



The Investigation of Clinical Guidelines and Standards on Infection Control in Specialized Dental Departments

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Abstract

BACKGROUND: It is important to adhere to infection control measures in dental procedures due to direct contact with blood and saliva. During the Coronavirus disease 2019 pandemic, regular surveillance is imperative to ensure adherence to the standards.

AIM: This study aimed to assess the level of adherence to infection control guidelines in specialized dental clinics in different working shifts.

MATERIALS AND METHODS: This study assessed the level of adherence of 45 selected dental departments to three main guidelines released by (I) the center for disease control (CDC), (II) the Ministry of Health (MOH), and (III) armed forces organization (AFO) in three different working shift. The CDC checklist had eight domains. Thus, the items of each domain were individually scored, and considering the weighting coefficient of each item, the total score was calculated. The same procedure was carried out for the two remaining guidelines. The possible effect of working shifts and different specialties on infection control practice was also calculated.

RESULTS: The mean rate of adherence was 70.7% to the CDC, 93.8% to the MOH, and 84.4% to the AFO guidelines indicating that adherence to the CDC guidelines was lower than the other two domestic guidelines. Individual assessment of each item revealed that hand hygiene (39%) and safe handling and disposal of sharp instruments (46%) acquired the lowest, while sterilization (79%) and safe injection (97%) acquired the highest score according to the CDC checklist. There was no relationship between working shifts and dental specialties regarding the adherence to infection control standards.

CONCLUSION: Dental clinics had different performances regarding infection control guidelines. Further emphasis should be placed on hand hygiene and disposal of sharp instruments.

Edited by: Filip Koneski
Citation: Keshvad MA, Vatandoust MT, Tahmasebi E, Yazdanian M, Sanaeinasab H, Salesi M, Rafiei E. The Investigation of Clinical Guidelines and Standards on Infection Control in Specialized dental Departments. Open Access Maced J Med Sci. 2022 Nov 24; 10(D):465-470. <https://doi.org/10.3889/oamjms.2022.10981>
Keywords: Dental clinics; Infection control; Guideline adherence; Hand hygiene
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Received: 19-Sep-2022
Revised: 21-Oct-2022
Accepted: 14-Nov-2022
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Funding: This research did not receive any financial support
Competing Interests: The authors have declared that no competing interests exist
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Introduction

Disease transmission can easily occur in dental clinics. Thus, prevention of cross-infection is imperative [1]. Dental clinicians and the staff are in close contact with patients and at risk of a wide range of infectious diseases from a simple cold to more serious conditions such as herpes, hepatitis, AIDS, and coronavirus disease 2019 (COVID-19) [2]. Such diseases can be easily transmitted through blood, saliva, and respiratory droplets [3]. Considering the increasing prevalence of infectious diseases and the fact that they cannot be easily detected, all patients should be considered potentially infectious, and dental instruments contaminated with blood or saliva should be considered infected [4], [5], [6], [7], [8], [9], [10]. For instance, the control panel of the dental unit, light switches, handpiece handle, dental chair, and

air and water spray are among the clinical surfaces that should be considered contaminated [11]. With the increased investment in oral health fields and improvement of public health services, people currently have easy access to dental care services. However, the increased demand for dental services and the emergence of COVID-19 pandemic created some concerns with respect to the efficient provision and adherence to infection control measures such as sterilization of instruments, availability of personal protective equipment, vaccination, and education and training of the personnel [12], [13]. Evidence shows that although no significant difference exists among the currently available infection control guidelines, the level of adherence to them may be highly variable among healthcare workers. For instance, Montagna *et al.* found that dental personnel did not adhere well to the main infection control measures, such that 90.1% wore a face mask, 95.5% wore sterile gloves,

91.2% wore a protective head cover, and 59.4% wore a medical gown. Furthermore, 20.5% had not been vaccinated against hepatitis B [14]. Moreover, it should be noted that adherence to infection control measures in developing countries is often lower than that in developed countries [15]. Different organizations have compiled infection control guidelines for medical and dental clinics including the World Health Organization, American Dental Association, National Health Services of the UK, and center for disease control and prevention (CDC) [16]. Moreover, the authorities of the Ministry of health (MOH) and some other organizations in each country have compiled guidelines, and adherence to the guidelines in dental offices and clinics is periodically monitored by the MOH inspectors [17]. The hypothesis of this study was that clinical adherence to the existing guidelines do not differ significantly and are not related to the specialty of practitioner's and their working shifts. To test this hypothesis, we aimed to assess the level of adherence to different infection control clinical guidelines in dental departments and find strengths and shortcomings of the existing guidelines to later compile a comprehensive infection control guideline. Furthermore, the possible relationship between type of dental specialty and working shifts with adherence to infection control standards was investigated.

Materials and Methods

Study design

This cross-sectional study was conducted on specialized dental departments and clinics affiliated with the main areas of Teheran, Iran in 2021–22. The sample size was estimated at 39 by considering a confidence interval of 0.95 with α error of 0.05% and $1-\beta$ power of the study (=80% ($z = 1.96$)) based on a similar study [18], which we overestimated to 45 to cover maximum data possible. The latest version of the CDC checklist regarding the infection control guidelines for dental clinics and also latest version of the checklists regarding the infection control guidelines for dental clinics released by the MOH and armed forces organization (AFO) were obtained. Due to the high number of personnel, the researcher presented to the clinics and visited the departments without prior notice in three working shifts: Early in the morning shift, at the end of the morning shift, and in the middle of the evening shift. All departments were visited, and all three checklists (CDC, MOH, and AFO) were individually filled out for each department. To prevent bias, a constant day was not selected for surveillance and the observation day varied throughout the week. The researcher presented to each department, introduced himself to the head nurse, and explained

the project course and objectives. Dental clinicians and personnel were not aware of the project to prevent bias.

CDC checklist

To analyze the answers to CDC checklist, a maximum of 2 points were allocated to each item using a 0-2-point scale, depending on the level of adherence, as follows: Over 90% adherence to the respective item of the protocol: full score was allocated. 75% to 90% adherence: 1.5 out of 2 points was allocated. 50% to 75% adherence: 1 out of 2 points was allocated. 25% to 50% adherence: 0.5 out of 2 points was allocated. >25% adherence: 0 points was allocated [19]. The score of each item was then multiplied by the weighting coefficient of the respective item (1 or 2). The weighting coefficient for each item was determined by consultation with a panel of experts. Finally, the sum of all scores in each of the 8 domains was calculated, and the final score was recorded. The sum of scores of all questions related to each domain was divided by the maximum score that could be acquired for that domain to calculate the percentage of adherence to the guidelines.

MOH and AFO guideline

These domestic checklists already have a built-in scoring system. Regarding MOH guideline the score of each item was calculated as follows: Overall cleanliness of the department; Maximum score of 5. Adequacy of instruments and equipment; maximum score of 4. Amalgam and needle safe disposal; Maximum score of 3. Sterilization; maximum score of 12. Supervision of personnel in adherence to infection control measures by a dental clinician; maximum score of 3.

The first item of the AFO checklist is related to sterilization and has two parts. The first part is related to the CSR, and has 13 questions. The second part is related to dental clinic and has 8 questions. This section has a total score of 112. The second item of the checklist includes three domains of environmental hygiene with 11 questions, personnel hygiene with 4 questions, and disposal of wastes with 9 questions. This section also has a total score of 105.

Statistical analysis

Considering the nonparametric nature of the data, Kruskal–Wallis test was carried out to measure the effect of working shifts and types of specialty on infection control practice. Statistical analysis was employed using SPSS version 22 (SPSS Inc., IL, USA) at a 0.05 level of significance.

Results

Assessment of adherence to CDC checklist based on types of dental specialty

Dental departments enrolled in this research were categorized based on their specialty as follows: Endodontics (n = 7), oral surgery (n = 6), restorative dentistry (n = 8), orthodontics (n = 4), pedodontics (n = 5), prosthodontics (n = 7), and general dentistry (n = 8). Quantitative assessment of the performance of different departments indicated that the maximum overall adherence to CDC guidelines was 74% for restorative departments, 69% for prosthodontics, 72% for pedodontics, 73% for endodontics, 71% for oral surgery, 78% for orthodontics, and 72% for general dentistry departments. Minimum overall adherence to CDC guidelines was 66% for restorative department, 65% for prosthodontics, 66% for pedodontics, 68% for endodontics, 65% for oral surgery, 71% for orthodontics, and 67% for general dentistry. Mean score of the infection control practice in each domain of CDC checklist is presented in Table 1.

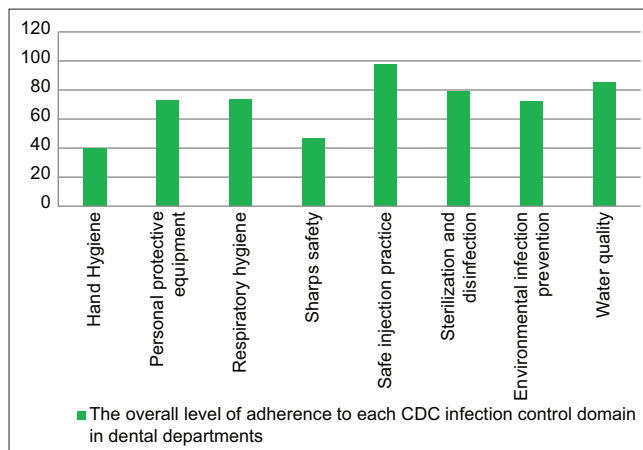


Figure 1: The overall level of adherence to each CDC infection control domain in dental departments

Statistical analysis showed no significant differences in any of these domains between different specialties ($p > 0.05$), except for prosthodontic departments in respiratory hygiene which had lower adherence ($p = 0.041$). Figure 1 illustrates the overall adherence to each domain with maximum adherence to safe injection (97%) and sterilization (79%) and minimum adherence to sharps safety (46%) and hand hygiene (39%) guidelines.

Assessment of adherence to CDC checklist based on working shifts

Table 2 shows the mean score of infection control adherence to each CDC domain based on working shifts. No significant differences were observed between working shifts and adherence to standards in any domains of CDC checklist ($p > 0.05$).

Overall assessment of adherence to the MOH checklists

Over all adherences to MOH infection control guidelines were 88% for overall cleanliness, 95% for availability of equipment, 100% for safe disposal of needles and amalgam residues, 91% for disinfection and sterilization, and 95% for supervision by dental clinicians.

Overall assessment of adherence to the AFO checklists

Regarding AFO infection control guidelines, these values were 91% for CSR sterilization, 89% for sterilization of department items, 74% for environmental hygiene, 85% for personnel hygiene, and 83% for waste disposal.

Discussion

Infection control in dentistry is much more diverse than wearing a face mask and sterile gloves, and includes adherence to hygiene measures, allocation of budget for this purpose, extensive vaccination of the personnel, and provision of the required infrastructure [20] such as provision of autoclave and sterilization equipment, holding continuing education courses for dental clinicians and personnel, and constant monitoring and surveillance of dental offices and clinics by the experts [21]. This study aimed to assess the level of adherence of selected dental departments to three guidelines to find the shortcomings and address them. The majority of the departments had poor adherence to the CDC guidelines regarding hand hygiene (39%) and handling and disposal of sharp instruments (46%), and these two items were mainly responsible for lowering the total percentage of adherence to the CDC guidelines. Thus, the questions

Table 1: Mean percentage (%) of adherence to CDC infection control domains based on different specialties

CDC domains specialty	Hand hygiene	Personal protective equipment	Respiratory hygiene	Sharps safety	Safe injection practice	Sterilization and disinfection	Environmental infection prevention	Water quality
Restorative	42	72.4	74.8	47.6	97.4	78.8	70.3	85
Prosthodontics	38.6	73.4	68	46.1	100	77.4	69	85
Pedodontics	40.6	73.6	73.8	46.8	97.4	79.2	72.4	85
Endodontics	39.5	72.5	74.2	43.9	94.3	80.6	74	85
Oral surgery	39.8	74.2	75.4	44.2	100	79.1	72.2	85
Orthodontics	39	73.5	75.5	Not indicated	96.7	80.7	73.7	85
General dentistry	41.3	70	73.5	49.2	97.4	79.3	72.1	85

CDC: Center for disease control and prevention.

Table 2: Mean percentage (%) of adherence to CDC infection control domains based on working shifts

CDC domain working shifts	Hand hygiene	Personal protective equipment	Respiratory hygiene	Sharps safety	Safe injection practice	Sterilization and disinfection	Environmental infection prevention	Water quality
Early in the morning	39.1	74.8	75.5	45.2	95.7	78.9	73.8	85
End of the morning	39.2	70.2	72.4	46.2	96.3	81.6	70.6	85
Middle of the evening	40.5	73.4	73	47.5	100	77.4	71.3	85

of the checklist regarding these two items were reviewed again, and it was revealed that the majority of the visited departments acquired very low scores in the following items: (I) washing hands before and after treatment of each patient, (II) washing hands before and after wearing sterile gloves, (III) hand scrubbing before surgical procedures, (IV) using the Scoop technique for needle recapping, and (V) removing the bur from the handpiece before removing the handpiece. The results of the present study were generally in line with the findings of similar studies. For instance, not using the correct recapping technique increases the risk of needle stick injuries. Al Qadire *et al.* [22] showed that the knowledge score of dental students regarding the needle stick injuries and how to prevent them was 6 out of 10. They reported the occurrence of needle stick injuries during preparation for anesthesia administration in 70% of those who experienced such injuries. Similar to the present study, incorrect needle recapping was the most common reason for needle stick injuries. A multi-center study conducted in Italy revealed that sharp instrument injuries most commonly occurred during preparation for anesthesia administration, and needle recapping or its disposal. Moreover, the frequency of such injuries was significantly higher in novice dental clinicians [23]. Regarding poor hand hygiene, a recent meta-analysis conducted in Brazil in 2019 reported results similar to the present findings. It was reported that adherence of dental students to hand hygiene guidelines was below 50%, which makes infection control a serious challenge [24]. Another meta-analysis conducted in 2018 evaluated the attitude, knowledge, and practice of medical and nursing students regarding hand hygiene, and concluded that the knowledge and practice of the healthcare workers in this regard were poor to moderate, and they acquired a lower than optimal score. To solve this problem, they explained that continuous monitoring by the health inspectors and head nurses is imperative [25]. Developing different strategies like hand hygiene campaigns are a method to encourage healthcare workers and improve their compliance. Pada *et al.* reported that hand hygiene accountability model increased compliance from 65% to 78% and reduced bacteremia from 5 episodes to none during their study in community hospitals [26].

In the present study, the majority of the evaluated clinics acquired a good score regarding sterilization (79%) and safe injection (97%), which was a strength. A similar study regarding the knowledge and practice of dental nurses with regard to sterilization reported results in line with the present findings. They added that approximately 75% of dental nurses working in teaching hospitals had acceptable performance in

this regard. This rate was even higher in the private sector [27]. It should be noted that the COVID-19 pandemic and the emphasis placed on wearing a face mask and adherence to infection control protocols may be responsible for acquiring a full score in items related to wearing a face mask in all clinics. A different result might have been obtained if the assessment had been performed in a different period of time [28]. A study conducted in Saudi Arabia showed that prior to the COVID-19 pandemic, dental clinicians had a poorer performance by 1.4 times regarding hand hygiene and use of protective goggles compared with after the emergence of COVID-19 pandemic [29]. Nonetheless, high adherence to the checklists was noted with regard to the use of sterile gloves for each patient, not washing the gloves, not using perforated or used gloves, changing the disposables contaminated with blood and saliva, and changing the burs and hand instruments. The same results were reported in university clinics, which is a strength point for such clinics [30]. Mutter *et al.* evaluated several public clinics affiliated to dental schools, and reported that 100% of dental clinicians wore a face mask and sterile gloves, and 85% of them changed their gloves between patients. Furthermore, in case of observing clear contamination, all dental clinicians replaced the contaminated items with new items. However, they reported poor adherence to guidelines regarding hand hygiene, needle recapping, and use of rubber dam [31]. The dental departments in our study were visited in three working shifts on different days with different specialties to control for the effect of fatigue and nature of the practice of dental clinicians and personnel on their adherence to the guidelines and it was shown that neither working shifts nor specialties had a clinically significant effect on infection control measurements. No similar studies have evaluated this possible relationship in dental departments but Verma *et al.* showed that fatigue in nurses with rotating night shifts can bring higher odds of needle stick injury [32]. The role of fatigue in infection control of hospitals has also been investigated in Huang study and it was suggested that a randomized real-time reminder setting may be a potential solution in reducing user fatigue and enhancing hand hygiene [33].

Despite the low score of departments in some items in the CDC checklist, the same departments acquired an acceptable score in MOH and AFO checklists, which highlights the difference among the three checklists. For example, the MOH checklist does not pay attention to details regarding the need for hand scrubbing, coughing protocol, quality of dental unit water, details of sterilization process, and details of using personal protective equipment such

as sterile gloves, face mask, and medical gown, and only asks general questions. Lack of details in the MOH checklist, and extensive attention to details in the CDC checklist may explain the difference in the acquired scores by the departments in these two checklists. To more comprehensively address the differences, the shortcomings of each checklist are discussed. The national checklists have shortcomings such as (I) difficult access, (II) lack of referencing and supporting evidence, (III) unclear scoring scale of each question, (IV) combining hygiene protocols with items such as equipment, software systems, human resources, and systematic assessment of services, (V) not being procedure-based, and not offering any strategy for monitoring, (VI) unfamiliarity of some clinics with the checklist, and the checklist not being officially conveyed to those in charge of supervision of clinics, (VII) not mentioning the details, and timing of hand washing in the clinics, (VIII) no specific question regarding correct needle recapping and safe injection, and (IX) lack of a specific item regarding the infection control of radiographic sensors. The CDC checklist also has some shortcomings as follows: (I) Not paying attention to the significance of adherence to strict measures such as hand scrubbing in each surgical procedure, (II) not paying attention to correct disposal of amalgam residues, and differentiating different types of wastes in trash cans of different colors, (III) too many questions regarding anesthesia induction and operating rooms which are not applicable to most dental clinics, (IV) not paying attention to cleaning of surfaces such as floors, walls, and doors in clinics, (V) not offering any strategy for surveillance and supervision of implementation of infection control measures, and (VI) the possibility of overestimation in assessment of the efficacy of each item. Thus, compilation of a more comprehensive guideline without the aforementioned shortcomings is recommended by the authorities and experts in the field. This study had several strengths. Not only the most common infection control guidelines were included, but also a scoring system was designed for the CDC checklist, which helped in better understanding and interpretation of results. Difficulty in direct observation of the performance of dental clinicians and personnel without informing them about the project, the possibility of performance bias, the subjectivity of scoring due to the presence of only one observer, and the possibility of missing data in other parts of the departments in large clinics due to the presence of only one observer were among the limitations of this study.

Conclusion

Hand hygiene and safe handling and disposal of sharp instruments were the most common items in which, dental clinics acquired a low score. Maximum

adherence to the guidelines was found with regard to sterilization and safe injection protocols. The mean score acquired in the three checklists was different such that the mean score of CDC checklist was lower than that of MOH and AFO checklists. There was no relationship between working shifts and dental specialties regarding the adherence to infection control standards.

Acknowledgments

The authors want to thank Dr Mojdeh Kalantar Motamed for the native translation of this article.

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