increases to 73%), N95 mask (13% before COVID-19 to 47% after COVID), and disposable gowns (before COVID-19 64%–91%). Whereas, no differences were detected in the use of surgical gloves and goggles. A similar observation was reported in a study conducted in Modena and Reggio Emilia, Italy, investigating the impact of COVID-19 pandemic on dentist’s behavior and practically on daily clinical practice. The study reported that 77% of the sample (n = 356) have modified the PPE used during COVID-19 [25]. As for preventive measures during clinical activity, 86% screened for COVID-19 through

**Table 3: Comparison of average working hours in clinic and average number of new and old patients treated daily before and after COVID-19**

| Group  | N  | Mean rank | Z      | p-value |
|--|----|-----------|--------|---------|
| Post-COVID-19-pre-COVID-19<br>(average working hours in clinic)                      |    |           |        |         |
| Negative ranks   | 23 | 22        | -2.069 | 0.039*  |
| Positive ranks   | 15 | 15.67     |        |         |
| Ties   | 32 |           |        |         |
| Post-COVID-19-pre-COVID-19<br>(average number of new and old patients treated daily) |    |           |        |         |
| Negative ranks   | 35 | 19.71     | -4.29  | 0.001*  |
| Positive ranks   | 4  | 22.5      |        |         |
| Ties   | 31 |           |        |         |

**Table 4: Association of usage different types of PPE while performing any dental procedure during COVID-19 among different parameters**

| Group                      | Surgical mask | Examination gloves | Surgical gloves | Head cap | Eye protection (face shield) | Eye protection (goggles) | N95 mask | Disposable gowns | Protective suits | Shoe cover | P Value |
|----------------------------|---------------|--------------------|-----------------|----------|------------------------------|--------------------------|----------|------------------|------------------|------------|---------|
| Province                   |               |                    |                 |          |                              |                          |          |                  |                  |            |         |
| Central                    |               |                    |                 |          |                              |                          |          |                  |                  |            | 0.42    |
| n                          | 26            | 25                 | 11              | 17       | 25                           | 13                       | 12       | 24               | 1                | 2          |         |
| %                          | 92.90         | 89.30              | 39.30           | 60.70    | 89.30                        | 46.40                    | 42.90    | 85.70            | 3.60             | 7.10       |         |
| Eastern                    |               |                    |                 |          |                              |                          |          |                  |                  |            |         |
| n                          | 8             | 7                  | 6               | 7        | 9                            | 5                        | 5        | 8                | 2                | 1          |         |
| %                          | 80.00         | 70.00              | 60.00           | 70.00    | 90.00                        | 50.00                    | 50.00    | 80.00            | 20.00            | 10.00      |         |
| Northern                   |               |                    |                 |          |                              |                          |          |                  |                  |            |         |
| n                          | 7             | 7                  | 6               | 9        | 8                            | 6                        | 5        | 11               | 2                | 0          |         |
| %                          | 63.60         | 63.60              | 54.50           | 81.80    | 72.70                        | 54.50                    | 45.50    | 100.00           | 18.20            | 0.00       |         |
| Southern                   |               |                    |                 |          |                              |                          |          |                  |                  |            |         |
| n                          | 11            | 7                  | 9               | 11       | 13                           | 4                        | 8        | 13               | 2                | 1          |         |
| %                          | 84.60         | 53.80              | 69.20           | 84.60    | 100.00                       | 30.80                    | 61.50    | 100.00           | 15.40            | 7.70       |         |
| Western                    |               |                    |                 |          |                              |                          |          |                  |                  |            |         |
| n                          | 7             | 5                  | 4               | 7        | 8                            | 2                        | 3        | 8                | 1                | 1          |         |
| %                          | 87.50         | 62.50              | 50.00           | 87.50    | 100.00                       | 25.00                    | 37.50    | 100.00           | 12.50            | 12.50      |         |
| Designation                |               |                    |                 |          |                              |                          |          |                  |                  |            |         |
| Consultant                 |               |                    |                 |          |                              |                          |          |                  |                  |            | 0.46    |
| n                          | 6             | 5                  | 3               | 6        | 6                            | 2                        | 4        | 6                | 1                | 0          |         |
| %                          | 85.70         | 71.40              | 42.90           | 85.70    | 85.70                        | 28.60                    | 57.10    | 85.70            | 14.30            | 0.00       |         |
| General dentist            |               |                    |                 |          |                              |                          |          |                  |                  |            |         |
| n                          | 22            | 21                 | 11              | 23       | 26                           | 13                       | 10       | 26               | 3                | 0          |         |
| %                          | 81.50         | 77.80              | 40.70           | 85.20    | 96.30                        | 48.10                    | 37.00    | 96.30            | 11.10            | 0.00       |         |
| Specialist                 |               |                    |                 |          |                              |                          |          |                  |                  |            |         |
| n                          | 31            | 25                 | 22              | 22       | 31                           | 15                       | 19       | 32               | 4                | 5          |         |
| %                          | 86.10         | 69.40              | 61.10           | 61.10    | 86.10                        | 41.70                    | 52.80    | 88.90            | 11.10            | 13.90      |         |
| Type of dental practice    |               |                    |                 |          |                              |                          |          |                  |                  |            |         |
| Government                 |               |                    |                 |          |                              |                          |          |                  |                  |            | 0.045*  |
| n                          | 25            | 22                 | 14              | 16       | 24                           | 9                        | 14       | 24               | 0                | 1          |         |
| %                          | 89.30         | 78.60              | 50.00           | 57.10    | 85.70                        | 32.10                    | 50.00    | 85.70            | 0.00             | 3.60       |         |
| Private clinic             |               |                    |                 |          |                              |                          |          |                  |                  |            |         |
| n                          | 25            | 19                 | 16              | 26       | 29                           | 14                       | 12       | 28               | 6                | 2          |         |
| %                          | 86.20         | 65.50              | 55.20           | 89.70    | 100.00                       | 48.30                    | 41.40    | 96.60            | 20.70            | 6.90       |         |
| University clinic/hospital |               |                    |                 |          |                              |                          |          |                  |                  |            |         |
| n                          | 9             | 10                 | 6               | 9        | 10                           | 7                        | 7        | 12               | 2                | 2          |         |
| %                          | 69.20         | 76.90              | 46.20           | 69.20    | 76.90                        | 53.80                    | 53.80    | 92.30            | 15.40            | 15.40      |         |
| Experience                 |               |                    |                 |          |                              |                          |          |                  |                  |            |         |
| >15 years                  |               |                    |                 |          |                              |                          |          |                  |                  |            | 0.761   |
| n                          | 9             | 8                  | 8               | 10       | 12                           | 7                        | 6        | 13               | 2                | 1          |         |
| %                          | 69.20         | 61.50              | 61.50           | 76.90    | 92.30                        | 53.80                    | 46.20    | 100.00           | 15.40            | 7.70       |         |
| 1–5 years                  |               |                    |                 |          |                              |                          |          |                  |                  |            |         |
| n                          | 18            | 16                 | 10              | 14       | 15                           | 10                       | 9        | 18               | 2                | 1          |         |
| %                          | 94.70         | 84.20              | 52.60           | 73.70    | 78.90                        | 52.60                    | 47.40    | 94.70            | 10.50            | 5.30       |         |
| 11–15 years                |               |                    |                 |          |                              |                          |          |                  |                  |            |         |
| n                          | 15            | 11                 | 7               | 11       | 15                           | 3                        | 9        | 15               | 1                | 1          |         |
| %                          | 88.20         | 64.70              | 41.20           | 64.70    | 88.20                        | 17.60                    | 52.90    | 88.20            | 5.90             | 5.90       |         |
| 6–10 years                 |               |                    |                 |          |                              |                          |          |                  |                  |            |         |
| n                          | 17            | 16                 | 11              | 16       | 21                           | 10                       | 9        | 18               | 3                | 2          |         |
| %                          | 81.00         | 76.20              | 52.40           | 76.20    | 100.00                       | 47.60                    | 42.90    | 85.70            | 14.30            | 9.50       |         |

\*Statistical significance set at 0.05

**Table 5: Comparison of usage of PPE while performing any dental procedure before and during COVID-19**

| Parameters used before COVID-19     | Parameters used during COVID-19 |       |         | p-value |
|-------------------------------------|---------------------------------|-------|---------|---------|
|                                     | Not used                        | Used  | Total   |         |
| <b>Surgical mask</b>                |                                 |       |         |         |
| Not used                            |                                 |       |         |         |
| n                                   | 0                               | 3     | 3       | 0.057   |
| %                                   | 0.00                            | 4.30  | 4.30    |         |
| Used                                |                                 |       |         |         |
| n                                   | 11                              | 56    | 67      |         |
| %                                   | 15.70                           | 80.00 | 95.70   |         |
| Total                               |                                 |       |         |         |
| n                                   | 11                              | 59    | 70      |         |
| %                                   | 15.70                           | 84.30 | 100.00% |         |
| <b>Examination gloves</b>           |                                 |       |         |         |
| Not used                            |                                 |       |         |         |
| n                                   | 6                               | 6     | 12      | 0.167   |
| %                                   | 8.60                            | 8.60  | 17.10   |         |
| Used                                |                                 |       |         |         |
| n                                   | 13                              | 45    | 58      |         |
| %                                   | 18.60                           | 64.30 | 82.90   |         |
| Total                               |                                 |       |         |         |
| n                                   | 19                              | 51    | 70      |         |
| %                                   | 27.10                           | 72.90 | 100.00  |         |
| <b>Surgical gloves</b>              |                                 |       |         |         |
| Not used                            |                                 |       |         |         |
| n                                   | 24                              | 20    | 44      | 0.1     |
| %                                   | 34.30                           | 28.60 | 62.90   |         |
| Used                                |                                 |       |         |         |
| n                                   | 10                              | 16    | 26      |         |
| %                                   | 14.30                           | 22.90 | 37.10   |         |
| Total                               |                                 |       |         |         |
| n                                   | 34                              | 36    | 70      |         |
| %                                   | 48.60                           | 51.40 | 100.00  |         |
| <b>Head cap</b>                     |                                 |       |         |         |
| Not used                            |                                 |       |         |         |
| n                                   | 14                              | 30    | 44      | 0.001*  |
| %                                   | 20.00                           | 42.90 | 62.90   |         |
| Used                                |                                 |       |         |         |
| n                                   | 5                               | 21    | 26      |         |
| %                                   | 7.10                            | 30.00 | 37.10   |         |
| Total                               |                                 |       |         |         |
| n                                   | 19                              | 51    | 70      |         |
| %                                   | 27.10                           | 72.90 | 100.00  |         |
| <b>Eye protection (face shield)</b> |                                 |       |         |         |
| Not used                            |                                 |       |         |         |
| n                                   | 5                               | 32    | 37      | 0.001*  |
| %                                   | 7.10                            | 45.70 | 52.90   |         |
| Used                                |                                 |       |         |         |
| n                                   | 2                               | 31    | 33      |         |
| %                                   | 2.90                            | 44.30 | 47.10   |         |
| Total                               |                                 |       |         |         |
| n                                   | 7                               | 63    | 70      |         |
| %                                   | 10.00                           | 90.00 | 100.00  |         |
| <b>Eye protection (goggles)</b>     |                                 |       |         |         |
| Not used                            |                                 |       |         |         |
| n                                   | 27                              | 21    | 48      | 0.23    |
| %                                   | 38.60                           | 30.00 | 68.60   |         |
| Used                                |                                 |       |         |         |
| n                                   | 13                              | 9     | 22      |         |
| %                                   | 18.60                           | 12.90 | 31.40   |         |
| Total                               |                                 |       |         |         |
| n                                   | 40                              | 30    | 70      |         |
| %                                   | 57.10                           | 42.90 | 100.00  |         |
| <b>N95 mask</b>                     |                                 |       |         |         |
| Not used                            |                                 |       |         |         |
| n                                   | 35                              | 26    | 61      | 0.001*  |
| %                                   | 50.00                           | 37.10 | 87.10   |         |
| Used                                |                                 |       |         |         |
| n                                   | 2                               | 7     | 9       |         |
| %                                   | 2.90                            | 10.00 | 12.90   |         |
| Total                               |                                 |       |         |         |
| n                                   | 37                              | 33    | 70      |         |
| %                                   | 52.90                           | 47.10 | 100.00  |         |
| <b>Disposable gowns</b>             |                                 |       |         |         |
| Not used                            |                                 |       |         |         |
| n                                   | 3                               | 22    | 25      | 0.001*  |
| %                                   | 4.30%                           | 31.40 | 35.70   |         |
| Used                                |                                 |       |         |         |
| n                                   | 3                               | 42    | 45      |         |
| %                                   | 4.30                            | 60.00 | 64.30   |         |
| Total                               |                                 |       |         |         |
| n                                   | 6                               | 64    | 70      |         |
| %                                   | 8.60                            | 91.40 | 100.00  |         |

telephone and also reported reducing the number of patients in the waiting area.

On the other hand, based on the data, some dentist did not adhere to the recommended PPE. Non-compliance of dentist to the infection control measures and PPE has been reported in earlier studies. The studies explained that dentist's attitude and knowledge could affect their adherence to guidelines [28], [29]. A study conducted in Jeddah showed that 24% of the sample did not wear eye protection during patient treatment [29]. Another study done among dentists in Makkah also showed that 11.2% do not wear masks and few do not wear gown during dental procedures. Recommendation of those studies was that dentist must take training in infection control to increase their knowledge and compliance [30], [31]. A recent study by Khader *et al.* [32] aimed to assess knowledge, perception, and attitude of dentists toward infection control and COVID-19. Findings showed that one-third of dentists included in their study do not perceive COVID-19 as a serious disease. They also concluded that dentists had limited awareness of the additional infection control measures required to that protect the dental staff and other patients from COVID-19 [32]. Another obstacle that could explain less response in the use of some of the PPE is shortage of the materials, for example, only 47% are using N95 mask. Based on the responses of participants in the last question in the questionnaire, 35% reported difficulty in finding the protective materials, especially the N95 mask.

The study has some limitations, first the low sample size that may affect the results. Another limitation is the time span of data collection, it was in a short period (3 weeks). The data were collected immediately after the permission of clinics to resume their routine treatment (July 5), therefore, some of the clinics were still undergoing emergency treatments and other clinics recently resumed their work.

This study is considered to be one of the first studies aimed to exploring infection control measures implemented in the dental setting in KSA during COVID-19. More research with bigger sample size is required to have a better understanding of adherence to guidelines by dental clinics and difficulties encountered in implementing cross-contamination measures. Further studies could assess the knowledge and attitude of dentists toward infection control protocols and COVID-19.

The evidence shows that majority of dentists working in KSA are following recommended measures to minimize the spread of COVID-19. Some dentists modified their PPE used during the pandemic. On the other hand, other dentists were not following strict infection control measures, it is required to increase awareness and provide training to dentist to increase compliance [31].

## Acknowledgment

The project was supported by Deanship of Graduate Studies and Scientific Research at Dar Al Uloom University, Riyadh, KSA.

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