Critical Review
Oral Pathology

# COVID-19 pandemic and the impact on dental education: discussing current and future perspectives

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**Abstract:** Due to the COVID-19 pandemic crisis, many dental schools and instructors are rethinking the way they teach and interact with students. New perspectives regarding a change in face-to-face activities, social isolation and the reformulation of clinical activities result in a transition toward e-learning and e-teaching processes. In this review, we discuss some favorable aspects and difficulties associated with virtual teaching and learning, searching for available tools and techniques as well as new perspectives.

**Keywords:** Coronavirus; Education, Dental; Dentistry.

## Introduction

Amid the confinement due to the COVID-19 pandemic, face-to-face classroom educational activities with undergraduate and postgraduate dentistry students were nearly interrupted worldwide. Educators are scrambling to adapt to social distancing (self-quarantine). The durations of quarantine and social isolation are unpredictable, and some virtual alternatives are being used to continue teaching activities. For instance, at a Canadian dental school, professors have continued to work from home and to provide remote courses and examinations, as requirements for a successful graduation were rebuilt.[1] Moreover, new perceptions are incorporated into this new scenario, including students' wellbeing, feelings of loneliness, and familiar losses.[1] In a recent survey focusing on the European management of the COVID-19 crisis, 90% of dental schools reported using online pedagogical software tools, 72% used live or streamed videos, 48% provided links to further online materials, 65% participated in organizing virtual meetings and, less frequently, small-scale working groups, social media groups or journal clubs.[2] Critically, even in the United States, few recommendations were made on social distancing to protect students, faculty, staff, and patients, and on how to follow dental education.[3] At this point, we have no precise information about Brazilian dental schools, aside from personal communications. Moreover, in many dental schools, especially in low-income countries, dental students are more susceptible to infections, including COVID-19, due to poorer knowledge and insufficient infection prevention.[4]

Well-known platforms such as email, Google® educational tools, Skype®, Facebook®, Instagram®, YouTube®, WhatsApp®, and Telegram® are

intensively used worldwide for theoretical contents, and are now adapting to this new purpose.[5,6,7,8,9,10] Other platforms, such as LinkedIn® and Pinterest®, can also be used. New forms of classroom conference and lectures, using videoconference systems like Zoom®, Jitsi®, Microsoft Teams®, and WebEx® were implemented at many institutions.[11,12,13,14] Other institutions advocate the use of personal platforms such as Moodle® to spread educational contents and to improve the communication between students and professors.

Despite these new adaptations focusing on educational matters, there is little evidence regarding the actual impact of these media platforms on student formation and knowledge solidification. Studies have highlighted successful experiences, albeit in isolated dental specialties.[15] Moreover, when preclinical and clinical training are considered, available options are scarce. To comprehend this new reality and suggest new approaches to critical areas of e-learning and e-teaching in Dentistry, we aimed to critically discuss the current and future perspectives for dental education in the COVID-19 era.

## Discussion

### Electronic platforms for theoretical education during the COVID-19 era

The COVID-19 crisis revealed that we have underestimated the role of the e-oral health infrastructure, and education and services issues, including teledentistry, which is incipient, albeit promissory.[1] Electronic platforms, video conferencing networks and social media are being used for theoretical purposes.[5,6,7,8,9,10,11,12,13,14,15] Educational electronic platforms are presented by educational institutions as an official alternative for non-classroom activities. For example, Moodle® platforms are extensively used by dental schools for active learning activities.[16,17] Moodle® is an online platform promoting blended-learning to enhance student training and improve their achievements, in line with international standards.[17] On Moodle®, it is possible to send didactic material, post videos, conduct forum discussions, tasks, assessments, and organize personal communication with students. Focusing on dental schools in low-income areas showed that Moodle® provided otherwise unavailable formative e-assessments and accommodated various question formats, and different skill levels taught by instructors. Generally, students were found to have positive impressions despite technical problems and related stresses.[18] While these platforms are advantageous because they are already structured and universal, they require improvements, constant maintenance, and a quality internet connection.

Open and paid platforms, such as Zoom®, Jitsi® or WebEx®, are interesting alternatives to classroom settings, although they depend on a quality internet connection. An interesting study,[19] on Problem-Based Learning using WebEx® revealed some issues with student distraction (phones and web browsing). Virtual facilitation required vigilance from facilitators and, sometimes, intervention. Students had a satisfactory assimilation and memorization. Assessments made by virtual platforms were not altered significantly, and facilitators easily acclimated to this new learning method. Although using physical means in face-to-face education is a more effective communication modality for clinical case-based discussions; remote, internet-based discussions on virtual platforms enable a more relaxed discussion ambience. However, their effectiveness depends upon a robust and ergonomic interface, involving some prior training.[11] The Zoom® platform, for instance, could be associated with other tools such as Twitter with satisfying results in small-group formats, engendering robust discussions and sparing unnecessary commutating during social isolation and even social restrictions over student gatherings.[14] At this point, the discussion on new contents and educational approaches could be unified, as for online courses for basic infection control on smart phone applications, which keep students updated with the latest information about infectious diseases and prevention.[4] Other commonly used learning platforms are Microsoft Teams® and Google Meet® as well as its additional resources, Google Classroom® and Hangout®. Google Meet® allows live activities with up to 250 simultaneous participants, with the possibility of sharing the presenter's screen (teacher or student), allowing various didactic actions. In

addition, with the consent of all participants, the activity can be recorded and stored in Google Drive® or Google Classroom®, for later reference. In remote activities, the privacy of user data is crucial. Tools using end-to-end encrypted systems, of which only the users can read the message, are recommended. These systems ensure secure information, without interference from external manufacturers and servers.[20]

Social media platforms, including Instagram®, Facebook®, WhatsApp®, Telegram®, and YouTube® are widely used as teaching alternatives. WhatsApp®'s usefulness as a tool for telepathology was evaluated, and provided satisfying responses to efficient screening, identifying suspicious lesions and following-up on critical cases.[9] Recently, we published a letter highlighting the importance of WhatsApp® as a communication and counseling tool during the COVID-19 crisis, focusing on oral diagnoses.[7] A comparison between the reception and response times of WhatsApp® and traditional electronic email, within the dental educational environment, showed that better results are achieved using instant multimedia messaging.[10] Facebook® allows students to discuss topics more openly and flexibly, with less rigid time and place constraints. It could be useful in teaching the theoretical aspects of medical emergencies in dental practice.[6]

Although these social media platforms are universal, the students may be distracted by low quality content. Recently we have demonstrated that the available content on oral cancer on this social media is of poor quality, considering various types of available media.[1] There is also no quality filter, and all types of content can be accessed. Other questions dwell on policies and legal issues, which academic dental institutions need to consider as they develop effective social media policies, including compliance perspectives and providing the needed resources.[8]

As an alternative to institutional digital electronic platforms, we have used YouTube®, Instagram®, and WhatsApp® as an open regional information network. From the content generated by teachers and researchers from various member institutions, we have been doing "Lives", posting on Instagram, and discussing via WhatsApp®. We have had an especially helpful experience through a "Live" broadcasted on YouTube® over the last two weeks (https://www.youtube.com/channel/UCAlUni3N2LUcGVKWYWLjqIw).

For this event, we gathered over a hundred professors, practitioners, and students from different Brazilian regions, to discuss topics on oral cancer and oncologic treatment side effects. Conversely, apps for mobile devices can be developed and remotely used, enabling interaction, including between teachers and students, as well as for content to be shared. These apps would enable interactions through conventional social media, and provide highly reliable content. Recently, we highlighted the possibility for health professionals and patients to interact through apps or social media amid the pandemic, which could also be applied to professor-student interactions.[7]

## Preclinical and clinical e-learning activities during the COVID-19 era

Together, these devices are being used to teach theoretical content. However, another concern is the interruption of education on laboratorial, preclinical, and clinical activities. How can students receive their theoretical-practical training without teaching preclinical or clinical activities face to face? For example, some dental schools in Europe are planning to modify their assessment schedule or extend program dates, particularly regarding clinical hours, rather than reducing the clinical graduation requirements.[2] While waiting for our dental schools to reopen, we should rethink and remodel our infrastructure offer, and manage occupational hazards, focusing on the safety of our students, staff, and patients.[1] As this situation could last, we should find alternatives to keep training our students until dental practice can resume.

For preclinical e-learning activities, online simulation with dental training manikins is extremely difficult. Although different clinical dental care simulators have been developed and yielded satisfying results,[21,22] they are scarce in educational institutions, are not portable, do not cover all areas of dentistry, and are very expensive. Conversely, other virtual models could be used more widely. For instance, positive experiences have been reported with virtual slides using whole-slide image for oral

pathology education, with superior results than with the traditional approach (conventional microscopy).[23] Several commercially available systems scan the glass slide, producing a high-resolution digital slide (whole-slide imaging), which enables the analysis and study of the slide in specific programs, according to the digitization system.[24] Usually, the software used in analysis is freely accessible. The whole-slide imaging can be stored on the institution's own drives or servers. Thus, the files can be accessed by teachers and students, including being shared on learning platforms during live performances. Despite the automatic digital slide scanner being expensive, many Brazilian dental schools have the equipment and use whole-slide imaging during oral pathology education.

Case-based discussions are an important learning strategy, applied in several dental specialties and courses. Virtual patient (VP)-based learning consists of simulating clinical cases to improve students' skills in decision making and diagnosis. Recently, a web-based VP training study on herpes simplex infection and recurrent aphthous stomatitis found an improved learning in dental students.[25] The learning platforms can also offer the possibility of case-based discussions. Besides chat discussion, live discussions are allowed, as well as sharing clinical, imaging and/or histopathological images. In such activities, the protection of patients' data, including images and demographic data, is essential. End-to-end encrypted systems are indispensable. In addition, many countries' data protection rights do not allow patient data to be transmitted to foreign servers.[20] Case-based discussions can be also achieved using social media, such as Instagram®, Facebook®, YouTube®, Twitter®, LinkedIn® and Pinterest®.

Another example is the use of a mobile app containing reference images, which was found to improve the students' ability to diagnose endodontic complications with excellent results.[26] For prosthodontics, an app could effectively improve clinical reasoning skills for planning prosthodontic rehabilitation.[27] However, we have, at this point, very few options available for our students. We strongly suggest these new options and the joint development of apps with computational teams focusing on complex scenarios such as theoretical, preclinical and clinical practices. Nevertheless, regarding teaching activities in dental school clinics, no e-learning strategies can replace experience with patients. In addition, in Brazil, mandatory curricular internships in the public service are also suspended.

## Care for staff members, professors, technicians, and students

Different degrees of proximity to COVID-19, the need for social distancing and isolation, and uncertainties about the outcome of the pandemic can significantly affect staff members and students' mental health. For students, concern about the delay in completing graduation is an additional issue, especially for final-year students. This context can cause anxiety, poor sleep or short sleep durations, predisposing people to depression and post-traumatic stress disorders.[28] Mental health disorders negatively impact learning and academic achievement.[29] Thus, the monitoring of staff members and students by the direction of college is important. Even in a period of uncertainty, holding regular meetings, especially with students, can reassure them and help decrease anxiety.

Although there are no official data on teaching activities in dental schools in Brazil during the COVID-19 pandemic, the sudden interruption of activities has led many dental schools to craft an emergency e-learning plan. Particularly in Brazil, most dental professors are untrained to perform remote learning. In addition to the need for adequate training, the sudden inception of e-learning can further increase anxiety. It should also be considered that the sudden start of e-learning can be a stressor for students, considering that not everyone will adequately adapt to this teaching modality. The dental school administration must plan strategies to keep staff and students motivated.

The COVID-19 pandemic has a significant economic impact, with an increased worldwide unemployment rate, including in Brazil (https://www.ilo.org/global/about-the-ilo/newsroom/news/WCMS_738742/lang--en/index.htm) where, with the adoption of social inclusion policies, thousands of public university students are low-income, with a family income per

capita of up to 1.5 minimum wages (minimum wage: 1,045 Brazilian reals; approximately 190 dollars) (http://www.andifes.org.br/wp-content/uploads/2019/05/V-Pesquisa-Nacional-de-Perfil-Socioecon%C3%B4mico-e-Cultural-dos-as-Graduandos-as-das-IFES-2018.pdf). There are also low-income students in private dental schools, albeit in smaller proportions. Considering this context and the high financial cost of dentistry course, many students need a job to achieve their goals. Thus, considering the ongoing critical pandemic crisis, it is reasonable to hypothesize an increase in dropout rates in dentistry courses in Brazil. This aspect must also be carefully considered by higher education institutions' administrations, both public and private.

## Future perspectives

Considering our new reality, it is possible to continue teaching theoretical content, keeping students' unequal access to quality internet in mind, especially those with low income. However, few effective alternatives are available to dental students today, considering pre-clinical and clinical scenarios. All dental schools from Europe reported access restrictions to academic buildings, and planned to provide or were already providing online education to replace educational materials.[2] Additionally, dentistry will have to ensure a greater convergence with medicine.[4] We should rethink our curriculum and our way of delivering classes and lectures in adequation with this new reality.[3,16,19] The COVID-19 pandemic highlights a need for further research in this area, to educate our students more comprehensively. Our educational councils should be stimulated to formulate institutional policies which generate new options for students and professors in this new reality. Finally, the challenges will be greater in developing countries. Unequal student access to quality internet can compromise achievement in remote activities. To return to clinical activities, major investments must be made in dental school clinics, to adapt to the new biosafety reality of the post-pandemic period.

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