

## The effect of the coronavirus disease-2019 challenge on oral and dental health education: A systematic review

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### Review Article

#### Abstract

**BACKGROUND AND AIM:** The effects of the coronavirus disease-2019 (COVID-19) pandemic on theoretical education and practical-clinical trainings of dentistry have been highly destructive, and electronic learning (e-learning) with various advantages and disadvantages is the only way in this period for education in order to prevent the spread of the virus. Therefore, the present study aimed to investigate the effects of the COVID-19 challenge on dental health trainings worldwide through a systematic review study.

**METHODS:** The keywords containing “education”, “dentistry”, and “Corona virus” were extracted from the Medical Subject Headings (MeSH) and the precise query of the research was designed. Then, the searches were performed in five main electronic databases, i.e., PubMed, Web of Science (ISI), Scopus, Embase, and Google Scholar, with no time and place limitations. In order to complete the study, manual search was also performed. Then, the studies were screened according to the systematic instructions of the review and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) chart was designed. Finally, the selected studies were reviewed to extract the required information.

**RESULTS:** Eventually, the studies included in the final review were 12 (out of 1851). The present study showed that the study situation during the COVID-19 outbreak was mainly based on online instructions, teleconference, and video conferencing around the world, aiming at distance learning. In some countries, hands-on learning and home-based simulation learning (HBSL) have been the widely used methods to train dental practical courses during the pandemic. Regarding the item of “the effect of COVID-19 on theoretical training and knowledge”, the students' general satisfaction and positive attitudes showed that e-learning has been successful in the coverage of theoretical courses. In the item of “the status of clinic training during the pandemic”, it was revealed that changes in training practical courses led to dissatisfaction with performance, reduced self-esteem, and insufficient training to dental students; thus, they asked for supplementary and review courses in the training program.

**CONCLUSION:** There have been gaps in preparation, facilities, policies, and feedback of dental colleges around the world in training dental courses in the conditions of crisis. Therefore, it is suggested to perform further studies to investigate the efficiency and effectiveness of technology-based learning (TB learning).

**KEYWORDS:** Coronavirus Disease-2019; Systematic Review; Curriculum; Dental Education

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Governments and health authorities in all countries around the world have announced the closure of educational institutions, including dental colleges, in order to restrict the prevalence and spread of the coronavirus disease-2019 (COVID-19).<sup>1</sup> The pandemic has been proved to be devastating in practical and clinical courses of dentistry due to the

nature of dental treatments.<sup>2</sup> Therefore, the strategies for dealing with these special conditions of pandemics need to be designed. As a result, new and different methods such as web-based learning platforms based on distance learning have been suggested.<sup>3</sup> Using innovative and creative methods based on modern technology and providing an active and interactive learning space, this

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method was accepted and welcomed by dental students.<sup>24</sup> One of the advantages of the web-based learning is the opportunity to review the educational sources for many times at any time and place. More access to educational videos, webinars, and workshops, which was not available before, is another advantage of this kind of learning.<sup>5</sup>

The web-based learning is along with some disadvantages as well: Insufficient knowledge about the modern technology, lack of access to the required hardware and electronic equipment, lack of proper internet connection, presence of the family in virtual classrooms, etc.<sup>6,7</sup>

Though electronic learning (e-learning) is the only way for the world of education to proceed and prevent the spread of coronavirus these days,<sup>8</sup> the direct communication between dental students and professors is weak in this method.<sup>9</sup> Moreover, the clinical and practical courses of this field cannot be completely fulfilled through distance learning methods. Studies have indicated that web-based learning methods are not ideal methods to evaluate dental students because these methods only evaluate their theoretical knowledge in an imperfect form.<sup>10</sup> Therefore, the present study aimed to determine the impacts of COVID-19 on oral and dental health education worldwide through a systematic review.

## Methods

This study was approved by the Ethics Committee, Kerman University of Medical Sciences, Kerman, Iran (Ethical Code: IR.KMU.REC.1400.161).

**Step 1; Protocol:** This study was a systematic review designed based on the Cochrane protocol for systematic reviews and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol and checklist.<sup>11</sup>

**Step 2; Eligibility criteria:** The essential requirement of this step was clarity and understanding of the questions of the study, i.e., the population, intervention, control, and outcomes (PICO) of the study. The first step in

evidence-based medicine is designing a researchable PICO,<sup>12</sup> which was as follows for the present study: Patient or problem (P): All studies focused on dental education during the COVID-19 outbreak. Intervention or indicator (I): The effect of pandemic conditions on theoretical education and practical dental training. Control or comparison (C): Different approaches and methods and techniques based on the technology for distance learning. Outcome (O): The feedbacks and results from the different electronic and web-based learning methods, and dental theoretical and clinic knowledge worldwide.

**Step 3; Searching strategy:** The strategy of extensive search with multiple combinations of keywords was used in the query search for maximum accuracy. The keywords used in this strategy were extracted from Medical Subject Headings (MeSH) in PubMed (Table 1).

**Table 1.** Words used in search strategy

Education	Corona virus	Dentistry
Covid-19	Dental	Training
SARS-COV-2	Dental student	Teaching
SARS Corona virus	Dental resident	Learning

COVID-19: Coronavirus disease-2019; SARS: Severe acute respiratory syndrome

In searching the keywords related to the independent variables, they were combined with the word "OR". Similar searches were made with the keywords related to the dependent variables. Then, the results of these searches were combined with the word "AND". Performing advanced and extensive search with different combination of the keywords and based on the title and abstract, the records found were transferred and processed by EndNote X7 software.

**Step 4; Information sources:** A comprehensive and systematic search on the subject under study was performed to find all published articles. The databases of PubMed, Web of Science, Scopus, Embase, and Google Scholar were searched. In order to increase the sensitivity, no time and place limitations were considered. Manual search was also performed in order to find missed references

in the linkages of the article references found.

**Step 5; Selection of studies:** In this stage, duplicate records were removed. Then, the abstracts and titles of the articles were examined by two separate reviewers independently based on the inclusion and exclusion criteria. If necessary, the full texts were studied to gain the final conclusion. The inclusion criteria were all epidemiological studies focused on dental education during the COVID-19 outbreak. The exclusion criteria were the published articles other than those in English and Persian languages, lack of access to full text (n = 2), lack of access to abstract, and unpublished studies (n = 1). All studies including letter to editor, systematic review, or scoping review were excluded. Other studies, i.e., cross-sectional, case-control, cohort, and clinical trials, were studied. To evaluate the studies, the inclusion criteria of all studies related to e-learning and distance dental education were considered.

**Step 6; Collecting data:** In this stage, various methods used for dental education during the COVID-19 outbreak were extracted, and then,

the feedbacks and effects of each were investigated on dental students' theoretical and preclinical knowledge and clinical performance.

### Results

By searching 5 main databases, 1850 records were found. Through complementary searches including manual search and gray literature, one more record was found, and finally, 1851 articles were analyzed by EndNote X7. After removing the duplicate articles, 669 titles and abstracts were examined. In this stage, the inclusion criteria and research competence were the criteria for investigation. Finally, the full texts of 12 articles were researched. The research path is summarized in the following PRISMA chart (Figure1).

Dental education with its two main components, including theoretical or didactic education, which is mostly in the field of basic sciences, and clinical education, experiences, and feedback on each of these two areas during different strategies and methods of distance education in different parts of the world are presented in table 2.

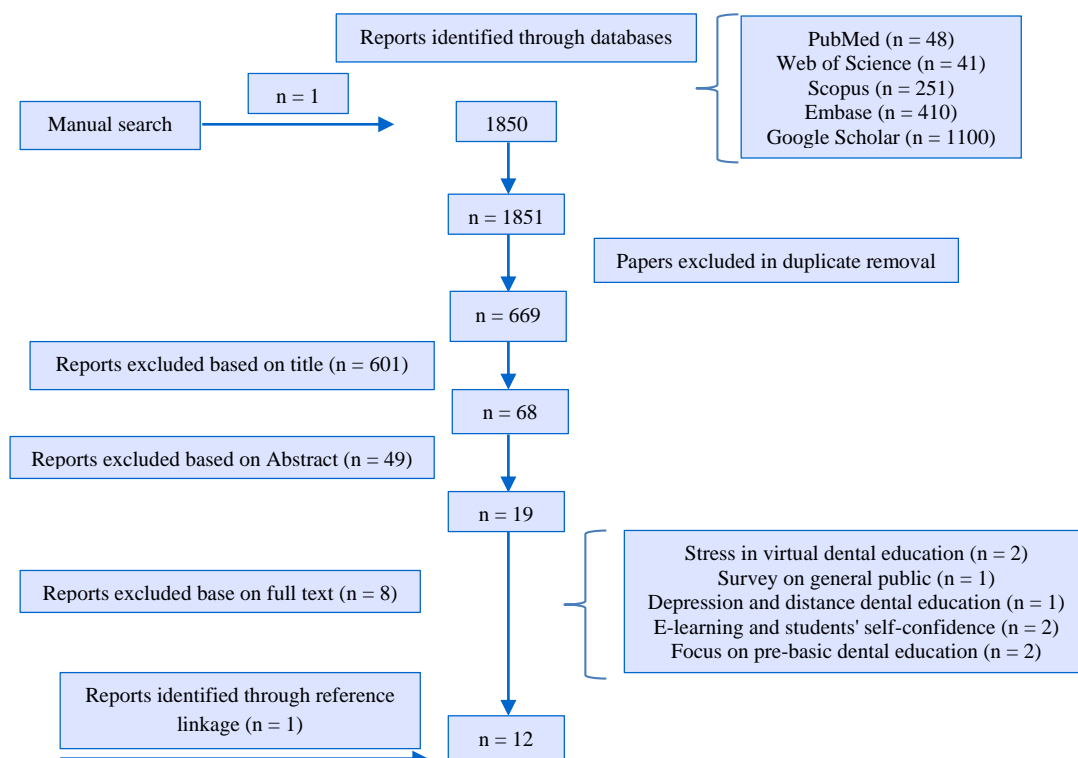


Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram

**Table 2.** Feedback and the effects of different distance education methods on the components of education in dentistry

Author	Region	Target group	Evaluation method	Study situation during the COVID-19 outbreak	Effect of COVID-19 on theoretical training and knowledge	Status of clinical training during COVID-19 pandemic
Wu et al. <sup>1</sup>	North America	Dental students and residents	Interview	Online instruction and teleconference	Continuation of quality of dental education, but stop of the preclinical simulation activities	Rescheduling and changes in licensure examination
Albujeer <sup>3</sup>	Iraq	New graduated dentists	Interview	E-learning	Successful e-learning coverage of the theoretical educational sessions	Design of an intensive course like the General Practice Residency (GPR)
Amir et al. <sup>5</sup>	Indonesia	Undergraduates	Online questionnaire	Distance learning	Less learning satisfaction for first-year students	Combined classroom and distance learning was efficient
Damien et al. <sup>13</sup>	Texas	DDS students	Inquiry from students	Simulation and hands-on learning	Difficulty participating in the training program, but good results	They regretted the inability to participate
Farooq et al. <sup>14</sup>	Egypt	BDS students	Not mentioned	Teledentistry with video conferencing	Effective way	Effective way
Onoral and Kurtulmus-Yilmaz <sup>15</sup>	Cyprus	All dental students	Reflective questions	Technology-based education	Online theoretical courses are more advantageous than the face to face ones.	Practical implementations should have been conducted as face to face
Zhao et al. <sup>16</sup>	Wuhan-China	Residents	Questionnaire	Continued studying mainly through free online resources	Improvement in didactic knowledge	No change from the past or worseing
Wang et al. <sup>17</sup>	China-Beijing	Dental students	E-mail questionnaire	Live broadcast as the major teaching way and online learning	Lowest satisfaction in "interaction between teachers and students" and low motivation of students to learn	Low satisfaction
Tan et al. <sup>18</sup>	Singapore	Oral health therapy students	Questionnaire and interview	HBSL and teleconferencing	Higher levels of overall satisfaction and self-confidence following HBSL	Overall student satisfaction and self-confidence in learning
Al-Taweel et al. <sup>4</sup>	Iraq	Undergraduate dental students	Questionnaire	Technology-based learning (TB learning)	Overall satisfaction and positive attitude towards TB learning were less than 50%.	Low-moderate satisfaction and positive attitude towards TB learning
Attanasi et al. <sup>7</sup>	New York	Dental hygiene students	Qualtrics questionnaire	Remote teaching methods and videos for clinical education	Online video conferencing and LMS platforms with successful didactic education	Successful clinical education

COVID-19: Coronavirus disease-2019; DDS: Doctor of dental surgery; BDS: Bachelor of Dental Surgery; HBSL: Home-based simulation learning; LMS: Learning Management System; GPR: General Practice Residency

## Discussion

This study reflected the requirement of increasing students' skill in using technology and computer in web-based learning as an important part of educational curriculum. In this regard, the study of Iyer et al. showed that problem-based learning, team-based and case-based learning, objective structured clinical examinations, and flipped classrooms are some of the methods that can be used to continue e-learning in dental students in this unusual situation.<sup>19</sup> Special courses can help the students who passed the preclinical stage during the virus pandemic, as well as the students educated during this period.<sup>20</sup>

The studies carried out by Doughty and Moshkun<sup>21</sup> and Shrestha et al.<sup>22</sup> showed that it is better to identify the parts of educational curriculum that have been canceled or integrated, and consider special arrangements for them, which is consistent with the results of the present study.

The study of Machado et al.<sup>23</sup> indicated that in the forthcoming period, it is better to perform an educational needs assessment to identify the clinical or practical topics that have been negatively affected in the highest rate, and consequently, supplementary courses can be offered based on the educational needs in full compliance with health protocols.

The present study indicated that the target groups, who needed supplementary courses, were the students under more pressure by the present conditions; including:

1. The students who could not pass the preclinical stage, due to the pandemic, and did not gain the required skills for clinical implementations.
2. The students who finished their final educational courses during the pandemic.
3. The specialized students who could not practice the related clinical trainings under the supervision of experts and experienced professors.

The study of Farooq et al. showed that according to the guides and recommendations provided by the World Health Organization (WHO), dental treatments are limited to

emergency treatments and the number of clinical cases for non-emergency treatments in dental colleges has been reduced considerably. This issue had destructive effects on dental students' clinical abilities and practical knowledge about up-to-date, widely used, and modern methods in the world, such as implant training or cosmetic procedures.<sup>14</sup> The results of the present study suggested that implementation of educational supplementary programs in applied and clinical knowledge domains have been highly effective on dental students. The studies by Peres et al.<sup>24</sup> and Mahendran et al.<sup>25</sup> revealed that the quality of what students have learned online during this period should be evaluated through a comprehensive test or, in other words, an entrance exam before passing the next educational courses.

According to the general results of the present study, students' dissatisfaction with distance learning is due to problems such as poor internet connection, time management, insufficient interaction with the professor, and inefficient concentration in virtual classes. However, in order to observe the health protocols, the curriculum of most practical courses was determined less than before, resulting in decreased self-esteem, anxiety, insufficient knowledge, or incompetency in dental students. Therefore, regarding the psychological effects of the phenomenon, the dental colleges have to provide the students with psychological services.

The present study showed that the professors are concerned with the lack of confidence in the effectiveness of education and virtual tests, lack of feedback from students' understanding while teaching the educational content, and lack of face-to-face communication with students. Making various problems in education, the period of the COVID-19 pandemic showed that dental colleges have to have specific curricula to deal with any other similar conditions in order to overcome the future possible crises and even design specific curricula for the period following a crisis.

It is suggested that the knowledge of dental students who have been trained through distance learning courses during the COVID-19 pandemic, be compared with that of students who have taken the same courses in face-to-face classes, in order to help those involved in educational planning for the coming semesters.

### Conclusion

The COVID-19 pandemic challenges dental education by creating multiple crises and problems. However, educators rely on their knowledge, skills, and abilities, and do their best to teach based on technology and modern methods, but achieving the ideal and necessary level of clinical functional skills

for dental students requires a review based on the need assessment in educational planning as well as the provision of supplementary courses.

Finally, gaps were observed in preparation, facilities, decisions, and feedbacks of dental colleges around the world in controlling and managing the education in the COVID-19 pandemic conditions.

### Conflict of Interests

Authors have no conflict of interest.

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This study was approved by Kerman University of Medical Sciences (research code: 400000036, ethical code: IR.KMU.REC.1400.161).

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