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Comparison of the use of personal protective equipment and infection control in dentists and their assistants before and after the corona crisis

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Abstract:

BACKGROUND: Coronavirus disease 2019 is a new viral outbreak in the world. Dentists and their assistants are at greatest risk of exposure to the virus, due to close contact with patients and dealing with aerosols. Hence, the aim of this study was to compare the use of personal protective equipment (PPE) and supplementary protective equipment (SPE) and observance of the principles of infection control (PIC) in dentists and their assistants before and after the corona crisis.

MATERIALS AND METHODS: This cross-sectional study was conducted using an online survey from May 6 to 20, 2020. Convenience sampling was used to select individuals. The questionnaire, consisting of four general categories about the use of PPE and SPE and the observance of PIC by dentists and their assistants before and after corona crisis, was registered at Porsline website (<https://survey.porsline.ir/s/KUt7VQB>). Frequencies in each subcategory were calculated and comparisons were done using Chi-square test, Fisher's exact test, and paired sample *t*-test. A $P < 0.05$ was considered statistically significant.

RESULTS: There were significant differences in the frequency of use of PPE by dentists before and after corona crisis for oral and dental examination and also dental procedures ($P < 0.001$). There were significant differences in the frequency of use of SPE and observance of PIC before and after corona crisis, except for different types of suction types ($P = 0.22$), dental handpiece ($P = 0.66$), and dental unit ($P = 1$). There were significant differences in the frequency of use of PPE by dental assistants before and after corona crisis ($P < 0.001$).

CONCLUSIONS: Although the frequency of use of PPE and observance of PIC increased among dentists and their assistants, this increase is not sufficient, especially for dental assistants, and a higher level of use of PPE and PIC observance in face of highly contagious and life-threatening viruses such as corona is required.

Keywords:

Coronavirus disease 2019, dentistry, infection control, personal protective equipment

Introduction

The prevalence of viral diseases is on the rise and has caused many problems for public health. Coronavirus disease 2019 (COVID-19) is a new viral outbreak in the world.^[1] Pneumonia triggered by novel coronavirus (COVID-19) in Wuhan, China, in December 2019 is an extremely

contagious disease. The WHO has stated the outbreak of COVID-19 as a pandemic issue.^[2,3] COVID-19 has now spread to almost every country in the world and is transmitted in a variety of ways;^[4] the main route of transmission of the virus is through person-to-person contact. Dentists and their assistants are at greater risk of exposure to the virus during close contact with patients and dealing with blood, saliva, and aerosols

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produced during dental procedures, and if the principles of infection control (PIC) are not observed, they can play a role in the spread of infection and disease to dental patients.^[5-8]

Although the virus is more contagious when the patient is symptomatic, the possibility of human-to-human transmission even exists in patients with mild or absent symptoms. The virus can survive in aerosol and on materials. COVID-19 can be viable in aerosols for up to 3 h with a half-life of 1.5 h. The virus can survive longer on stainless steel and plastic with an average half-life of approximately 5.6 and 6.8 h, respectively, and the viable virus was detected up to 72 h.^[9] Routine dental procedures produce aerosols, which have potential risks for dental care personnel and patients. Because of high transmissibility of the COVID-19, dental teams should be alert and maintain a healthy environment for both the patients and themselves.^[7] COVID-19 transmission often occurs through airborne droplets. Use of personal protective equipment (PPE), including gloves, masks, protective outerwear, protective surgical glasses, and shields, is strongly recommended to protect eye, oral, and nasal mucosa.^[8]

Some dentists may not meet the minimum requirements for infection control and do not use appropriate PPE such as masks, gloves, and goggles, during oral examinations and dental procedures, or do not follow the PIC well, which can lead to the transmission of various viral and bacterial infections.^[4,6]

Patil *et al.*^[10] in a brief review introduced protective measures, including patient evaluation, PPE and patient protective equipment use, sterilization, and disinfection protocols, for decreasing the risk of COVID-19 infection for dentists. They stated that several healthcare workers, despite the strict infection control and preventive measures, are infected with COVID-19, and some of them died of the disease. The reasons for this problem should be evaluated. They concluded that dental staff needs to follow several steps, from patient evaluation to infection control at personal, procedural, and clinical levels, to prevent COVID-19 infection.

Gallagher *et al.*^[11] in their study outlined contemporary evidence on PPE for health professionals and explored its relevance for dental professionals, with practical recommendations for action. They emphasized on the critical lack of relevant evidence and stated that further research is required involving dental personnel, procedures, and in dental settings. Therefore, the aim of this study was to compare the use of PPE and supplementary protective equipment (SPE) and the observance of PIC in dentists and their assistants before and after the corona crisis.

Materials and Methods

After the approval of the study in the university research council and also the university ethics committee and obtaining the ethics code (IR.BUMS.REC.1399.46), this cross-sectional, descriptive, analytical study was conducted in 2020. The study population included all Iranian general dentists volunteer to participate in the study who were engaged in providing dental services after the announcement of the first case of corona disease in Iran and before the complete ban on dental activities. To estimate the sample size, the sample size formula

for estimating the population ratio ($n = \frac{z^2 p (1-p)}{d^2}$) was

used. Due to the lack of study in this field and to estimate the maximum required sample, the $P = 0.5$, confidence interval (z) = 95%, and margin of error (d) = 0.05 were considered into account. Therefore, the sample size was obtained equal to 385 people. Convenience sampling was used to select individuals. All dentists voluntarily participated in the survey with written consent form. One of the exclusion criteria was incomplete completion of the questionnaire. Questionnaires with duplicate internet protocol address (IP address) as well as questionnaires that took <10 min to complete were also removed.

For this study, due to the lack of a similar study, a researcher-made questionnaire was used. The questionnaire development process was performed in three basic stages, including item generation, determining face and content validity, and determining the reliability of the questionnaire. To make a questionnaire about the use of PPE and the observance of PIC by dentists and their assistants in the corona crisis, at first, the item generation phase began with a comprehensive review of existing published scientific sources on this subject. After that, several focus groups were formed to gain a comprehensive understanding of the PPE and PIC in the target population. The members of these focus groups were eight specialists in fields of dentistry, medicine, epidemiology, public health, and also community health nursing.

Then, the prepared questionnaire was evaluated by ten professors of dentistry and methodology in terms of content validity; the questions with problems were edited based on the professors' opinions, and finally, the validity of the questionnaire was confirmed as qualitative content validity.

To check the reliability of the questionnaire, the questionnaire was provided to 30 eligible individuals, and Cronbach's alpha was used to confirm the reliability; alpha >0.7 was considered as appropriate reliability. The reliability of questionnaire (Cronbach's alpha = 0.82) was confirmed.

The questionnaire consisted of demographic data and four general categories including use of PPE for oral and dental examination before and after corona crisis, use of PPE for aerosol-generating dental procedures before and after corona crisis, use of SPE and observance of PIC before and after corona crisis, and use of PPE by dental assistants before and after corona crisis. The first category consisted of three subcategories comprising nine options about the use of PPE for oral and dental examination including different types of mouth and nose protectors (no protector, surgical mask, and N95 mask), eye and face protectors (no protector, general safety glass/face shield, and chemical splash goggle), and hand protectors (no protector, disposable polyethylene gloves, and disposable vinyl/nitrile/latex gloves). The second category consisted of 11 subcategories comprising 31 options about the use of PPE for aerosol-generating dental procedures including different types of mouth and nose protectors, eye and face protectors, hand protectors, body protectors (no protector, medical scrub uniform/laboratory coat, simple medical protective gown/simple coverall medical protective gown, and hydrophobic medical protective gown/hydrophobic coverall medical protective gown), hair protectors (no protector, simple medical cap, and hydrophobic surgical scrub cap), sleeve protectors (no protector, disposable sleeves, and hydrophobic disposable sleeves), shoe protectors (no protector, disposable shoe cover, and hydrophobic shoe cover), tooth isolation (no isolation, cotton roll, and rubber dam), mouthwash usage (yes/no), disinfection of dentist's hands (no disinfection, hand sanitizer/liquid hand wash), and disinfection of patient's hands. The third category consisted of 14 subcategories comprising 33 options about the use of SPE and observance of PIC including different types of suction (saliva ejector, high-volume suction), dental handpiece (conventional dental turbine and contra-angle handpiece, anti-retraction dental turbine and contra-angle handpiece, disposable turbine, and red band contra-angle handpiece with electric motors), dental unit (conventional dental unit, dental unit equipped with one-way valves), surface disinfectants (no surface disinfectants, low-level surface disinfectants, medium-level surface disinfectants, and high-level surface disinfectants), private dental handpiece (use of nonsterile and nondisinfected common dental handpiece, common disinfected dental handpiece for patients, private sterile dental handpiece for each patient), separation of infectious waste in the yellow garbage bag (yes/no), use safety box to repel sharp and winning tools (yes/no), use of private disposable supplies for each patient (yes/no), dental unit waterline disinfection (yes/no), disinfection of prosthetic molds before sending to the laboratory (yes/no), disinfection of prosthetic molds upon delivery from the laboratory (yes/no), discharge water and air lines for a

minimum of 20–30 s after each patient (yes/no), use of air and surfaces disinfection equipment (no disinfection, use of ultraviolet [UV] lamp/ozon generator/cold plasma device/air ionizer), and use of vital signs check devices for patients (no vital sign check, use of digital thermometer/pulse oximeter). The fourth category consisted of eight subcategories comprising 24 options about the use of PPE by dental assistants including different types of mouth and nose protectors, eye and face protectors, hand protectors, body protectors, hair protectors, sleeve protectors, shoe protectors, and disinfection of hands.

Due to corona crisis and observance of social distance, the research was conducted online. The link of the questionnaire (<https://survey.porsline.ir/s/KUt7VQB>) shared via Iranian Dental Society channel in Telegram Messenger and also via other virtual dental groups and channels. Questionnaires with duplicate IP address or taking <10 min to complete were excluded from the study.

The obtained data entered into the SPSS software (version 16) (Released 2007, SPSS for Windows, Version 16.0, SPSS Inc., Chicago, USA). Frequencies in each subcategory were calculated, and comparisons were done using Chi-square test, Fisher's exact test, and paired sample *t*-test. A $P < 0.05$ was considered statistically significant.

Results

Out of a total of 400 questionnaires received, 381 questionnaires were fully completed (response rate: 95.2%). The average age of the participants was 44.56 ± 11.72 years. 46.5% were males and 53.5% were females. 69% worked in personal office, 15.2% in government clinic, and 15.8 in private clinic. 69.3% of the dentists had very much concern about infections with COVID-19.

Personal protective equipment for oral and dental examination

There were significant differences in the use of following PPE before and after corona crisis: mouth and nose, eye and face, and hand protectants ($P < 0.001$). Not wearing a mask by a dentist was reduced from 4% before corona crisis to 0.8% after corona crisis. No one used an N95 mask before corona crisis. The use of N95 mask reached 46.5% after corona crisis. 44.1% of the dentists did not wear glasses or shield before corona crisis, and after corona crisis, this figure reached 1.6%. The use of face shield increased from 13.4% before corona crisis to 54.3% after corona crisis. Wearing chemical splash goggles before and after corona crisis was not different. 16.5% of the dentists did not wear any gloves before corona

crisis, and after corona crisis, all of dentists wore gloves. Before corona crisis, dentists primarily wore disposable polyethylene gloves (40.9%); after corona crisis, dentists mainly wore disposable latex gloves (69.3%).

Personal protective equipment for aerosol-generating dental procedures

There were significant differences in the use of following PPEs before and after corona crisis: mouth and nose protectant, eye and face protectant, hand protectants, sleeves protectant, shoe protectant, tooth isolation equipment, mouthwash usage, disinfection of dentist's hands, body protectant, and hair protectant ($P < 0.05$) [Table 1]. Not wearing a mask by dentists was reduced from 3.1% before corona crisis to 0% after corona crisis. No one used an N95 mask before corona crisis. Before corona crisis, the use of one surgical mask was the highest, while after corona crisis, the use of an N95 mask was the highest. 11% of the dentists did not wear glasses or shield before corona crisis, and after corona crisis, this figure reached 0.8%. The use of chemical splash goggles increased from 1.6% before corona crisis to 39.4% after corona crisis. Before corona crisis, general safety glasses were the most widely used equipment, while after corona crisis chemical splash goggles were the most used. 2.4% of the dentists did not wear any gloves before corona crisis, and after corona crisis, all of dentists wore gloves. Dentists mainly wore disposable latex gloves before and after corona crisis. Not wearing a body protector (including laboratory coat and medical scrub) by dentists was reduced from 11% before corona crisis to 1.6% after corona crisis. Among different types of gowns, only 2.4% of dentists used simple medical protective gown before corona crisis. Most dentists (79.5%) wore laboratory coat before corona crisis. The use of simple and hydrophobic coverall medical protective gown was notable after corona crisis. Not wearing a medical cap by dentists was reduced from 90.6% before corona crisis to 7.1% after corona crisis. 81.9% of dentists used simple medical cap and 11% used hydrophobic surgical scrub cap after corona crisis. Not wearing disposable sleeves by dentists was reduced from 89% before corona crisis to 7.9% after corona crisis. 86.7% of dentists used disposable sleeves and 5.4% used hydrophobic ones after corona crisis. Not wearing disposable shoe cover by dentists was reduced from 99.2% before corona crisis to 74.8% after corona crisis. Not using tooth isolation by dentist was reduced from 43.3% before corona crisis to 7.1% after corona crisis. 55.1% of dentists used cotton roll isolation before corona crisis and 88.2% used that after corona crisis. There was not much difference between using rubber dam before (1.6%) and after (4.7%) corona crisis. Using mouthwash by dentists was increased from 21.3% before corona crisis to 44.1% after corona crisis. Not disinfection of dentist's hands before dental

procedures was reduced from 33.9% before corona crisis to 0% after corona crisis. Before corona crisis, disinfection with water and hand wash liquid was the predominant method, and after corona crisis, disinfection with hand sanitizers was predominant.

Supplementary protective equipment and principles of infection control

There were significant differences in the use of following SPE and observance of PICs before and after corona crisis: surface disinfectants, private and sterile dental handpieces, separation of infectious waste, safety box usage, disinfection of patient's hands, using private disposable dental products for each patient, dental unit waterlines disinfection, disinfection of the prosthetic mold before sending it to the laboratory, disinfection of prosthetic mold at the time of delivery from the laboratory, discharge water and air lines after each patient, checking vital signs, and use of air disinfectant equipment ($P < 0.05$) [Table 2]. There were not significant differences in the use of following SPE and PIC before and after corona crisis: suction types, types of dental handpieces, using dental unit equipped with one-way valves ($P > 0.05$) [Table 2]. Before corona crisis, the use of high-volume suction was 25.2%, which reached 29.1% after corona crisis; however, the use of saliva ejector was still predominant. Before corona crisis, the use of anti-retraction handpieces and disposable turbine was 6.3% and 1.6%, respectively; after corona crisis, the use of anti-retraction handpieces and disposable turbine was 7.1% and 2.4%, respectively; however, the use of conventional dental turbine and contra-angle handpiece was still predominant. In general, both before and after corona crisis, the use of low-level disinfectants prevailed. However, the use of high-level disinfectants and sodium hypochlorite increased after corona crisis (3.1% and 29.2%, respectively, after corona crisis versus 1.6% and 2.4%, respectively, before corona crisis). Not using disinfectants was 6.3% before corona crisis and reduced to 1.6% after corona crisis. Using nondisinfected nonsterile dental handpieces was 1.6% and 0.8% before and after corona crisis, respectively. Use of disinfected nonsterile dental handpieces was reduced from 63% before corona crisis to 12.6% after corona crisis. Conversely, the use of sterile dental handpieces was increased from 35.4% before corona crisis to 86.6% after corona crisis. Separation of infectious waste was increased from 63% before corona crisis to 91.3% after corona crisis. Safety box usage was increased from 79.5% before corona crisis to 97.6% after corona crisis. Not disinfection of patient's hands was reduced from 83.5% before corona crisis to 7% after corona crisis. Using private disposable dental products for each patient was increased from 76.4% before corona crisis to 97.6% after corona crisis. Dental unit waterlines disinfection was increased from 29.1% before corona crisis to 88.2% after corona crisis. Disinfection of the

Table 1: Distribution of the frequency of personal protective equipment used by dentists for dental procedures before and after corona crisis

Equipment	Time		P
	Before corona crisis, n (%)	After corona crisis, n (%)	
Mouth and nose protectors			
No mask	12 (3.1)	0	<0.001
One surgical mask	363 (95.3)	93 (24.4)	
Two surgical masks	6 (1.6)	78 (20.5)	
N95 mask	0	210 (55.1)	
Eye and face protectors			
No glasses or shield	42 (11)	3 (0.8)	<0.001
General safety glasses	246 (64.6)	138 (36.2)	
Face shields	87 (22.8)	90 (23.6)	
Chemical splash goggles	6 (1.6)	150 (39.4)	
Hand protectors			
No gloves	9 (2.4)	0	0.036
Disposable polyethylene gloves	75 (19.7)	60 (15.7)	
Disposable vinyl gloves	15 (3.9)	15 (3.9)	
Disposable nitrile gloves	36 (9.4)	30 (7.9)	
Disposable latex gloves	246 (64.6)	276 (72.5)	
Body protectors			
No lab coat or medical scrub	42 (11)	6 (1.6)	<0.001
Medical scrub	27 (7.1)	60 (15.7)	
Lab coat	303 (79.5)	126 (33.1)	
Simple medical protective gown	9 (2.4)	54 (14.2)	
Simple coverall medical protective gown	0	9 (2.4)	
Hydrophobic simple medical protective gown	0	12 (3.1)	
Hydrophobic coverall medical protective gown	0	114 (29.9)	
Hair protectors			
No medical hat	345 (90.6)	27 (7.1)	<0.001
Simple medical cap	24 (6.3)	312 (81.9)	
Hydrophobic surgical scrub cap	12 (3.1)	42 (11)	
Sleeve protectors			
No disposable sleeves	339 (89)	30 (7.9)	<0.001
Disposable sleeves	42 (11)	330 (86.7)	
Hydrophobic disposable sleeves	0	21 (5.4)	
Shoe protectors			
No disposable shoe cover	378 (99.2)	285 (74.8)	<0.001
disposable shoe cover	3 (0.8)	39 (10.2)	
Hydrophobic disposable shoe cover	0	57 (15)	
Tooth isolation			
No tooth isolation	165 (43.3)	27 (7.1)	<0.001
Cotton roll isolation	210 (55.1)	336 (88.2)	
Rubber dam isolation	6 (1.6)	18 (4.7)	
Mouthwash usage			
No mouthwash	300 (78.7)	213 (55.9)	<0.001
Mouthwash	81 (21.3)	168 (44.1)	
Disinfection of dentist's hands			
No disinfection	129 (33.9)	0	<0.001
Disinfect with gel or solution	84 (22)	357 (93.7)	
Disinfect with water and hand wash liquid	168 (44.1)	24 (6.3)	

prosthetic mold before sending it to the laboratory was increased from 81.1% before corona crisis to 96.9% after corona crisis. Disinfection of prosthetic mold at the time of delivery from the laboratory was increased from 41% before corona crisis to 97.6% after corona crisis. Discharge

water and air lines after each patient was increased from 29.9% before corona crisis to 68.5% after corona crisis. Use of air disinfectant equipment was increased from 7.1% before corona crisis to 15% after corona crisis. Before corona crisis, only UV lamps were used, but after corona

Table 2: Distribution of the frequency of supplementary protective equipment and observance of principles of infection control used by dentists before and after corona crisis

Equipment	Time		P
	Before corona crisis, n (%)	After corona crisis, n (%)	
Suction types			
Saliva ejector	285 (74.8)	270 (70.9)	0.22
High volume suction	96 (25.2)	111 (29.1)	
Types of dental handpieces			
Conventional dental turbine and contra-angle handpiece	351 (92.1)	345 (90.5)	0.66
Anti-retraction	24 (6.3)	27 (7.1)	
Disposable turbine	6 (1.6)	9 (2.4)	
Surface disinfectant			
No surface disinfectors	24 (6.3)	6 (1.6)	<0.001
Low-level surface disinfectors	237 (62.2)	168 (44.1)	
Medium-level surface disinfectors	105 (27.5)	84 (22)	
High-level surface disinfectors	6 (1.6)	12 (3.1)	
Sodium hypochlorite	9 (2.4)	111 (29.2)	
Specific and sterile dental handpieces			
Nondisinfected non sterile dental handpieces	6 (1.6)	3 (0.8)	<0.001
Disinfected nonsterile dental handpieces	240 (63)	48 (12.6)	
Sterile dental handpieces	135 (35.4)	330 (86.6)	
Separation of infectious waste			
No separation	141 (37)	33 (8.7)	<0.001
Separation	240 (63)	348 (91.3)	
Safety box usage			
No safety box usage	78 (20.5)	9 (2.4)	<0.001
Safety box usage	303 (79.5)	372 (97.6)	
Disinfection of patient's hands			
No disinfection	318 (83.5)	27 (7)	<0.001
Disinfect with gel or solution	0	177 (46.5)	
Disinfect with water and hand wash liquid	63 (16.5)	177 (46.5)	
Specific disposable dental products for each patient			
No specific disposable dental products for each patient	90 (23.6)	9 (2.4)	<0.001
Specific disposable dental products for each patient	291 (76.4)	372 (97.6)	
Dental unit equipped with one-way valves			
Dental unit without one-way valves	267 (70.1)	267 (70.1)	1
Dental unit equipped with one-way valves	114 (29.9)	114 (29.9)	
Dental unit waterlines disinfection			
No dental unit waterlines disinfection	270 (70.9)	45 (11.8)	<0.001
Dental unit waterlines disinfection	111 (29.1)	336 (88.2)	
Disinfection of the prosthetic mold before sending it to the laboratory			
No disinfection	72 (18.9)	12 (3.1)	<0.001
Disinfection	309 (81.1)	369 (96.9)	
Disinfection of prosthetic mold at the time of delivery from the laboratory			
No disinfection	225 (59)	9 (2.4)	<0.001
Disinfection	156 (41)	372 (97.6)	
Discharge water and air lines after each patient			
No discharge	267 (70.1)	120 (31.5)	<0.001
Discharge	114 (29.9)	261 (68.5)	
Use of air disinfectant equipment			
Not to use of air disinfectant equipment	354 (92.9)	324 (85)	<0.001
Ultraviolet lamp	27 (7.1)	48 (12.6)	
Ozone generators	0	9 (2.4)	
Ionizer (cold plasma)	0	0	
Checking vital signs			
Not checking vital signs	381 (100)	315 (82.7)	<0.001
Checking vital signs	0	66 (17.3)	

crisis, the ozone generator was also used to disinfect the air. Before corona crisis, none of the dentists checked vital signs, and after corona crisis, 17.3% checked vital signs.

Personal protective equipment of dental assistants

There were significant differences in the use of following PPE before and after corona crisis: mouth and nose protectant, eye and face protectant, hand protectant, hair protectant, shoe protectant, disinfection of dental assistant's hands, body protectant, and sleeves protectant ($P < 0.001$). Not wearing a mask by dental assistants was reduced from 33.1% before corona crisis to 0% after corona crisis. No one used N95 mask before corona crisis. Before corona crisis, the use of one surgical mask (67.7%) was the highest; after corona crisis, the use of masks was as follows: surgical mask (80.3%) and N95 masks (19.7%). 77.2% of dental assistants did not wear glasses or shield before corona crisis, and after corona crisis, this figure reached 3.1%. After corona crisis, general safety glasses (60.6%) were the most widely used, followed by face shields (34.7%). 14.2% of dental assistants did not wear any gloves before corona crisis, and after corona crisis, all of dental assistants wore gloves. The use of disposable polyethylene gloves increased from 40.9% before corona crisis to 49.6% after corona crisis. The use of disposable latex gloves increased from 34.7% before corona to 40.2% after corona. Others used disposable vinyl and nitrile gloves. Not wearing a body protector (including laboratory coat and medical scrub) by dental assistants was reduced from 26.8% before corona crisis to 0% after corona crisis. Although, like before corona crisis (70.9%), the use of laboratory coat after corona crisis (74%) was the most widely used body protector, 21.3% used simple and hydrophobic medical protective gown (including coverall types). Not wearing a medical cap by dental assistants was reduced from 96.8% before corona crisis to 75.6% after corona crisis. Not wearing disposable sleeves by dental assistants was reduced from 93.7% before corona crisis to 83.5% after corona crisis. Not wearing disposable shoe cover was reduced from 99.2% before corona crisis to 78.7% after corona crisis. Not disinfection of dental assistant's hands was reduced from 35.4% before corona crisis to 0% after corona crisis. Before corona crisis, disinfection with water and hand wash liquid (37.8%) was the predominant method, and after corona crisis, disinfection with hand sanitizers (93.7%) was predominant.

Discussion

In general, the status of the dentists was appropriate in face of corona crisis with respect to the use of PPE and SPE and observance of PIC. The status of dental assistants was slightly different, and although there has been notable increase in the use of PPE, this increase is not sufficient to combat a highly contagious and

life-threatening virus such as COVID-19. Given the nature of the COVID-19, and especially its transmission through aerosols, it should be explained to the dental assistants that there is no difference between the PPE used by the dentists and their dental assistants.

Although the use of N95 masks for oral examinations and dental procedures has increased significantly compared to before corona crisis, it does not seem to be enough to deal with a life-threatening, highly contagious virus-like COVID-19. This should be well explained to dentists and dental staff that even a moment of neglect of the virus and noncompliance with the minimum of PPE such as a N95 mask can increase the risk of infection with this disease in dentists and dental assistants, and in turn, medical staff can transmit the disease to other patients and family members and the community. The use of chemical splash goggles has not been much different from before corona crisis, especially for oral and dental examination, both in dentists and dental assistants, and most of them still use general safety glasses or face shield. The reason for this could be related to the unknown nature of the coronavirus at the beginning of the epidemic. The medical staff probably did not have a clear idea of the high contagion of the virus at first, especially through aerosols. However, with the current knowledge of the behavior of this virus, the use of chemical splash goggles is one of the minimum requirements for dentists and their assistants. In addition, dentists have rarely used a rubber dam. This issue can be viewed both from an attitude perspective and from an educational perspective. Dentists may not believe in using a rubber dam or may not be aware of its significant effects on reducing the transmission of infections and reducing aerosol production. It is also possible that due to the difficulty of using the rubber dam and not providing the necessary training on how to place the rubber dam correctly, dentists are less willing to use it. Therefore, there is a need to correct attitudes and provide information on its benefits and provide the necessary training on how to properly place rubber dam; to do this, dental schools should plan and make the necessary predictions in the general dental students' curriculum. To provide some equipment needed in the event of a COVID-19 crisis, such as a unit equipped with one-way valves, high-volume suction, and air disinfection devices, especially due to the difficult economic conditions in the whole society and including dentists, measures and facilities should be provided by the government for dentists in order to improve the quality of their equipment. In the case of surface disinfectants, it is necessary for dentists to move more rapidly and strongly toward high-level disinfectants. In the field of screening patients when visiting dental centers and checking vital signs, the necessary knowledge and equipment should be provided for dentists.

Ali *et al.*^[4] in their review stated that there is a possibility of transmission of COVID-19 infection through aerosols between patients and dentists. Screening tests should be performed in a dental setting to prevent this transmission. They stated that the use of gloves, face shields, masks, gowns, and antiseptic hand wash is mandatory for dentists. Khanagar *et al.*,^[5] Ge *et al.*,^[7] and Ather *et al.*^[12] stated that dentists in the corona crisis should not only comply with health standards and aseptic principles that are part of their legal duties but also comply with caution regarding the transmission of infections through contact and airborne transmission, including aerosols. They stated that dentists should use PPE, including disposable surgical mouth masks or N95, protective eyewear, face shields, and protective clothing (fluid-resistant disposable gowns), head covering, use of rubber dam and high-volume suction, and shoe coverings. In Khader's study,^[6] most dentists were aware of COVID-19 symptoms, routes of transmission, and PIC and preventive measures in dental setting during corona. However, dentists did not have a sufficient understanding of precautionary measures to protect dental personnel and patients against corona virus. Izzetti *et al.*^[8] recommended guidelines based on the Italian experience in terms of patient triage, patients' entrance into the dental office, dental treatment, and after-treatment management. Alharbi *et al.*^[13] stated that guidelines for dentistry services during the COVID-19 pandemic were based on grouping the patients according to condition and need and considering the procedures according to risk and benefit.

One of the limitations of the present study was that the study was done online, which to some extent reduced the number of participants in the study. Other limitations include newfoundness of COVID-19 disease and the lack of a similar study in the present study field. However, since this study, for the first time, compared the use of PPE and PIC in dentists and their assistants before and after the corona crisis, it causes a kind of innovation and novelty in the present study. Among the strengths of the study, we can mention the successful new experience of conducting the study and completing the questionnaire in the country level and online.

Conclusions

Although the frequency of use of PPE and SPE and observance of PIC increased among dentists and their assistants, this increase is not sufficient, especially for dental assistants, and a higher level of use of PPE and PIC observance in the face of highly contagious and life-threatening viruses such as COVID-19 is required. It will be useful to plan for some changes in the dental

curriculum, hold COVID-19-specific retraining courses for both dentists and dental assistants, and provide facilities by governments for dentists to combat the coronavirus.

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Conflicts of interest

There are no conflicts of interest.

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