

## A radical change in the dental education model in the COVID-19 pandemic



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### ABSTRACT

The present cross-sectional, observational study was done to assess the new norms of dental education, its effect on the students, and awareness in the post-COVID-19 era. Every question had 2 options- after complete lockdown and after partial lockdown. A higher percentage of the students believed that quarantine during the lockdown enhanced their collaboration with their fellow students. 60.7 % of the students during the complete lockdown and 76.9% during the partial lockdown, felt more motivated by the distant technology-dependent model of education. Students during the complete lockdown (69.20%) and partial lockdown (69.50%) felt that online group discussion and discussion of clinical-based case scenarios had an enhancing effect on their learning. Dental students (67%) in the complete lockdown and 75.70% in the partial lockdown felt comfortable with the e-learning. During the complete lockdown, 57.9% of the subjects were not confident in the clinical skills acquired, whereas during the partial lockdown only 38.2% were not confident in the clinical skills acquired. Mean scores for dental education, clinical readiness, and self-preparedness were higher after the partial lockdown as compared to the complete lockdown. However, the self-preparedness was more after the partial lockdown as compared to the complete lockdown. Dental colleges have to deal with e-learning methods being developed all of a sudden due to the pandemic. However, there are still problems with online learning and teaching that can be improved with the help of a supportive administration and tutors recording of learning videos as well as proper training of the staff and students.

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### 1. Introduction

The COVID-19 pandemic has led to institutions taking important measures regarding ongoing education. During this pandemic, e-learning had ensured that we can continue with our education and that students do not lose their precious time. E-learning has changed the ways in which dental students take their classes. Colleges are conducting e-learning while conducting clinical sessions under strict protective protocols ([Hattar et al., 2021](#)).

Students who previously did traditional classes faced a new challenge in e-learning ([Oraif and Elyas, 2021](#)). The learning system by electronic resources is called e-learning. Use of computers and internet is the main part of e-learning. The traditional classroom teaching method has been replaced by e-learning to avoid the spread of COVID by educational institutions ([Maatuk et al., 2022](#)). Dental education is based on Problem Based Learning (PBL) that is taken by lectures which is easily replaced by ZOOM, Google meet etc. The other method is by simulation lab course wherein after a demo given by the teacher, student would practice in the simulation models and this part can be done by using modern digital methods. But the procedure as well as the final work needs to be checked step by step by the teachers. Along with this, clinical patient training has been the most difficult part of dental training and education in this pandemic ([Chang et al., 2021](#)).

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Lockdowns and less patients and in clinics were the challenges faced. The problems further included loss in revenue sources in private clinics and collapse of research programs that caused problems for students and faculty (Alzahrani et al., 2020). During the COVID-19 pandemic, most of the colleges switched to online teaching. Experience that we have got in the past year has allowed us to make modifications in our dental institutions (Fernández and Rivas, 2020).

## 2. Research methodology

This survey was conducted to investigate the new norms of dental education, its effect on the students, and awareness in the post-COVID-19 era. This survey was only for academic purposes and the personal identity was kept confidential. The data was collected from November 2021 to February 2022.

### 2.1. Sample of the study

Dental students across Saudi Arabia were selected by random sampling as a sample for this study. Students aged 18-25 years, who gave consent for the questionnaire were included and those who did not give consent were excluded. 497 students from different areas of Saudi Arabia were selected as samples for this study.

### 2.2. Data collection

To understand the design of online teaching activities among teachers at all levels, online questionnaires were adopted in this study to investigate. This was an observational and cross-sectional study done in Saudi Arabia using a questionnaire with the consent form attached to it. Every question had 2 options- After the complete lockdown- when the complete education was online, from March 2020 to May 2020. After partial lockdown- when partly education was online (Lectures, Theoretical Assignments) and partly offline (conducting practical and clinical sessions and assignments with maintaining social distancing and following proper COVID protocols), from September 2020 to February 2022. The responses between both groups were compared and analyzed.

## 3. Results

Table 1 shows the intergroup comparison of dental education between wave-1 (complete lockdown) and wave-2 (partial lockdown). During the first wave, in complete lockdown, most of the students, agreed to the fact, that they missed educational experiences as a result of the lockdown. During the second and third wave (partial lockdown), the majority of the students disagree with the fact that they did miss the education experience as a result of the lockdown. During both

the partial and complete lockdown, more than half of the students felt that online assessment is a good method for evaluation. The majority believed that the quarantine increased their collaboration with their colleagues both during the complete and partial lockdown. Similarly, 60.7 % of the students during the complete lockdown and 76.9% during the partial lockdown, felt motivated to following-up with distant e-learning during the complete lockdown. During the first wave, majority of the subjects (59.50%) disagree that online lectures are better as compared to face to offline/face theatre lectures. During the partial lockdown (76.30%) agree that online lectures are better as compared to face to offline/face theatre lectures. Similarly higher percentage of the students during the complete lockdown (69.20%) and partial lockdown (69.50%) felt that group discussion by e-learning of clinical case scenarios, had a positive value on their education. A significant number of dental students (67%) in the first wave (complete lockdown) and 75.70% of the subjects in the partial lockdown felt comfortable with the technology-based education.

Table 2 shows the intergroup comparison of clinical readiness between wave-1 (complete lockdown) and wave-2 (partial lockdown). During the first complete lockdown, 57.9% of the subjects were not confident in the clinical skills acquired during the COVID duration whereas during the second partial lockdown only 38.2% were not confident in the clinical skills acquired during the COVID duration. After the first complete lockdown, 40 percent of the study subjects preferred to be indirectly supervised following their graduation or following the completion of the level. After the partial lockdown, only 33.9 percent of the subjects preferred to be mentored or indirectly supervised after their graduation or following the completion of their level.

After the complete lockdown, around half of the students were not confident in starting an independent practice after graduation or doing patients independently at the next level. Whereas after the partial lockdown, around one-third were not confident enough. After the complete and partial lockdown (45 percent and 43 percent) of the study subjects preferred extra hours of clinical training, post-completion of their course. 43.9% of the subjects after complete lockdown did not understand the practical sessions and were non-confident in carrying out the pre-clinical work by themselves. However, after the partial lockdown, only 25.9 did not understand the practical sessions and were not confident in carrying out the pre-clinical work by themselves.

Table 3 shows the intergroup comparison of self-perceived preparedness between wave-1 (complete lockdown) and wave-2 (partial lockdown). Most of the students showed preparedness related to the majority of attributes and professional skills such as evidence-based knowledge and clinical practice, managing patient expectations, referring patients with complex treatment needs, maintaining accurate

records, continuing professional development, protecting patient confidentiality, patient communication, and informed consent. However, the self-preparedness was more after the partial lockdown as compared to the complete lockdown, and the difference between the groups was statistically significant when analyzed using the chi-square test.

An Intergroup comparison of mean scores between the groups is shown in Table 4. The mean scores for dental education, clinical readiness, and self-preparedness were higher after the partial lockdown as compared to the complete lockdown however the difference was statistically significant only for the dental education and self-preparedness.

**Table 1:** Intergroup comparison of dental education between wave-1 (complete lockdown) and wave-2 (partial lockdown)

		Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree	Chi-Square value	P value
Did you miss educational experience?	Complete lockdown	95 19.1%	50 10.1%	50 10.1%	253 50.9%	49 9.9%	281.31	0.001 (Sig)
	Partial lockdown	123 24.7%	253 50.8%	44 8.8%	50 10.0%	28 5.6%		
	Lockdown	85 17.1%	73 14.7%	27 5.4%	201 40.4%	111 22.3%		
Is online assessment a good method for evaluation	Complete lockdown	85 17.1%	73 14.7%	27 5.4%	201 40.4%	111 22.3%	107.61	0.001 (Sig)
	Partial lockdown	42 8.4%	88 17.7%	51 10.2%	89 17.9%	228 45.8%		
	Lockdown	17 3.4%	33 6.6%	92 18.5%	158 31.8%	197 39.6%		
Did quarantine increase your collaboration with your colleagues?	Complete lockdown	55 11.1%	71 14.3%	69 13.9%	115 23.1%	187 37.6%	39.590	0.001 (Sig)
	Partial lockdown	15 3.0%	43 8.6%	57 11.4%	125 25.1%	258 51.8%		
	Lockdown	98 19.7%	198 39.8%	52 10.5%	53 10.7%	96 19.3%		
Did you feel more engaged in e-learning?	Complete lockdown	39 7.8%	28 5.6%	51 10.2%	114 22.9%	266 53.4%	255.41	0.001 (Sig)
	Partial lockdown	39 7.8%	28 5.6%	51 10.2%	114 22.9%	266 53.4%		
	Lockdown	48 9.7%	52 10.5%	53 10.7%	149 30.0%	195 39.2%		
Did the group discussion by e-learning of clinical cases and scenarios had a positive effect on your education?	Complete lockdown	29 5.8%	51 10.2%	72 14.5%	98 19.7%	248 49.8%	24.455	0.001 (Sig)
	Partial lockdown	29 5.8%	51 10.2%	72 14.5%	98 19.7%	248 49.8%		
	Lockdown	65 13.1%	50 10.1%	49 9.9%	155 31.2%	178 35.8%		
Do you feel comfortable with all this technology-based education?	Complete lockdown	52 10.4%	38 7.6%	31 6.2%	113 22.7%	264 53.0%	30.445	0.001 (Sig)
	Partial lockdown	52 10.4%	38 7.6%	31 6.2%	113 22.7%	264 53.0%		
	Lockdown	52 10.4%	38 7.6%	31 6.2%	113 22.7%	264 53.0%		

**Table 2:** Intergroup comparison of clinical readiness between wave-1 (complete lockdown) and wave-2 (partial lockdown)

		No	Yes	Not Sure	Chi-Square value	P value
Do you have confidence in the clinical skills acquired during the COVID duration?	Complete lockdown	288 57.9%	140 28.2%	69 13.9%	39.127	0.001 (Sig)
	Partial lockdown	190 38.2%	210 42.2%	98 19.7%		
	Lockdown	189 37.8%	199 39.8%	109 21.9%		
Do you want to be supervised or mentored after your graduation?	Complete lockdown	189 37.8%	199 39.8%	109 21.9%	3.971	0.137 (Non-Sig)
	Partial lockdown	209 42.0%	169 33.9%	120 24.1%		
	Lockdown	247 49.7%	152 30.6%	98 19.7%		
Do you feel confident in starting an independent practice after graduation?	Complete lockdown	150 30.1%	239 48.0%	109 21.9%	43.641	0.001 (Sig)
	Partial lockdown	150 30.1%	239 48.0%	109 21.9%		
	Lockdown	150 30.1%	239 48.0%	109 21.9%		
Do you want to have extra hours of clinical training?	Complete lockdown	150 30.1%	239 48.0%	109 21.9%	1.642	0.440 (Sig)
	Partial lockdown	150 30.1%	239 48.0%	109 21.9%		
	Lockdown	150 30.1%	239 48.0%	109 21.9%		
Did you understand the practical sessions and were you confident in carrying out the pre-clinical work by yourself?	Complete lockdown	218 43.9%	246 49.5%	33 6.6%	113/61	0.001 (Sig)
	Partial lockdown	129 25.9%	205 41.2%	164 32.9%		
	Lockdown	129 25.9%	205 41.2%	164 32.9%		

#### 4. Discussion

Dental colleges, as well as hospitals, are potential sites for the spread of COVID (Bennardo et al., 2020). Hence the response to the pandemic in dental institutions has led the dental schools to conduct online lectures in the earlier phase of COVID followed by partly online lectures along with offline practical and clinical sessions in the latter wave of COVID (Taha et al., 2020). Training dentists in a time of pandemic has many challenges. The aim is to ensure good quality education with maximum possible safety of our students and staff which is not

easy. Dental schools have problems with premises and equipment by doing changes to the teaching methods by implementing important ways to protect our teaching and non-teaching staff, students as well as patients. Despite the limitations, students should adapt to the new ways of education and reality (Sajdłowski et al., 2021). Teachers are struggling to strictly follow social distancing, but virtual ways are used to continue teaching. Students are also having stress and anxiety that their clinical skills have suffered a lot during this pandemic (Hung et al., 2021).

**Table 3:** Intergroup comparison of self-perceived preparedness between wave-1 (complete lockdown) and wave-2 (partial lockdown)

		No Experience	Mostly	Always	Chi-Square value	P value
Can you evaluate the latest dental materials using the evidence-based approach?	Complete lockdown	49 9.9%	149 30.0%	299 60.2%	39.127	0.001 (Sig)
	Partial Lockdown	11 2.2%	89 17.9%	398 79.9%		
	Lockdown	52 10.5%	143 28.8%	302 60.8%		
Have you gained sufficient knowledge of scientific principles to support practice?	Complete lockdown	52 10.5%	143 28.8%	302 60.8%	3.971	0.137 (Non-Sig)
	Partial Lockdown	8 1.6%	103 20.7%	387 77.7%		
	Lockdown	88 17.7%	114 22.9%	295 59.4%		
Does the knowledge obtained reflect on your clinical practice and are you able to address the learning needs?	Complete lockdown	88 17.7%	114 22.9%	295 59.4%	43.641	0.001 (Sig)
	Partial Lockdown	18 3.6%	108 21.7%	372 74.7%		
	Lockdown	97 19.5%	158 31.8%	242 48.7%		
Can you manage patients' expectations for their treatment?	Complete lockdown	97 19.5%	158 31.8%	242 48.7%	1.642	0.440 (Sig)
	Partial Lockdown	31 6.2%	171 34.3%	296 59.4%		
	Lockdown	137 27.6%	146 29.4%	214 43.1%		
Are you able to diagnose and refer your patients with complex treatment needs?	Complete lockdown	137 27.6%	146 29.4%	214 43.1%	113/61	0.001 (Sig)
	Partial Lockdown	12 2.4%	169 33.9%	317 63.7%		
	Lockdown	53 10.7%	147 29.6%	297 59.8%		
Can you maintain accurate records of your clinical notes?	Complete lockdown	53 10.7%	147 29.6%	297 59.8%	129.31	0.001 (Sig)
	Partial Lockdown	6 1.2%	159 31.9%	333 66.9%		
	Lockdown	1 .2%	98 19.7%	398 80.1%		
Are you able to restrict your relations with your patients to a professional level?	Complete lockdown	1 .2%	98 19.7%	398 80.1%	39.967	0.001 (Sig)
	Partial Lockdown	0 .0%	91 18.3%	407 81.7%		
	Lockdown	12 2.4%	187 37.6%	298 60.0%		
Do you take responsibility for your continuing professional development?	Complete lockdown	12 2.4%	187 37.6%	298 60.0%	7.432	0.029 (Sig)
	Partial Lockdown	6 1.2%	156 31.3%	336 67.5%		
	Lockdown	2 .4%	149 30.0%	346 69.6%		
Can you take appropriate measures to protect patient confidentiality?	Complete lockdown	2 .4%	149 30.0%	346 69.6%	70.484	0.001 (Sig)
	Partial Lockdown	0 .0%	46 9.2%	452 90.8%		
	Lockdown	16 3.2%	118 23.7%	363 73.0%		
Can you communicate potential procedural risks to the patients?	Complete lockdown	16 3.2%	118 23.7%	363 73.0%	12.654	0.001 (Sig)
	Partial Lockdown	7 1.4%	83 16.7%	408 81.9%		
	Lockdown	1 .2%	131 26.4%	365 73.4%		
Can you obtain informed consent from your patients?	Complete lockdown	1 .2%	131 26.4%	365 73.4%	39.523	0.001 (Sig)
	Partial Lockdown	0 .0%	55 11.0%	443 89.0%		
	Lockdown	3 .6%	157 31.6%	337 67.8%		
Can you motivate your patients to maintain good oral/general health?	Complete lockdown	3 .6%	157 31.6%	337 67.8%	27.381	0.001 (Sig)
	Partial Lockdown	1 .2%	88 17.7%	409 82.1%		
	Lockdown	61 12.3%	189 38.0%	247 49.7%		
Are you aware of your legal responsibilities as a dentist?	Complete lockdown	61 12.3%	189 38.0%	247 49.7%	9.410	0.001 (Sig)
	Partial Lockdown	54 10.8%	149 29.9%	295 59.2%		
	Lockdown	181 36.4%	189 38.0%	127 25.6%		
Do you have complete knowledge and confidence in skills regarding my practical or pre-clinical exercises/ techniques at my level?	Complete lockdown	181 36.4%	189 38.0%	127 25.6%	198.50	0.001 (Sig)
	Partial Lockdown	10 2.0%	342 68.7%	146 29.3%		
	Lockdown	73 14.7%	281 56.5%	143 28.8%		
Do you have complete knowledge of all theoretical lectures at your level?	Complete lockdown	73 14.7%	281 56.5%	143 28.8%	57.151	0.001 (Sig)
	Partial Lockdown	38 7.6%	393 78.9%	67 13.5%		
	Lockdown					

**Table 4:** Intergroup comparison of mean scores between the groups

	GPS_	N	Mean	Std. Deviation	Std. Error Mean	P value
Dental education	Complete lockdown	498	24.35	8.930	.40020	0.001 (Sig)
	Partial Lockdown	498	25.79	8.318	.37278	
Clinical readiness	Complete lockdown	498	1.93	1.936	.08676	0.267 (Non-Sig)
	Partial Lockdown	498	2.08	2.169	.09723	
Self-perceived preparedness	Complete lockdown	498	21.95	8.55	.38352	0.001 (Sig)
	Partial Lockdown	498	24.76	5.991	.26850	

A higher score indicates good dental awareness and education

Since dentistry is based on lab practical and clinical practice, educational institutions should develop policies to protect students and staff and to ensure the continuity of education. In one study, Students' satisfaction with online education for theory and practical was investigated. A large number of students stated that practice should have been conducted. Many students said that online theory lectures are advantageous (Önoral and

Kurtulmus-Yilmaz, 2020). Farrokhi et al. (2021) did a scoping review that showed the main concern was that the courses had more lectures with less practical training along with a lack of student motivation (Farrokhi et al., 2021). In the present study, most of the students believed that online assessment is a good method for evaluation. The majority believed that the quarantine increased their collaboration with their colleagues.



In another study, students appreciated new methods. Previously, Hattar et al. (2021) reported that 78.7% of students said that the quarantine had increased their collaboration with fellow students. But less practical training was a problem (Varvara et al., 2021). Some authors said that there was a psychological effect among students as stress was high along with high anxiety. While learning through online theory lectures was low. But many students said that learning through online courses was neutral (Iosif et al., 2021). In one study, students had a good general knowledge of COVID and got the information from official sources; and want to have more lectures related to this infection to increase knowledge (Boukhobza et al., 2021). Some authors have demonstrated that Problem-based learning and case-based scenarios were good for teaching. The students had four classes every week. Protective measures used in clinical training were washing hands, wearing masks and gloves, and face shields along with protective clothing (Jiang et al., 2021). One case recommended training faculty using online methods and developing plans with decreased cognitive stress and increasing interactive sessions (Mukhtar et al., 2020). Dental institutions have successfully done online tests and assessments with the help of multiple choice questions, essay-type questions, and virtual case scenarios and used software like Turnitin for plagiarism detection. These methods are cost-effective and help students attend from different areas and distant locations (Alkadi, 2021). As per the results of our study, e-learning of clinical cases and scenarios had a positive effect on our students' education.

Dental colleges must implement measures in regard to the risk of infection during clinical sessions and should focus on minimizing aerosol generation unless an emergency creeps up. Students in dentistry are at higher risk as they work in the oral cavity by generating aerosols with their handpieces. Hence, screening of the patients should be done (Hassan and Amer, 2021). Dental colleges have to deal with e-learning methods being developed all of a sudden (Chavarría-Bolaños et al., 2020). However, there are still many limitations to online teaching and learning such as proper and supportive administration, the establishment of a proper internet network, and tutors recording of learning videos (Wu, 2021). Psychological anxiety and depression are commonly found in dental students and staff (Li et al., 2021). Dentists can enhance the quality of students' as well as patients' life (Bhardwaj et al., 2019). Awareness is important to control this anxiety. Dental institutions need to do psychological counseling for staff and students along with online consultations (Aldhuwayhi et al., 2021). This along with managing a patient's anxiety is important as it causes increased chairside treatment time for the dentist (Bhardwaj et al., 2021). Training of students is necessary along with maintaining the health of students, staff, and patients. And if necessary infection control measures are not taken then the clinics would be centers for the spread of this pandemic (Hajmohammadi and

Kamran, 2020). Personal protective equipment as well as N95 masks should always be donned by practitioners while in the colleges and clinics (Bhardwaj et al., 2020). Implementation of new technologies will help us to increase the level of education that will benefit our students (Hattar et al., 2021). Conduction of training and online seminars is important for staff to support e-learning along with proper maintenance of IT computers and internet equipment. Students, as well as staff, should get all information via the university's intranet (Sahu, 2020). More attention to students, staff, and patients should be given along with a focus on more research (Giudice et al., 2020). In the present study, most of the subjects were confident in the clinical skills acquired as well as managing their patients after the latter phase of the pandemic.

## 5. Conclusion

The present pandemic outbreak made the conducting of clinical sessions as well as dental education difficult. However, teachers have explored their capabilities and are making use of online technology to modify their teaching. The students have also adapted to the online mode of education and are gaining complete knowledge through online theoretical lectures and practicing clinical sessions with utmost protective measures. The present experience with the pandemic has given us many opportunities which will be helpful to improve our education system. This study can be concluded to be very important for overcoming the difficulties faced during this pandemic with regard to dental education and will prove to be a good reference for further studies.

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## Compliance with ethical standards

## Ethical consideration

This research has been conducted in accordance with the World Medical Association Declaration of Helsinki. It has been approved by the Institutional Review Board of Majmaah University (MUREC-Apr.17 /COM'2022/33-1).

## Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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