



Effectiveness Of A Web-Based Learning Module On The Knowledge Of Dental Interns In Regard To Infection Control During Covid-19 Pandemic – A Before And After Study

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Type of Publication: Original Research Paper

Conflicts of Interest: Nil

Abstract

Aim: To test the efficacy of a Web based learning module on the knowledge of Dental Interns of Udaipur city, regarding infection control protocols in times of COVID 19 Pandemic

Materials and methods: A before and after experimental study was conducted among the dental interns of Udaipur city. A 25 itemed structured questionnaire was developed based on the study objectives. Questionnaires were filled initially, then an online learning module was conducted and after the training session, questionnaires were filled again. Knowledge scores at baseline and follow up intervals were evaluated.

Results: The mean difference in baseline and follow up scores for males was 9.91 ± 0.376 whereas for females it was 11.5 ± 0.208 . A statistically significant upgradation in knowledge scores was observed for all study participants ($p=0.000$).

Conclusion: In this study, it was found out that the intervention in the form of online learning module led to significant increase in the knowledge of dental interns regarding infection control in the times of COVID 19. The results also suggested that online technologies have many benefits to offer for teaching and learning of dental students.

Clinical significance: The results of this study suggest that e learning technologies have to be developed elaborately in the field of dentistry for imparting knowledge and the practical knowledge of these protocols will reduce the risk of disease transmission among dentists as well as patients.

Keywords: Infection control, Knowledge, Dental student, COVID-19.

Introduction:

Health care systems all over the world are facing many problems pertaining to public health and growing infectious diseases are one of them. Many reasons could be cited for these including globalization, climate change, ecosystem disturbances, poverty, migration, war, bioterrorism etc. We are living in a time where we can clearly see that infectious diseases are on a rise. A recent example of such a global pandemic is SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2), which was first identified amid an outbreak of

respiratory illness cases in Wuhan city, China. On March 11, 2020, WHO declared COVID 19 as global pandemic¹. Since it has been declared as a pandemic, it has become a serious public health problem challenging multiple countries across the globe and emergency of international concern.

COVID 19 has extensively affected our day-to-day life. Faced with the new realities of working from home, temporary unemployment, home schooling of children and lack of physical contact with other family members, friends and colleagues have aggravated emotions of fear, stress and worry,

thereby deteriorating physical and mental health. This pandemic has not even spared the disciple of dentistry. Hence, it's important for dental health care providers to acquaint themselves with the infection control guidelines to be pursued in this present scenario for rendering quality dental care.

The major transmission routes of COVID 19 include close physical contact, blood borne transmission, fomites, respiratory droplets and aerosols. Different dental procedures generate aerosols in different amounts. Aerosols are smaller in diameter compared to the respiratory droplets, they remain suspended in the air for a longer period of time and may travel long distances thereby resulting in infection through inhalation in both close proximity and long distances. The asymptomatic patients can also transmit COVID 19.

Cross infection is defined as the transmission of infectious agents between patients and the health care providers in a clinical setting². Due to the characteristics of dental settings, the risk of cross infection is very high among dental health care providers. Study conducted by Smales & Samaranyake (2003)³ reported that whenever new infectious diseases emerge, infection control protocols within the dental office are modified accordingly. Study conducted by Meng et al (2020)⁴ showed that adopting infection control precautions have been effective in preventing new infections with SARS-CoV-2, when providing emergency dental care in China. Since the dental health providers are at a high risk of exposure to COVID 19, adhering strictly to safety precautions and implementing the guidelines issued by CDC (Centre for Disease Control and Prevention)⁵ can prevent such misfortunes from happening. Complying with infection control guidelines will not only be of help to health care providers but will also provide a safe working environment for dental auxiliary staff and patients. Since the dental students are in their learning phase and do not have much exposure to clinical practice, so it's very important to familiarize them with the infection control protocols as they are going to be the future -bearers of the profession of dentistry.

For imbibing these protocols, dental colleges play a pivotal role. Strictly adhering to these infection control protocols, using of personal protective

equipment, limiting the use of aerosol generating procedures, prioritizing the use of minimally invasive dentistry, preprocedural mouth wash rinses, disinfection of dental clinics and proper biomedical waste management can all go a long way in the prevention of transmission of this deadly disease through dental health care settings. Proper dental education can play a key role in broadening the vision of dental students regarding infection control protocols and can help them to acclimate themselves in times of this COVID 19 pandemic. Hence the purpose of this study was to assess the change in the knowledge among the dental interns of Udaipur city, Rajasthan, India, after delivering an online learning module on infection control protocols in times of this COVID 19 pandemic.

Materials & Methods:

- 1) **Study Design, Study Population & Study Area** – A before and after experimental study was conducted among the dental interns.
- 2) **Ethical Clearance & Official Permission** – The study protocol was reviewed by the ethical committee and was granted ethical clearance. An official permission was taken before conducting the study.
- 3) **Informed Consent** – Study participants were informed thoroughly about the purpose and procedure of the study and Informed voluntary consent (online consent) was obtained prior to the study.
- 4) **Inclusion Criteria** –
 - 1) Dental Interns who had not attended any such web-based learning module on infection control in dental practice in times of COVID 19 pandemic in the past.
 - 2) All those who were willing to participate in the study.
 - 3) All those who had given consent.
- 5) **Exclusion Criteria** –
 - 1) Those who were not willing to participate in the study.
- 6) **Questionnaire Details** -

A 25 itemed structured questionnaire was developed based on our study objective. The

questionnaire had 2 sections. The first section consisted of general information of the study participants like name, email id and gender. The second set of questionnaire consisted of questions related to the infection control guidelines for the dental settings during this prevailing COVID 19 pandemic. These guidelines were issued by CDC (Centre for disease control and prevention) on June 17, 2020.

7) Pre-Testing –

The assessment of the content validity of the questionnaire was related to the opinions expressed by a group of five academicians. Mean content validity ratio (CVR) was calculated as 0.8. Face validity was assessed by administering the online survey form to six subjects who were asked to rate the survey form on a Likert's scale. Chi- square test was applied and it was found that 90% of the participants found the questionnaire to be easy ($p < 0.05$). Internal validity was also assessed using Cronbach's alpha which was found to be satisfactory (0.84). The questionnaire was further pretested to assess its feasibility and reliability which was found to be satisfactory. All the necessary changes were included in the main study.

8) Sample Size Calculation-

Appropriate sample size was calculated using G power software and the calculation determined that at least 65 participants were needed to provide 80% statistical power with alpha set as 0.05.

9) Methodology –

A list of dental colleges of was obtained. Out of total 5 dental colleges, one dental college was randomly selected. All the interns of the college were included in the study. Based on the inclusion and exclusion criteria, total 85 intern students were recruited for the study.

The study was conducted in 3 phases – the Preparatory phase, the Implementation phase and the Evaluation phase.

1) Preparatory phase - A WhatsApp group was made and all the study participants were added in that group. Sensitization of the study participants regarding the research study was done through the WhatsApp group.

2) Implementation phase – During this phase, the online questionnaire was posted in the WhatsApp group, and the study participants were asked to fill it carefully. After all the responses were obtained, an online learning module was organized for them. A power point presentation was delivered through Cisco Webex Meetings app. The session included detailed information about all the infection control guidelines that were issued by CDC (*the transmission routes of COVID 19, it's signs and symptoms, concept of triage and precautions to be followed by triage personnel, hand hygiene instructions, precautions to be followed during aerosol generating procedures, importance of PPE, proper sequence of donning and doffing of PPE kit, focusing on the limited reuse of N95 Respirators during pandemic for their optimization*). After the training session of the study participants, same questionnaire was again given to the study participants and they were asked to fill it and the follow up responses were collected.

3) Evaluation phase – The data was coded and entered into Microsoft Excel Spreadsheet. Each correct response was coded 1, and all the incorrect responses were coded as 0. A total knowledge score was obtained for each study participant. Data analysis was done using SPSS version 25 software. Descriptive statistics were calculated. McNemar's test was employed to assess the change in frequency of correct responses from baseline to follow up. Repeated measures 2 -way ANCOVA Test served to assess the statistical significance of mean differences in knowledge scores before and after the module according to the gender of study participants with academic performance as covariate. Paired and unpaired t test were used to compare the knowledge scores at baseline and follow up intervals for the study participants. Confidence level and level of significance were fixed at 95% and 5% respectively.

Results:

A before and after intervention study was conducted to assess the impact of online learning module on the

dental interns. A total of 85 dental students were educated in reference to the infection control protocols to be followed in dental practice in times of COVID 19 pandemic. The baseline and follow up knowledge were assessed using a Google Form. The data was then analyzed to measure the effect.

The demographic distribution of the dental intern students who had participated in the study. Total of 85 dental intern students were included in the study. Out of them, 26.3% were males with a mean age of 21.91 ± 0.971 years and 73.7% were females with mean age of 21.92 ± 0.946 years, the mean age of all the study participants being 21.92 ± 0.947 years. (Table 1)

The comparative assessment of the baseline and follow up online learning module knowledge of dental interns. When the proportion of correct responses were assessed, statistically significant increase was observed from baseline to follow up assessments. Before the learning module, only 53.6% of the dental interns knew about the possible transmission routes of SARS-CoV-2, post training evaluation revealed that then the number increased to 75.0% ($p = 0.012$). Before the module, around 51.2% of the dental intern students knew the correct possible symptoms of SARS-CoV-2, but after the module, 79.8% of the intern students were aware about the possible transmission symptoms of SARS-CoV-2 ($p = 0.001$). The difference in the answers of both these questions was statistically significant. Only 17.9% of the study participants were vigilant about the fact that dental care can be provided with appropriate protocols to a patient having fever due to dental infection, but no other symptoms of SARS-CoV-2. However, post online learning module knowledge assessment suggested that 83.3% of the study participants became aware of this fact ($p = 0.001$). Before the online training, only 19% of the study participants knew how to reduce the level of microorganisms in aerosols generated during dental procedures, but after the online learning module, 82% of the study participants knew the answer ($p = 0.000$). The concept of properly maintained ventilation systems in dental clinics was known by only 13.1% of the study subjects before the online learning module, while after the module 77.4% of the study participants came to know about it ($p = 0.001$).

Baseline evaluation of knowledge concerning how the dental chair with all the auxiliary parts should be disinfected revealed that only 17.9% of the study participants knew the correct response, while after the online training 78.6% of the study participants came to know about it. Only 25.0% and 27.4% of the study participants gave correct responses to the questions enquiring about the proper sequence of donning & doffing of PPE, however post training results showed a statistically significant ($p= 0.001$) rise in the responses by the participants of up to 81.0% and 79.8% respectively. (Table 2)

The gender wise comparative assessment of the mean differences of the knowledge scores at baseline and follow up intervals. The mean difference in baseline and follow up scores for males was 9.91 ± 0.376 whereas for females it was 11.5 ± 0.208 . This gender-based comparison clearly depicts that females showed a much greater overall increase in knowledge compared to males [Main effect of gender ($p=0.000$)]. Also, the main effect of intervention showed significant improvement in knowledge scores post module ($p=0.000$). The mean knowledge scores increased significantly [Interaction effect of gender and intervention ($p=0.039$)] from baseline to follow up interval according to the gender of study participants (time*gender) (Table 3)

The comparative assessment of the mean difference of knowledge scores at baseline and follow up intervals for males, females and the all the study subjects. The mean difference in baseline and follow up scores for males was 9.91 ± 0.376 whereas for females it was 11.5 ± 0.208 . A statistically significant upgradation in knowledge scores was observed for males, females and all study participants ($p=0.000$) (Table 3a)

Discussion:

Dental settings are a potential source of COVID 19 infection, due to the high rate of aerosols generated during various dental procedures. A comprehensive knowledge regarding infection control in dental practice in times of this COVID 19 pandemic is mandatory for both the dental students and professionals. If competent and sufficient precautions are not taken, chances of cross contamination will be exponentially high. It's time that the dental students understand infection control protocols and follow them very diligently to save their lives as well as the

lives of their patients. Dental students are very much in their learning phase with not much exposure to clinical settings, so it becomes very crucial to empower them extensively with the relevant knowledge of the disease and how to prevent its transmission.

This pandemic has forced the modality of online learning or e - learning to develop unanticipatedly. Various online learning platforms have been able to effectively deliver knowledge to students just a click away. Social networking apps available these days for all mobile devices, tablets and laptops, enable the teachers to reach their students anywhere at any time. A study stated that technical, educational and instructional advantages of teaching learning activity via WhatsApp far outweigh its disadvantages⁶.

The aim of this study was to educate Dental intern students regarding infection control protocols in times of this pandemic. The most important target of intervention strategies is the alteration of personal behavior from health damaging to health promotion. This before and after intervention study was conducted in the form of online learning module. Studies have revealed that majority of the study participants feel that pretests help them to ameliorate their learning ability and focus towards didactic lecture and aids in improved performance. A possible explanation could be that pretests help one to understand their incapacibilities. Thus, pretests help to increase the level of attentiveness and eagerness among the students helping them acquire new knowledge more effectively. This finding is in agreement with the studies conducted earlier.^{7,8}

The sample population of dental interns was chosen intentionally to impart education to them regarding infection control protocols. These basics should be taught to the undergraduate dental students as they are in their learning phase and can imbibe the knowledge very efficiently thereby educating and empowering them. This sample population chosen was similar to a study conducted already.⁹ Their study population included the undergraduate students from first year to interns as they felt that knowledge pertaining to COVID 19 is a generalized epidemic related topic and this was a very good opportunity for the undergraduates and interns to expand their horizons and get deep insight into infection control protocols.

The distribution of study population according to gender revealed that 73.7% of the study population were females while only 26.3% of them were males. Study conducted earlier has also supported our finding that females were predominant in the sample population¹⁰, which might be explained that number of female dentists in Jordan is higher than the number of male dentists based on the latest Jordan Dental Association Statistics¹¹.

Our study revealed that around half of the study participants were aware about the possible routes and possible symptoms of COVID 19, but after the online learning module on infection control the knowledge increased significantly to 75% and 79.8% respectively. The findings of our study are in accordance with the study conducted before¹², which has showed that some notable deficiencies in knowledge existed among the dental professionals.

Only about one-fourth of the study population had knowledge regarding the proper sequence of donning and doffing of Personal protective equipment kit (PPE). This shows a dearth of knowledge. Our results are in accordance with the study results, these studies have also reported a glitch in the level of knowledge among dental students in regard to the infection control measures^{13,14}

Results of our study have concluded that the baseline and follow up mean knowledge scores vary i.e., there is an increase in the follow up knowledge of the dental intern students. So, we can say that the online learning module proved to be effective. Our results are in accordance with the study conducted.^{15,16} This upgradation in knowledge was assessed by pre- and post-questionaries.

In our study it was seen that there is significant relationship between gender and mean scores of knowledge. Gender based comparison of pre- and post-training scores of school staff showed an overall significant improvement in knowledge in the study conducted already.¹⁷ Various study results have revealed that pretests were thought to improve the performance of study participants by helping them realizing their short comings and improving their focus towards the knowledge delivered with the aim of learning the unknown things and facts.

The main purpose of education is to enhance the potential of the students. Our online learning module

was successful enough to fulfil its objective and was an acceptable tool. However, on assessing the baseline knowledge scores, we cannot deny the fact that knowledge in regard to infection control measures in dentistry is not integrated successfully into the curriculum of undergraduate dental learning. So rigid amendments need to be made in order to sustain the field of dentistry in times of pandemic like this.

Conclusion:

In this study, it was found out that the intervention in the form of online learning module led to significant increase in the knowledge of dental interns regarding infection control in the times of COVID 19. The results also suggested that online technologies have many benefits to offer to dental students. Hence, it is recommended that infection control practices to be elaborately inculcated in the dental curriculum with practical application to reduce the risk of disease transmission among the doctors as well as among the patients.

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Tables:

Table 1: Distribution of study participants according to gender

Gender	Frequency (%)	Age (years)
		(Mean ± SD)
Male	23 (26.3)	21.91 ± 0.971
Female	62 (73.7)	21.92 ± 0.946
Total	85 (100)	21.92 ± 0.947

SD = Standard Deviation

Table 2: Comparative assessment of proportion of correct responses at baseline and follow up intervals among the study participants

Questions	Correct responses		p – value
	Baseline	Follow up	
	N (%)	N (%)	
1. Possible transmission routes of SARS-COV-2 are	45 (53.6)	63 (75.0)	0.012*
2. Possible symptoms of SARS-COV-2 are	43 (51.2)	67 (79.8)	0.001*
3. SARS- COV-2 infected persons without symptoms can also infect others	47 (56.0)	72 (85.7)	0.000*
4. Which among the following are larger in diameter	32 (38.1)	70 (83.3)	0.000*
5. First step in dental patient management during COVID 19 pandemic include	54 (64.3)	69 (82.1)	0.018*
6. History of the patients to be recorded should be	49 (58.3)	69 (82.1)	0.002*
7. If a patient has fever due to underlying dental infections but no other symptoms of SARS-COV-2, can dental care be provided with appropriate protocols	15 (17.9)	70 (83.3)	0.000*
8. Alcohol based hand rub (ABHR) should have an alcohol content of	48 (57.1)	67 (79.8)	0.001*
9. What is triage	55 (65.5)	73 (86.9)	0.004*
10. What precautions should be taken by triage personnel	48 (57.1)	72 (85.7)	0.001*
11. Waiting area amendments during COVID 19 pandemic includes	29 (34.5)	71 (84.5)	0.001*

12. Which of the below mentioned should be prioritized in dental clinics during COVID 19 pandemic	14 (16.7)	63 (75.0)	0.001*
13. To reduce the level of microorganisms in aerosols generated during dental procedures, we should	16 (19.0)	69 (82.1)	0.000*
14. Dental chair with all the auxiliary parts within 3 feet distance should be disinfected using	15 (17.9)	66 (78.6)	0.000*
15. Properly maintained ventilation systems in dental clinics provide air movement in a	11 (13.1)	65 (77.4)	0.001*
16. What is CADR in an air filtration unit	62 (73.8)	75 (89.3)	0.000*
17. Specialized clothing worn by the employee for protection against infectious materials is called as	34 (40.5)	72 (85.7)	0.001*
18. All of the following are true regarding PPE, except	30 (35.7)	73 (86.9)	0.001*
19. PPE should be matched to the potential mode of viral transmission. Do you agree?	50 (59.5)	68 (81.0)	0.192
20. What are the components of PPE kit to be worn during aerosol generating procedures?	19 (22.6)	65 (77.4)	0.000*
21. What is the proper sequence of donning PPE	21 (25.0)	68 (81.0)	0.000*
22. What is the proper sequence of doffing PPE	23 (27.4)	67 (79.8)	0.001*
23. What is the recommended time of hand rubbing with sanitizer	29 (34.5)	71 (84.5)	0.000*
24. What has been widely used as an option for conserving respirators during pandemics	20 (23.8)	74 (88.1)	0.001*
25. N95 respirators must only be worn by a single wearer	54 (64.3)	71 (84.5)	0.003*

Test applied – McNemar’s test, * Statistically Significant

Table 3: Comparative assessment of the knowledge scores at baseline and follow up intervals according to gender

Knowledge scores	Gender (Mean ± SD)		p value
	Male	Female	
Baseline	10.56±2.539	9.45±1.896	Main effect (Intervention)
Follow up	20.47±2.163	20.95±2.104	0.000*
p-value	Main effect (Gender)		Interaction effect
	0.000*		0.039*

Test applied – Repeated Measures 2-way ANCOVA (Analysis of Covariance), * Statistically Significant, SD = Standard Deviation

Covariate: Academic performance

Table 3(A) – Comparative assessment of the mean difference of knowledge scores at baseline and follow up intervals for males and females.

Gender	Mean difference (Mean ± SD)	p value
Male	9.91±0.376	0.000*
Female	11.5±0.208	0.000*
Total	21.41 ± 3.786	0.000*

Test applied – Paired t test, * Statistically Significant, SD = Standard Deviation