



Challenges of clinical dental education during the pandemic: A mixed-methods approach

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Abstract

Background: The COVID-19 pandemic and its high prevalence greatly affected education, especially majors such as dentistry, which require patient encounters. The objective of the current study was to investigate dental students³ and professors³ perspectives on the effects of the pandemic on clinical dental education.

Methods: This mixed-methods study had two phases: (1) in the qualitative phase, interviews were conducted with the heads of each clinical department and the students' representatives. Interviews were recorded, transcribed, and categorized to extract the main issues; (2) A self-administered questionnaire was designed based on the extracted themes. All the 4th–6th year dental students in the 2021–2022 academic year were invited to participate. Data were analyzed using SPSS.

Results: Twelve main issues were extracted from the interviews, including a reduced number of patients, reduced self-esteem concerning clinical care among students, the need for isolated facilities, etc. In the quantitative phase, 76% of the students participated in this study, 86% of whom believed that the quality of clinical education during the pandemic had decreased. The lack of patients and, as a result, the decrease in the number of determined requirements were listed as the most important factors in this reduction. The students mostly preferred to have extra time to compensate for their lack of experience.

Conclusion: The COVID-19 outbreak has negatively affected dental education. Despite the advances in e-learning, dental education cannot easily convert from patient-based education to theoretical or even virtual education. Providing proper clinical education always remains critical.

Keywords: Qualitative research, Quantitative evaluation, COVID-19, Education, Dental

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Introduction

In December 2019, a novel coronavirus was detected in China, spreading across the globe. Later, the World Health Organization declared the COVID-19 pandemic on March 12, 2020.¹ The quick spread of COVID-19 forced many countries to adopt quarantine protocols to limit the virus's transmission across society.² Following these protocols, all universities were closed in order to maintain social distancing, and theoretical classes were held on digital platforms.^{3,4}

Dental education consists of three components: theoretical courses, pre-clinical courses, and clinical practice, which requires close contact with patients.⁵ Since the corona virus is predominantly transmitted by respiratory droplets and close contact with the carrier, dental practitioners are at increased risk of contracting the virus. In many countries, the provision of dental services was limited to emergencies.⁶⁻⁸ This fact considerably limited clinical dental education. In many dental schools, access was only permitted for emergency treatments, prioritizing vulnerable patients.⁸⁻¹⁰

The National COVID-19 Response Committee established quarantine protocols in Iran in February 2020. Dental Schools were closed during the first months of the pandemic, and practical education was disrupted. Due to the lack of experience with pandemics, developing a comprehensive protocol for reopening the schools required much time and budget. Provision of personal protective equipment (PPE), including insulated clothing, N95 masks, shields, etc., isolation of units, and equipping departments with suitable facilities for ventilation of workspace and waiting rooms to minimize the spread of aerosols caused delays in reopening universities. Other causes of this delay include screening patients and students before entering the faculty and providing disinfectants for everyone, resulting in the shortening of the semester,



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which required changing the practical training program.¹¹

Limited information exists about the pandemic's effects on dental students' clinical education. A scoping review on dental education during the pandemic showed that as dental students' preparedness is related to gaining the proper amount of practical experience, virtual clinical training is not sufficient.¹² In this study, we aimed to explore the effects of the COVID-19 pandemic on clinical dental education from professors' and students' perspectives to help with better decision-making and preparedness during probable future crises.

Methods

Study design and participants

This study was conducted from August 2021 to June 2022, using a mixed-methods approach, including a qualitative and a quantitative phase. The undergraduate dentistry program in Iran is a six-year program, with clinical courses starting in the fourth year. The study's target group was fourth- to sixth-year undergraduate students who deliver patient care in clinical wards. The first-, second- and third-year students were excluded from the study as they had no face-to-face encounters with patients.

The samples were selected using the census method. In the qualitative phase, class representatives (six individuals) and heads of each clinical department (seven individuals) were recruited as they were assumed to be best aware of the situation of each department and the challenges that the students were going through during the pandemic. One of the authors contacted these individuals and briefly explained the study's purpose, and if the individual was willing to participate, an interview was arranged with them. The interviews took place in a private room and were recorded with the interviewees' permission. The length of each interview was about 15 minutes. No prompting was done by the interviewer to guide the respondents' answers. In the semi-structured framework of the interview, every participant was asked the same questions within a flexible framework, and the interviewees were encouraged to talk about their experiences through open-ended questions. Each interview started by asking the main question, "In your opinion, do you think that the COVID-19 pandemic affected clinical dental education?" continued by letting the individuals express their points of view about the effects. The last question of each interview was, "What is your suggestion to improve the quality of practical dental training during the COVID-19 pandemic?"

In the next step, each interview was implemented and presented to the interviewees for double-checking. Two independent faculty members, other than the interviewer, extracted and calibrated the educational issues mentioned by participants, highlighting the main themes.

Reliability and validity of the instrument

In the quantitative phase, a questionnaire was designed

using the main themes extracted in the previous section. For content validity, 11 professors with expertise in education were requested to review the questionnaire and assess each item based on four criteria: relevance, clarity, simplicity, and necessity. The content validity ratio (CVR) was calculated based on the responses to the necessary questions (n), and the formula CVR = (n - N / 2) / (N/ 2) was used. According to Lawshe's table, the cut-off point for 11 professionals is 0.63.13. The content validity index (CVI) for each item was obtained by dividing the number of experts who ranked the items as compatible or fully compatible for each criterion (relevance, clarity, and simplicity) by the total number of experts. The minimum required CVI for each item was 0.78.14 Two questions of the initial questionnaire were removed as their CVR was lower than the cut point. The modified questionnaire was given to ten random students. After two weeks, the same students filled out the questionnaire for the second time in order to assess the questionnaire's reliability. The agreement between the two answers was assessed using weighted kappa. The weighted kappa ranged from 0.57 (moderate agreement) to 0.88 (strong agreement), with a mean value of 0.64, and no question was removed regarding reliability.15

The final questionnaire included five sections. In the first section, the study purpose was explained briefly in a paragraph, and consent was obtained from the participants. The second section was demographic, including questions about the students' gender, academic year, and mean grade range. The following section included 12 questions obtained from the qualitative phase about the main issues affecting the quality of practical training during the pandemic. The close-ended questions were scored on a 5-point Likert scale: 1 (strongly agree), 2 (agree), 3 (not sure), 4 (disagree), and 5 (strongly disagree).

The next section of the questionnaire included the main approaches suggested by the interviewees in the qualitative phase to improve the quality of practical training during the pandemic. The questions were scored using a Likert scale. The final section included one question asking the individual whether they believed the quality of practical education during the COVID-19 pandemic got worse, better, or did not change at all.

The link to the final online questionnaire in Porsline, an Iranian online survey platform (https://survey.porsline. ir), was sent to the student class groups on Telegram messenger with a short explanation about the study. All undergraduate students in their seventh semester and later during the first year of the pandemic were included.

Statistical analysis methods

The quantitative data were analyzed using IBM SPSS Statistics for Windows, version 21 (IBM Corp., Armonk, N.Y., USA). The chi-square test was used to investigate the relationship between students' gender and their opinions about the quality of education. Spearman's correlation coefficient and the Kruskal-Wallis test were used to investigate the relationship between students' mean grade average as an indicator of their educational status and their opinion regarding the quality of practical education, as well as the relationship between students' semester and their level of self-confidence in providing dental services.

Results

The qualitative phase

The qualitative analysis of the interviews' data resulted in the extraction of 12 main areas of concern, including issues related to patients, the educational system, educational facilities, clinical wards, and students. Table 1 shows some examples of the exact quotes from the interviews for each theme.

A. Faculty's perspective

From the faculty's perspective, the first issue was the decreased quality of theoretical education due to online learning, which affected the students' ability to treat patients.

• The next issue was the professors' stress about

Table 1. Examples of the exact quotes mentioned in the interviews for each theme

contracting COVID-19 while supervising students' practical work.

B. Students' perspective

Professors were tired because they attended both morning and evening shifts in a row, affecting their function in the clinic.

- Shortening of the semester due to the quarantine closures
- Not being able to meet clinical requirements
- Students' decreased self-confidence due to less clinical experience

C. Mutual issues

Issues that were mentioned both in the faculty and students' interviews were the following (Figure 1):

- Patients' stress about COVID-19 transmission during dental visits and reduced patient attendance
- Small number of isolated units
- The decrease in the number of assigned clinical requirements
- Students' stress about COVID-19 transmission during dental visits
- Sequencing of clinical wards for social distancing and

Theme	Example of the exact quotes
Stress about COVID-19 transmission and their reduced attendance in the clinic	"About patient attendance, we had a real issue." "Patients would not come to the clinic because of their fear and the protocols, which suggested only emergency visits." "If there is no urgency, patients prefer to visit in a better situation"
Small number of isolated units	"The low number of isolated units there is only one isolated unit per 4 students" "Unfortunately, limiting the number of our units to isolated units has resulted in fewer students being able to treat patients per shift." "The other issue was the emphasis on working in isolated units and their limited number."
The decrease in the number of clinical requirements	"During this pandemic, our usual clinical requirements were not met. This affects the learning process." "We have reduced the number of clinical requirements to the minimum possible amount, and all of this means a fall in the quality of clinical education."
Students stress about COVID-19 transmission	"The fear of catching COVID-19 has caused the interaction with the patients to be shorter and weaker, and this fact reduces the quality of education." "Since we were worried about virus infection and were not used to PPE, we were exhausted and wanted to just finish our job and leave the ward as soon as possible."
Lower quality of the afternoon shift	"We had lower patient attendance in the afternoon shifts." "The afternoon shifts are over by 14:30 instead of 16:00 since both the staff and professors wish to leave the wards due to the university's shuttle service schedule or tiredness." "We didn't have enough patients in the afternoon shift."
Decreased quality of theoretical education	"The other issue was theoretical training; if there isn't any pressure on the students, they won't study enough, and that is the thing that happened during e-learning." "Failure to hold a face-to-face class due to lack of interaction has a negative effect on theoretical education, and a student with insufficient information does not function well in the clinic."
Professors' stress about getting COVID-19	"The professor who supervises the students' clinical skills now comes only when necessary." "the faculty members, prefer to be less present than the past because of their fear of contracting the virus."
Professor's tiredness	"The presence of some professors in both shifts makes them tired." "The professors have less chance of interaction with students since they are present in two shifts in a row."
Shortening of the semester	"The real issues we are struggling with are the low patient attendance and the decreased number of clinical sessions." "Because of the shortening of the semester, we could not follow-up our patients to meet the requirements of the periodontics department."
Not being able to meet clinical requirements.	"Because of low patient attendance and fewer sessions, many students could not meet their requirements and were forced to finish them in time for the exams." "Because of the lower number of isolated units, many students' requirements were not met, and they had to finish them in the next semester."
Students' decreased self- confidence	"We only had two patients for restorative treatment in the seventh semester, which will cause decreased self-confidence for seeing patients in the future." "I do not know how former students felt, but none of us have enough self-confidence to see patients on our own in the future."



Figure 1. Issues mentioned in the students' and faculty's interviews

lower quality of the afternoon shift

In response to our question about suggested ways to improve the quality of clinical education during the pandemic, the following items were mentioned:

• Holding practical training workshops: Some of the verbatim statements of the interviewees were:

"We can hold practical training workshops, like rotary or bug fixing workshops, for small groups of students to make up for it."

- Allocating extra time to students to compensate for reduced requirements: One interviewee mentioned, "Summer vacations can be used to compensate for deficiencies."
- Preparation of educational videos (demos) for the students in each department: According to one of the professors, "We can prepare demographic videos and make them available to students."
- Holding online case discussion classes: This was preferred and mentioned by the academic staff.
- "...Holding interactive online classes can be a solution."

The quantitative phase

The questionnaire was sent to 140 fourth- to sixth-year undergraduate students. With a 76% response rate, 107 filled questionnaires were collected (54% female respondents).

Regarding the mean grade average, 40.2% of the students were in group A (grades between 17 and 20 out of 20), 53.3% were in group B (grades between 15 and 17 out of 20), and 6.5% were in group C (grades between 14 and 15 out of 20).

Quality of clinical education

Of our participants, 86% believed that the quality of clinical dental education during the pandemic had decreased, 8.4% believed that the COVID-19 pandemic had no effect on clinical dental education, and only 5.6% believed that the quality had increased.

Table 2 shows the students' responses to the questions about the factors affecting clinical dental education.

Patient factors

The students listed the following as reasons for their lack of self-confidence in their clinical abilities: patients' stress about contracting the virus (65%), lower exposure to patients (85.9%), lower patient attendance in the evening shift (89.7%), and not being able to complete clinical requirements (88%).

Regarding the unfinished requirements, the fixed prosthetic ward, with 82 (79.6%) votes, followed by the endodontic ward, with 62 (60.2%), and the removable prosthetic ward, with 61 (59.2%) votes, had the most problems due to a lack of suitable cases. In contrast, the orthodontics (0%), radiology (1.9%), and diagnosis departments (7.8%) had the least problems regarding unfinished requirements (Figure 2).

Faculty and staff factors

More than half of the students agreed that the professors spend less time supervising the students in the clinic because they worry about contracting the virus, and 96.5% of the students believed that the staff and faculty members tend to leave the clinic earlier than the schedule, so they have shorter clinic sessions in the evening shift.

Educational factors and infrastructure

Students (73.9%) believed that the shortening of semesters, the lack of isolated units for students in the clinics (91.6%), and the decrease in the number of clinical requirements (91%) had affected their abilities and clinical training program.

Table 3 shows students' perspectives on proposed solutions for the problems created in practical training during the pandemic.

Suggested ways to improve the quality of clinical education The most preferred suggestions to improve the quality of clinical education for the students were compensating for their missing requirements in an extracurricular manner (85%) and holding practical workshops (81.1%). Although the academic staff liked holding online classes, only 58.8% Table 2. Students' responses to questions about factors affecting the quality of practical training

Question	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
Fatigue of professors due to the two shifts of the departments has affected the quality of practical education	13 (12.1%)	43 (40.2%)	15 (14%)	32 (29.9%)	4 (3.7%)
The small number of patient visits in the evening shift has affected the quality of practical training	52 (48.6%)	44 (41.1%)	4 (3.7%)	7 (6.5%)	0 (0%)
The shortness of the evening shift and the staff's willingness to leave earlier has affected the quality of practical training	67 (63.2%)	35 (33.3%)	2 (1.9%)	1 (0.9%)	1 (0.9%)
Shortening and compression of the semesters have affected the quality of practical education	37 (34.6%)	42 (39.3%)	14 (13.1%)	11 (10.3%)	3 (2.8%)
The small number of isolated units compared to the students in each ward has had an impact on the quality of practical education	64 (59.8%)	34 (31.8%)	4 (3.7%)	4 (3.7%)	1 (0.9%)
The concern of patients about the possibility of contracting COVID-19 has influenced the change in the quality of practical training	21 (19.6%)	49 (45.8%)	19 (17.8%)	15 (14.8%)	3 (2.8%)
The stress of students regarding the possibility of COVID-19 during practical work has affected the quality of practical education	17 (15.9%)	45 (42.1%)	18 (16.8%)	24 (22.4%)	3 (2.8%)
Reduced presence of professors for supervision of student practical work due to the concern of contracting COVID-19 has influenced the quality of practical education	27 (25.5%)	34 (32.1%)	20 (18.9%)	22 (20.8%)	3 (2.8%)
Reducing the number of practical requirements has had an impact on the quality of practical education	60 (56.1%)	37 (34.6%)	5 (4.7%)	4 (3.7%)	1 (0.9%)
Incomplete practical requirements due to the lack of suitable cases have affected the quality of practical education	41 (38.3%)	53 (49.5%)	6 (5.6%)	6 (5.6%)	1 (0.9%)
The coronavirus pandemic resulted in students' lack of self-confidence due to less exposure to patients.	39 (36.4%)	53 (49.5%)	3 (2.8%)	11 (10.3%)	1 (0.9%)
Changing the method of teaching theoretical courses has affected the practical quality of education	25 (23.4%)	27 (25.2%)	16 (15%)	30 (28%)	9 (8.4%)



Figure 2. Students chose a department in response to the question: "Which department's requirements did you have the most trouble completing?"

of the students preferred this approach.

Gender factor

The chi-square test results showed no significant relationship between gender and the responses about the quality of clinical education during the pandemic (P value = 0.7).

Students' mean grade average factor

Spearman's correlation coefficient of 0.2 and the *P* value of 0.04 revealed that students with lower grade averages were more satisfied with the quality of education during the COVID-19 pandemic.

The Kruskal-Wallis test showed that the highest

satisfaction with the quality of education was related to the lowest grade average, and the lowest satisfaction was related to the students with the highest grades (P value = 0.056).

Students' semester factor

If we consider the academic semester as a ranking variable, Spearman's correlation coefficient for the relationship between these two variables is 0.28 (P=0.003), meaning that students who had more time until graduation reported higher self-confidence status.

Examining groups two by two using the Kruskal-Wallis test showed that students in the last semester reported significantly lower self-confidence levels than those in the Table 3. Student's perception of solutions for improving practical education

Solution	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
Holding practical training workshops	38 (35.8%)	48 (45.3%)	12 (11.3%)	4 (3.8%)	4 (3.8%)
Allocating extra time to students to compensate for reduced requirements	44 (41.1%)	47 (43.9%)	8 (7.5%)	6 (5.6%)	2 (1.9%)
Preparation of educational videos (demos) for the students in each department	45 (42.1%)	36 (33.6%)	11 (10.3%)	12 (11.2%)	3 (2.8%)
Holding online case discussion classes	30 (28%)	33 (30.8%)	23 (21.5%)	16 (15%)	5 (4.7%)

seventh semester (P = 0.042).

Discussion

In this study, we assessed the professor's and student's perspectives regarding the effects of the COVID-19 outbreak on clinical dental education. According to our data, all of the professors and most students agreed that the COVID-19 outbreak had an adverse effect on the practical education process. Most students who were satisfied with the quality of education during the pandemic had a lower grade average. The reasons for this satisfaction may be greater ease of passing the courses due to the reduction in the number of requirements and the benefits of virtual exams; however, proving this hypothesis requires further studies in the future.

The patients' concern about COVID-19 transmission during dental visits and their reduced attendance in the clinic were the main issues affecting clinical education; as a result, the Academic Committee was forced to reduce the number of clinical requirements.¹⁶ The lower number of clinical interactions with patients resulted in the lack of proper clinical experience and the students' lower confidence levels.

Based on the principles of medical ethics, two major duties of a dentist are beneficence and quality of care. These principles suggest that the highest possible level of care should be provided to the patient, and dentists must consider the alternative therapies available and weigh potential benefits against potential harms or risks.¹⁷ This issue requires the training of dentists with high clinical capabilities. Although most studies have focused on online theoretical dental education⁵, the clinical aspect of dental education is a more important moral subject as it encompasses students' encounters with actual patients.

The senior students were more concerned about their lack of skills since they did not have the time to compensate for the missing experience and were going to treat patients on their own soon in the following year. A similar issue was addressed in the study by Jum'ah et al, where students were concerned about the negative impact of the pandemic on their clinical skills and the delay in their clinical training.¹⁸

While professors believed that the amount of assigned clinical requirements during the pandemic was insufficient for gaining enough skills, the students mentioned that even finishing these requirements was not easy due to the lack of suitable cases. The study of Loch et al supports our results, suggesting that the students felt stressed about the low number of suitable cases for finishing their clinical requirements and the possibility that

it would affect their graduation.7

According to our findings, the Fixed Prosthetic Department had the highest number of cancellations and fewer patients. This may be because treatments provided in this ward are not considered emergencies, and most patients preferred to postpone their treatment during the pandemic. The endodontic ward was the following department with the lowest number of suitable cases. Similar to the findings by Carter et al, where the most common complaint was symptomatic irreversible pulpitis,¹⁹ in our study, most patients came for emergency treatments such as pulpotomy and pain relief and refused to finish the entire endodontic treatment after the emergency session.

According to current data, no student reported a lack of suitable cases in the orthodontic department. This is because most of the student's requirements in this ward are to follow up with former patients. Students were not forced to take new patients, and much of this ward's practical training shifted to theoretic sessions during the pandemic. Other departments that did not lack suitable cases were the diagnosis and radiology departments. This is because any patient who enters the dental clinic at any time should go through these two departments to diagnose their condition and then be referred to other departments for treatment.

A suitable and appropriate treatment is possible with sufficient information, and this shows the importance of theoretical training in the quality of clinical education. The students and professors had different perspectives on online theoretical classes. Although most of the faculty believed that shifting to virtual platforms has decreased the quality of education, some students said they benefitted from online classes because they could review each session whenever they wanted. They would not miss any classes due to time and place limitations. During the pandemic, professors were suddenly forced to use virtual infrastructures, and the lack of knowledge and experience was one of the causes of the deficiencies. It is important to work on improving online digital platforms to address the inconveniences and train the academic staff and the students to use these platforms properly.

According to our data, most students agreed to compensate for the missing requirements by treating

patients in the extra time allocated during the holidays if safe conditions were provided. In contrast, the study of Hung et al showed that despite the students' concern about lack of experience during the pandemic, only 11% of them were willing to take a shorter winter break and make up for lost educational time.⁶ Our participants also welcomed holding supplementary workshops to improve their clinical abilities.

Strengths and Limitations:

The strength of this study was that the questionnaire was prepared using a qualitative phase instead of translating a survey designed for other countries. Therefore, the roots of the educational problems in Iran's context were found.

This study included students from one faculty in Iran. Although our response rate was good, similar studies should be conducted across the country to better understand the limitations and improve the educational quality by providing guidelines for clinical education.

Conclusion

The COVID-19 pandemic influenced all aspects of people's lives. Social distancing protocols to prevent infection spread affected many social behaviors, including dental care and education. While theoretical courses could be handled through virtual platforms, clinical education faced more problems. It is important to maintain educational quality, but the safety of the students, faculty, staff, and patients is more important. As our knowledge of COVID-19 progressed, more effective ways of disease control were described. Also, it would be beneficial to look for experiences from care seekers during the pandemic to better prepare for future crises.

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Author's Contribution

Conceptualization: Ghazal Nosrati and Mahshid Namdari. Data curation: Mahshid Namdari. Investigation: Ghazal Nosrati. Formal analysis: Mahshid Namdari and Maryam Sadeghipour. Methodology: Maryam Sadeghipour. Project administration: Ghazal Nosrati. Supervision: Mahshid Namdari. Software: Sediqe Shafiei and Ghazal Nosrati. Validation: Mahshid Namdari and Maryam Sadeghipour. Visualization: Sediqe Shafiei and Ghazal Nosrati. Writing-original draft: Ghazal Nosrati. Writing-review & editing: Sediqe Shafiei.

Competing Interests

None.

Data Availability Statement

The authors confirm that the data and material are available for further interpretation, replication, and building upon the findings reported in the article.

Ethical Approval

The study was approved by the Shahid Beheshti University of medical science Ethics Committee (ethical code: IR.SBMU.DRC. REC.1400.179). Participation was voluntary, and participants were assured that the collected data were used only for study purposes.

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