

2020-11

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Sonkar J, Saxena D, Kong C. Influence of COVID-19 on Dental School Education in United States: Emerging and Future Challenges. *Journal of the Massachusetts Dental Society*, Volume 69, Number 3, Fall 2020

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# The Influence of COVID-19 on Dental School Education in the United States: Emerging and Future Challenges

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## EDITORS' NOTE

The information contained in this article was accurate at the time of its acceptance. It's understood that the situation at each dental school is different and subject to change.

## INTRODUCTION

Wuhan, in the Hubei Province of China, became the epicenter of a pneumonia outbreak of unknown cause in December 2019.<sup>1</sup> The viral pathogen was named as the causative agent for the condition known as coronavirus disease 2019 (COVID-19) by the World Health Organization (WHO) on January 12, 2020. Coronavirus was announced as a causative pathogen on January 8, 2020, by the Chinese Center of Disease Control.<sup>2</sup>

Literature reports COVID-19 virus and severe acute respiratory syndrome coronavirus (SARS-CoV) have 70% similarity and belong

to the same beta coronavirus subgroup with genetic differences.<sup>3</sup> The viral pathogen is highly contagious and has the ability to spread aggressively and infect numerous people in a small time frame. The WHO declared it a global pandemic on March 11, 2020.<sup>4</sup> Transmission occurs primarily through respiratory droplets among subjects who are in close contact with one another. Patients diagnosed positive with the disease present with symptoms such as fever, dry cough, difficulty breathing, and chest radiographs showing invasive pneumonic infiltrates in both lungs.<sup>5</sup> The incubation period of COVID-19 has been estimated at five to six days on average but could be as long as 14 days. The primary mode of transmission occurs via respiratory droplets produced when the infected person coughs or sneezes. The mode of transmission is identical to coronavirus-induced pneumonia leading to SARS where airborne droplet transmission of infection was considered the main route of spread.<sup>6</sup>

In order to limit the spread of the virus and contain the outbreak, the Department of Public Health issued the cessation of all non-emergent dental care and promoted online and remote teaching to encourage social distancing. While this is a step toward controlling the outbreak, nonetheless this has severely impacted dental school academics, making it challenging for the senior pre-doctoral and post-doctoral candidates to graduate. As a teaching institution, the dental school must not only navigate the challenge of managing and providing optimal patient care, but also address scholastic responsibilities. The primary objective of this article is to review and explore online pedagogy, remote learning, and its impact on student learning. The article also aims to outline numerous approaches undertaken by dental institutions in the United States to address academic challenges and clinical care.

## PARADIGM SHIFT TO REMOTE LEARNING AND ITS IMPACT

Due to the increased risk of viral transmission, the COVID-19 pandemic has warranted minimal human interaction, thus affecting normal functioning of life. In order to safeguard the health of dental personnel, students, and patients, dental schools in the United States announced immediate closure of all clinical facilities only tending to emergencies and made a paradigm shift to consultations through telemedicine and remote learning.<sup>7</sup> Per the Department of Public Health guidelines, a gathering of more than 10 people is prohibited. The protocols for remote learning and clinical care were outlined and heavily influenced from the system adapted during the SARS outbreak in 2003.<sup>8</sup> In the current scenario, per the Commission on Dental Accreditation (CODA) Guidelines for Reporting an Interruption of Education During COVID-19, numerous modifications are being made to dental education programs as they are interrupted due to the stay-at-home orders. These modifications were drafted in a closed meeting conducted on April 2, 2020, and were set forth to ensure that the education quality will comply with the accreditation standards.<sup>9</sup>

The scholastic adjustments outlined by CODA would not only ensure students continue their education without interruption, but also minimize the chances of exposing students to increased risk of infections. Some of the modifications adopted included

transition to virtual learning by organizing remote classes, meetings, and exams and advising students to return home if possible. Furthermore, the recommendations included that the dental schools should encourage students to engage in self-learning by utilizing online resources and embracing the latest academic developments.<sup>7</sup> Several schools have initiated clinical simulations to ensure completion of clinical competencies while enforcing the class to be fewer than 10 people.<sup>10</sup> Moreover, the modifications also included canceling external rotations and externships, and rotating minimal personnel—residents and faculty—for on-call coverage during emergency care.<sup>11</sup>

All CODA-accredited dental and dental-related education programs have an obligation and responsibility to ensure the competency of the program's graduates, including the Class of 2020.<sup>9</sup> To ensure continuity of education with minimal disruption, CODA-recognized innovative approaches have been adopted by institutions for online pedagogy and are incorporating the use of different platforms like Zoom, Microsoft Teams, Respondus Monitor/LockDown Browser, and ExamSoft for distance education, case studies, problem-based learning tutorials, artificial intelligence, and virtually proctored examinations.

For instance, Boston University Henry M. Goldman School of Dental Medicine (BUGSDM) has switched to various modes of social media (Facebook, Instagram, Twitter, email, and university websites) to allow timely and regular communication with faculty, students, and staff. Clinical activities and patient care for all pre-doctoral students and residents have been suspended until further notice. The school has adopted Zoom as one of the online mediums to conduct live lectures for dental students, departmental meetings, treatment planning seminars for pre-doctoral and post-doctoral dental candidates, and oral examinations. A task force consisting of all pre-doctoral and post-doctoral program directors, post-doctoral residents, and class presidents was established. The objective of this task force was to develop academic plans to ensure timely completion of the clinical competencies and requirements to allow for graduation.

Institutions like the University of Florida College of Dentistry have developed a written case-based assignment and rubric for

the remaining senior students to complete their clinical requirements and competency assessments. For those who still require clinical competencies, University of Florida and Boston University have decided to use their mock board clinical experiences for competency assessment. The Howard University College of Dentistry, University of Minnesota School of Dentistry, and Stony Brook College of Dental Medicine are a few of the many dental schools that have adopted Zoom for didactic teaching and seminars. Top Hat is another popular platform embraced by dental institutions for online learning, administering remote exams and quizzes, and verifying online attendance. It would be interesting to compare these platforms and assess their ease of usage in terms of user interface and navigation.

A recent study explored student perceptions toward online learning and traditional classroom teaching, and it was concluded that students favored online learning as they experienced improved interaction with faculty due to their ability to provide immediate feedback and instant response.<sup>12</sup> While there are perceived advantages to an online medium, another study reported that 66% of online students were at increased risk for obesity and about 54% demonstrated a sedentary lifestyle with minimal physical activity.<sup>12</sup> Students also illustrated increased predilection for loneliness and depression.<sup>13</sup>

Faculty members have reported their experience with online learning to be satisfying, as they have valued students' attentiveness and receptivity; however, limited infrastructure and administrative aid, intimidation due to a higher student-faculty ratio, and technological incompetence can be roadblocks.<sup>12,13</sup> In order to bridge the barriers of virtual learning, it is important to assess the perceptions and outcomes from the dental students and faculty.

## SCHOLASTIC CONSIDERATION

COVID-19 has impacted multiple aspects of students' lives and amplified their anxiety by causing economic stress. The lockdown has not only affected their daily lives and academics, but also impacted employment opportunities in the future. Worldwide quarantine has disrupted businesses and contributed to an economic slowdown that complicates the future employment situation, further fueling students' apprehension.

Prolonged social distancing and lack of interpersonal communications often trigger psychological symptoms, such as depression and anxiety, leading to poor availability of mental health care.<sup>14</sup> A similar impact was seen among medical students during the Middle East Respiratory Syndrome Coronavirus (MERS-COV) outbreak in Saudi Arabia, where 23% of the students reported mild to moderate anxiety, mostly prevalent in females and junior medical candidates.<sup>15</sup> Similarly, another study reported increased risk of worry, stress, and stigma from working at hospitals as about 30% of health care professionals were reported positive with MERS-COV infection.<sup>16</sup> CODA has emphasized the need for psychological services for students, residents, and fellows because of the fear and pressure they experience. Reassurance, an optimistic approach, and virtual interaction with an advisor (faculty/staff) will help students express their fears and gain timely interventions.

As COVID-19 continues to spread worldwide, so does xenophobia. Constant news reports and public sentiments displayed in the media and on social media can deteriorate mental health and fuel hatred toward a particular ethnicity and/or community. One's emotional intelligence quotient is further challenged, leading to depression, social anxiety, and/or neurosis when combined with isolation and social distancing.<sup>17</sup> There have been increased reports of mental instability, such as persistent anxiety, panic attacks, and delirium, along with suicidal thoughts—especially for those who are on the front line treating the COVID-19 virus.<sup>14</sup> International students in the United States often come across varying degrees of discrimination based on their skin color, accent, and country of origin. A recent report highlights a surge in anti-Asian sentiment since the COVID-19 pandemic.<sup>18</sup> The report discusses the increasing incidence of xenophobic slurs on online mediums targeted toward Asian and Asian-American students to the point where Chinese students have been vilified on the streets and on campus, increasing fear and anxiety for their safety and their future in the United States.

The pandemic has resulted in an escalation of tensions, pushing these students further into social isolation. Reports have pointed out elevated stress, low self-esteem, and extreme behavior (e.g., suicide) among

these students.<sup>19</sup> The Office of Civil Rights and U.S. Secretary of Education Betsy DeVos have acknowledged increasing incidences, concerns, and reports regarding stereotyping, harassment, discrimination, and bullying directed toward Chinese-Americans and others of Asian descent, including students during the past SARS outbreak.<sup>20</sup> Protocols should be kept in place by institutions to ensure that there is no bias or discrimination on the basis of race and ethnicity, and that students are protected. There is a need for risk assessment and evaluation of the mental health of students, especially international scholars. Constant updates on COVID-19 and credible reports can reduce tension, mass hysteria, and the spread of fear mongering. Online mental health programs offered by universities can be beneficial tools in managing the mental state of their students and employees. Access to telemedicine, especially psychiatrists, has proven advantageous in early symptom identification and timely psychological interventions.<sup>21</sup>

#### STEPS TAKEN TO ENHANCE UNIVERSAL PRECAUTIONS FOR EMERGENCY PERSONNEL

*Universal Precautions—Protocols and Policies*  
Current reports suggest that COVID-19 transmission occurs through close contact with an infected person and disease can spread via aerosols that enter lungs through oral, nasal, and suspected fecal routes.<sup>5</sup> Due to the nature of dental practice, dental professionals are at high risk for infection. This produces additional challenges to dental schools as they cater to clusters of workforces including faculty, staff, students, and patients. Aerosols are routinely produced through the use of high-speed handpieces, ultrasonic, and Cavitron instruments. Blood and salivary droplets can be suspended in the operatory from two hours up to 9 days.<sup>22</sup> Recent evidence points out that the virus can be suspended in the air and on various types of inanimate objects for several hours to possibly even days depending on the humidity and surrounding temperature.<sup>23</sup> Due to the virus's ability to survive for longer periods, disinfection is important. Hand washing has long been proven to impede microbial spread and reduce risk of transmission.<sup>24,25</sup> The practice of double gloving during intraoperative emergency procedures significantly impedes microbial transfer to the provider and the patient.<sup>26</sup>

Respiratory droplets and aerosol production in the dental operatory are inevitable. As a result, the use of N95 or FFP2/3 masks are recommended for health care providers to protect against respiratory distress-inducing viruses like SARS coronavirus, MERS coronavirus, and COVID-19.<sup>27,28</sup> Recommended personal protective equipment (PPE) including gowns, masks, face shields, goggles, and respirators help prevent the virus from entering skin or mucosa. Due to the COVID-19 outbreak, recently published literature emphasizes the use of ultraviolet C rays to disinfect the operatory and the use of alcohol-based wipes to cease microbial transmission.<sup>23</sup> It is imperative that the disinfectant used to clean the surfaces has anti-viral activity. Various formulations that are quaternary ammonium or ethanol-based can be used as an alternative to cleaning operating surfaces.<sup>23</sup> Chlorhexidine rinses prior to operative procedures reduce microbial load, thus decreasing transmission risk for the next 60 minutes.<sup>29</sup>

#### EMERGING CHALLENGES

Several guidelines have been mandated for dental practices, including: emergency appointments only; using telemedicine to triage patient consultations and referrals; restricting patient visits to minimal entry and exit points in well-ventilated areas; limiting personnel; triaging symptomatic patients with respiratory symptoms; and installing barriers and separate rooms for suspected patients.<sup>30</sup>

##### *Triage Patients to Restricted Entry/Exit Points*

It is highly recommended that proper precautions be followed while managing patients during dental appointments. Triage tents should limit entry and exit points with clear signage indicating safe hygiene practices. Maintaining six feet of distance between patients and personnel followed by rapid triaging to secure limited face-to-face contact can safeguard health and safety. The triage workforce should work in minimum numbers and rotate often while strictly following universal precautions. All dental personnel should be equipped with PPE and patients should wear masks during their screenings and office visits. Prompt referrals and isolation of suspected COVID-19 patients should be established. Symptomatic patients should be treated following the U.S. Centers

for Disease Control and Prevention (CDC) recommendations. Patients who have or are suspected of having COVID-19 should be moved to well-isolated and ventilated rooms. Patients with serious oral and maxillofacial involvements should be promptly referred to hospital care.<sup>30</sup>

#### Patient Examination

Risk of nosocomial infections are high as microbes not only spread through respiratory or oral routes, but also through punctured gloves and PPE.<sup>25</sup> One must minimize procedures that could induce coughing or the production of aerosols. Alginate impressions and intraoral radiographs can induce respiratory droplets and coughing.<sup>31</sup> Use of intraoral scanning, panoramic radiographs, or cone beam computer tomography should be promoted during the current situation.<sup>32</sup> Alternative dental procedures to reduce aerosol production must be considered. The use of pre-operative mouth rinses, such as chlorhexidine, can potentially decrease microbial count.<sup>30</sup>

#### Dental Emergencies

Use of isolated, well-ventilated, or negative-pressure rooms are recommended for treatment. One must strictly follow universal precautions while rendering treatment, followed by appropriate disinfection of the operator. In the event that procedures result in aerosol production, the patient must be scheduled toward the end of the day to prevent risk of transmission. Adequate clinical judgment must be used to reduce patient interaction and aerosol production while determining the course of therapy for dental care. Use of absorbable sutures, high-speed suction, and rubber dams can reduce saliva dispersion in the air and impede transfer of microbes.

#### CONCLUSION

The dental academic fraternity has united by sharing their departmental and university guidelines across mediums and online task groups in order to be able to ensure provision of the best possible dental education to students during these uncertain times. Although online remote learning, novel patient management protocols, and telemedicine have served to keep dental education and dental care running to their minimal capacity, future studies assessing the impact are warranted. **JMDS**

#### ACKNOWLEDGMENTS

The authors thank Dr. Erin Breen, periodontist and dental faculty at the Boston University Henry M. Goldman School of Dental Medicine, for her contributions.

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