



Original Article

# Innovation of dental education during COVID-19 pandemic



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## KEYWORDS

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**Abstract** *Background/purpose:* The impact of the pandemic of COVID-19 has a certain influence on various walks of life around the world. Because of the pandemic of this novel coronavirus in terms of COVID-19, the social life global wide has been changed a lot. To keep the social distance between human being to prevent from being infected is the most important strategy for all the countries. Many dental schools have been locked down to minimize the spread out of this coronavirus infection. Close contact between human being are required for all those learning process in traditional dental education. Learning methods should be innovated to keep on the learning process but away from being infected for dental education during pandemic. The purpose of this manuscript is to exchange the information and experience of those dental educators from different countries to prepare for the future demand for dental education during pandemic.

*Materials and methods:* By means of three online symposiums, dental educators from different countries were invited to give presentation and discussion regarding to the information and experience in the innovation of dental education during the pandemic.

*Results:* The results showed that the impact of the pandemic of COVID-19 affects the dental education a lot. Intelligent technology has certain benefit for the learning process of dental education during the pandemic.

*Conclusion:* The impact of the pandemic of COVID-19 affects dental education a lot. The model of dental education should be innovated to suit different situations and novelty intelligent technology should be applied for future dental education.

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## Introduction

The impact of the pandemic of COVID-19 has a certain influence on various walks of life around the world.<sup>1–3</sup> From West to East, from living style to business model, all have suffered from this coronavirus situation.<sup>4</sup> Because of the pandemic of the COVID-19, the social lifestyle global wide has been changed a lot. Even though the geographic distance among different countries becomes smaller due to the spread out of this coronavirus, the social distance between human beings should be increased to prevent from being infected.<sup>5–7</sup> Many dental schools have been locked down because of the pandemic.<sup>8</sup> Most of the lectures are switched to the online mode to keep on the learning progress for their dental students.

Dental education is mainly composed of three parts: The first is a Lectures/Problem Based Learning (PBL) part. This part is easy to switch to online mode. There are different systems available in the internet like: ZOOM meeting, Google Classroom, Google meet, Skype, and so on for the online learning. It is not difficult to keep the social distance for this kind of study. The second part is a Simulation laboratory courses. For this course, traditionally, after a demonstration by the teachers, the student will make practice in the simulation models. In such a pandemic environment, this part may be done using modern digital or virtual reality (VR) techniques. However, current facilities are not good enough, and also the procedure as well as the final work needs to be checked step by step by the teachers. Thus, the simulation laboratory courses need close contact between teacher and student. The third part is a Clinical skill training in terms of Internship training which is the most important infrastructure of dental education. There will be close contact between the intern doctor and the patient as well as the teacher. This part is also the most difficult part of dental education to deal with in a pandemic environment. In other hand, most of dental school have a research duty for faculty and student (undergraduate and postgraduate). For research, both *in vitro* and *in vivo*, students need close contact between human beings or with animals.

How to achieve the balance between keep on learning progress for dental students but not inducing spread out of infected cases is an important issue for dental education.<sup>9</sup> After the pandemic has been ebbing then lifting the shut down may induce another pandemic crisis because of the inevitable social contact in dental education. This will be an important issue in the ongoing dental education. Many lifestyles have been changed during the pandemic, to fit the future demand or another pandemic, dental education should be preparing in advance to face the future challenge and another possible pandemic. Through trial and error,

many dental schools around the world are working extremely hard to continue dental education in such kind of COVID-19 pandemic environment. The purpose of this manuscript is to exchange the information and experience of those dental educators from different countries, to prepare for the future demand for dental education.

## Materials and methods

The Association of Dental Education, Asia Pacific (ADEAP), co-organized three online symposiums with Chinese Taipei Association for Dental Sciences regarding to the innovation of dental education during COVID-19 pandemic. Dental educators from different countries were invited to attend online symposiums with ZOOM software (Zoom Video Communications Inc., San Jose, California, USA) and give presentations regarding their information and experience in the innovation of dental education during the COVID-19 pandemic from their own countries. These three online symposiums were held on 30th March, 2020, 15th April, 2020, and 10th June, 2020, separately.

The topic of 1st symposium was "Influence of COVID-19 in Dentistry". Eight scholars from The University of Sydney, Australia; The University of Hong Kong, Hong Kong; Loma Linda University, USA; International Medical University, Malaysia; National Yang-Ming University, Taiwan; Tohoku University, Japan; Chulalongkorn University, Thailand; and Columbia University, USA were invited to present the current situation of dental education during the pandemic in each own country.

The topic of the second meeting was "How to proceed the clinical skill training courses under the pandemic of COVID-19?" Seven Scholars from seven countries were invited to present how to proceed the clinical skill training under the pandemic of COVID-19, which includes: King's college of London, England; University of Geneva, Switzerland; Tohoku University, Japan; Harvard School of Dental Medicine, USA; University of Health Science, Cambodia; Manila Central University, Philippines; and Taipei Medicine University, Taiwan.

The topic for the third online symposium was "Post COVID-19 challenges in dental education, research and clinical activities". Five scholars from University of Brescia, Italy; University of British Columbia, Canada; Hokkaido University, Japan; National University of Singapore, Singapore; and Our Lady of Fatima University, Philippines, were invited to present and discuss the innovation of dental education to fit the future demands for the lifting post-COVID-19 pandemic lockdown.

Finally, we have compiled information and experience that collected from these online symposiums.

## Results

We summarized the information and experience obtained from different countries in Table 1. The results showed that lectures and PBL courses are processed in online mode except in Taiwan. Simulation laboratory courses are desisted in most countries except in Cambodia (with video demonstration). Simulation laboratory courses remain proceeded in Taiwan only. All the clinical training courses are desisted in most countries except in Taiwan. In Japan, the students are divided into small groups and case conferences and assessments were held online. Most of the research work is desisted in most countries except in Taiwan. In Japan, all the animal studies were suspended, only limited studies *in vitro* can still proceed. The private dental clinic is almost closed in most of the countries, except in Taiwan. Emergency dental treatment can be performed in the teaching hospital or local public dental clinic in all countries. While emergency dental treatment can also be performed in the private dental clinic in Taiwan.

## Discussion

The pandemic of novel coronavirus has a great impact on all the aspects of human life in global wide.<sup>1–3</sup> To prevent spread out of those infected cases by maintaining the social distance becomes the most important rule for all the countries.<sup>3,10</sup> Stay home to keep away from gathering can minimize the possibility of infection transmission in one way. But in another way, it limits the human contact and many social activities which downgrade the economic condition in many countries. Lockdown the border of

neighboring countries by suspending the transportation from one country to another has an advantage to keep away from coronavirus infection, but it also ceases the communication between different countries. The business will be terminated due to the lockdown, if the trade model has not been changed.

Dental education is a profession with the demand for close contact between human beings. After more than four months of lockdown because of the pandemic of COVID-19, we are facing another challenge in terms of “unblock” which may induce another crisis of being infected. Thus it is worthwhile to study the information and exchange the experience of those dental educators from different countries, to prepare for the future demand for dental education.

The results showed that almost all the lectures (or PBL courses) are switched to online courses to keep the social distance from gathering (Table 1). Many meetings have also been proceeded using online meetings. Different APPs have been utilized during the pandemic, i.e.: ZOOM, Google meet, Skype, Microsoft teams, Panopto, Canvas. The lockdown browser is used for the students’ examination in some of the dental schools in the USA. By means of the lockdown browser, students cannot search on the internet (like google and so on) to find an answer during the internet examination. This is one of the example to use modern information technology (IT) to prevent from cheating during the examination. In other hand, a dedicated online examination platform for dental education will also need to be developed. Different IT products have been used. Microsoft TEAMS has been used for real time online teaching for undergraduate students, while ZOOM is used for postgraduate students because it is convenient for the

**Table 1** Dental education during COVID-19 pandemic in different countries.

Country	Lectures/ PBL <sup>a</sup>	Simulation laboratory	Clinical practice	Research	Emergency treatment	Comments
Australia	online	No	No	No	Yes	Tele-dentistry Level 3 restriction
Cambodia	online	VDO <sup>b</sup> demonstration	No	No	Yes	Insufficient of patients Shortage of PPE <sup>c</sup>
Hong Kong	online	No	No	No	Yes	Postpone treatment
Japan	online	small groups	No	limited	Yes	Consolidating teaching hospital
Malaysia	online	No	No	No	Yes	
Philippines	No	No	No	No	Yes	Professional Postpone
Switzerland	No	No	No	No	Yes	Except emergency
Taiwan	Yes	Yes	Yes	Yes	Yes	Screening and history checked, delayed 2 weeks
Thailand	online	No	No	No	Yes/No	Only emergency surgery treatment
USA	online	No	No	No	Yes	No private clinics, Tele-dentistry, Combine teaching for 2021 curriculum, OSCE <sup>d</sup> instead of live-patients clinical exam Board exam in third years instead of fourth year for class 2022

<sup>a</sup> PBL: Problem Based Learning.

<sup>b</sup> VDO: Video.

<sup>c</sup> PPE: Personal Protective Equipment.

<sup>d</sup> OSCE: Objective Structured Clinical Examination.

students to call a meeting. Not only students but also the teachers should be familiar with those advanced IT productions. Professor Keiichi Sasaki from Tohoku University, Japan said that the change of learning modes from the auditorium to online, students can adapt it more quickly than senior teachers since students are more familiar with those IT productions. But the change may be difficult for those senior staff to adapt. This generation gap may become minimized after the pandemic, because of the current and future demand for the inevitable necessity of IT products for all generations.

Simulation laboratory courses are suspended in most countries, because of the movement control in many countries to keep the social distance and from gathering (Table 1). Video demonstration of simulation was used in Cambodia. However, since hand-on training is essential for the simulation laboratory course of dental education, a simple and easy-to-use virtual reality (VR) haptic device must also be developed. Otherwise, it is impossible to bring the simulation laboratory course online. Since the new semester in Taiwan was postponed for two weeks to begin, thus all the simulation laboratory courses were delayed for two weeks to start in February, 2020. But it was carried on through the whole semester until the middle of June, 2020 in Taiwan.

All the clinical training courses in each country are suspended because most of the dental hospitals and clinics are closed during the pandemic, except in Taiwan (Table 1). In Japan, students are divided into different groups to decrease the number of students to minimize the risk of so-called 3C: closed indoor venue, crowded place, and close contact, and only prepare the online case presentation and assessment. All the research work are suspended in most countries. Animal studies were suspended in Japan, but limited *in vitro* studies, which can be proceeded with computer at home were remain conducted. But all those research activities were ongoing in Taiwan. However, many researchers and scientists should be facing shift work during this pandemic situation. Even post-COVID-19 pandemic, the situation would be no any different.

Since most of the dental hospitals and dental clinics are closed, only emergency treatment like uncontrolled bleeding, cellulitis or a diffuse soft tissue bacterial infection with intra-oral or extra-oral swelling that potentially compromise the patient's airway, or trauma involving facial bones will be treated in the emergency unit of teaching hospital or public dental clinic in most countries. Video visits and telephone visits were used in Australia and USA. But emergency cases can be treated both in teaching hospitals as well as private dental clinic in Taiwan. The hospital should develop the guideline to protect patient and doctor from COVID-19 infection.

The guideline for emergency dental services are: 1. To wear personal protective equipment (PPE) which includes surgical hat, surgical gown including foot cover, surgical mask, and face shield. 2. To take the patient's temperature and ask the medical history (symptoms of COVID-19), traveling and contact history. 3. High power suction and rubber dam isolation for aerosol generation procedures are mandatory during treatment procedures.<sup>11–17</sup> This is similar in other countries. Emergency treatment should also be part of dental education during the pandemic of COVID-

19, only attending doctors and residents practiced in the emergency room but not intern doctors in most of the teaching hospitals of most countries, this may be due to movement control and lack of PPE.<sup>10</sup> The dental emergencies and urgent care have the risk of nosocomial infection to either student or staff state of Washington's Governor ordered subject to major penalties if performing non-emergency procedures. Dental students can be involved in this kind of emergency treatment only if PPE and other anti-infected equipment is sufficient to support this special learning course.<sup>10</sup> Australia government announced Level 3 Restrictions which declared that all of the dental clinics should be closed, because of the shortage of surgical masks and N95 respirators for a protracted period. PPE should be prepared in stock not only for dental practice but also for dental education purpose in advance for the challenge of the next pandemic to keep the right to education for those dental students.

Taiwan demonstrated an exception in dental education during the pandemic. It may be due to some early actions taken in Taiwan. The Central Epidemic Commanding Center (CECC) has been activated since 20th January, 2020. Strategies suggested and controlled by CECC in the field of medication included: triage and screening for patients with fever, limited visitors to all hospitals, and management of outsourcing manpower. Surgical masks and gowns as well as 75% alcohol for sterilization have been rationed by the CECC. All hospital medical professionals were required by the CECC to refrain from going abroad. Dental services have been classified as one of the high risk health services, PPE were suggested to use and provided by CECC accordingly, Non-emergency dental services, especially those generating aerosols, are suggested to be delayed to a later time. TOCC (travel, occupation, contact, cluster) history have been used to screen for the high risk group. The IT of Taiwan's public health insurance system has been very useful in providing traveling history, occupation history and rationing surgical masks for all citizens. To wear a surgical mask is mandatory for everyone during taking public transportation. All schools and universities delayed their new semester for two weeks to decrease social/community interactions. CECC calls press briefing at 2 PM every day to provide the public with correct information both domestically and internationally. More than 50,000 people has been quarantined by the CECC, and a fine up to 30,000 USD for incompliance. Because of these strategies, the dental education can be proceeded as usual only all the staff and students have to wear a surgical mask all the time and take the temperature before entering dental school. Internship clinical skill training course is proceeded in the teaching hospitals as usual only the number of patients treated are decreased because of delayed treatment asked by some patients.

The severity of the pandemic of COVID-19 was depended upon the social contact among people.<sup>3,5</sup> The number of confirmed cases and the number of death because of the pandemic of COVID-19 seem to be higher in those countries whose strategy to lockdown were later than those countries with an earlier decision to lock down. The number of death may also due to the pandemic are higher in those countries with super aged society.<sup>18,19</sup> It may be due to those elderly are general health compromised.<sup>20</sup> Thus to integrate



general health into dental education becomes more and more important.<sup>21</sup> Dental patients are also becoming more and more elderly. Therefore, we must pay attention to this point when we are providing dental education.

Online lectures or demonstration becomes an inevitable technique for future dental education. To learn sufficient knowledge and technology regarding to IT will be mandatory in dental education both for educators and students. How to make assessment online will be an important issue for future demand. The epidemiology experts say that second and third wave of COVID-19 pandemic is certain to come. Humans have fought various epidemics and viral outbreaks throughout history. Even after this COVID-19 pandemic, there will be another pandemic sometime in the future. We, as dental educators and dental professionals, must create a system to address this situation. There is a lot of work to be done, such as build online lectures, develop VR devices for online simulated training, develop an online exam system, and create guidelines for dental education under the pandemic situation.

Crisis can also produce opportunities. Since many lectures are switched to online courses during the pandemic. By means of the internet, those courses can be disseminated to as many students as possible only if the internet is equipped. Many dental schools are shortening of teaching staff ie; man powers and teachers.<sup>22,23</sup> In this case, if online courses can be shared among different dental schools in different countries, we can not only solve the problem of shortage of teaching staff but also can determine the main courses for the core competency of the dental students in different countries to reach a consensus of core competency world-wide.

The impact of the pandemic of COVID-19 affects dental education a lot. To face the future challenge the dental educators should be cautious but not panic, being flexible, and willing to face the changes. The novel coronavirus may force dental educators to revolutionize the education system. Intelligent technology can help for dental education in many ways during the pandemic. The model of dental education should be innovated to suit different situations and new technological tools should be applied for dental education.

## Declaration of competing interest

The authors have no conflicts of interest relevant to this article.

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