A Comparison of Dental Education Between University of Toronto and Zhejiang University During COVID-19 Pandemic

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Research

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Abstract

Background: To compare the contingency modifications to the dental education between the University of Toronto Faculty of Dentistry and the Zhejiang University School of Stomatology during COVID-19 pandemic, and to share experiences in keeping the dental academic continuity, resuming practicing activities and preparing the faculty and students for a new normality. Three approaches were adopted to collect information and data: online interviews and email-contact with the instructors and the deans, a small-scale online survey of dental students, and official online announcements of various authorities.

Results: The two universities shared similarity in changing trends, while differed in details. The delivery of lectures, seminars and exams was transitioned from in-person mode to online mode and has proceeded effectively and efficiently. The pre-clinical lab training and clinical rotation were the most retarded parts and will not be resumed until the settle-down of the pandemic. Research activities have been kept on at the best possible level. Since the Zhejiang University reopened the campus in May 2020, clinical activities and research works were in recovery with a cautiously-planned and gradual phased approach.

Conclusion: Both universities have been trying their best to meet the academic needs of students while protect their health, and to keep alert to the real time epidemic situation in preparation for resumption. Dental institutions could take the COVID-19 pandemic as an opportunity to armor dental students with infection control measures prior to their reengagement into clinical practice. There is a need of a new normality for global dental education that spans time and space.

Background

The COVID-19 (2019 Novel Coronavirus) pandemic has a profound impact on people around the world in many ways. According to the latest tally from Johns Hopkins University & Medicine,[1] the number of COVID-19 cases confirmed worldwide has exceeded 7.78 million (accessed on Jun 14). Countries around the world are taking responsibilities in building comprehensive strategies and instructions to prevent infections, save lives, and minimize economic and social disruption. People are working from all kinds of places to “flatten the curve” of the coronavirus pandemic to get through this crisis.[2] Whether the disease will be effectively controlled through effective vaccination or adequate social distancing, there is still a long way to go.

Both dental professionals and dental patients are in an increased risk of contracting infectious diseases via direct contact or aerosol.[3] Dental care always involves face-to-face communication and treatment manipulation with patients not wearing masks.[4] The dental workforce is frequently exposed to saliva, blood and other body fluids which are potential infectant.[5-7]

During the current COVID-19 pandemic, the dental education institutions are challenged to cope with various difficult circumstances.[8] A number of contingency modifications must be implemented to balance protecting students, staff and patients, and ensuring the academic continuity. The institutions

also take important responsibility for training dental students, as well as the staff, to adopt adequate knowledge about infection prevention and control. As mentioned by Suhani Ghai,[9] the current dental curriculum does not cover infection control adequately especially in resource-constrained countries, dental students are probably more susceptible to viral respiratory illnesses because of the poorer knowledge and lack of practice of infection prevention.

It is of great importance to explore the contingency changes in different dental education institutions and systems worldwide in this unprecedented pandemic, which seems not to end quite soon and may recur periodically in the future. The exploration would be focused on whether these changes compromise the quality and efficiency, whether students have been fully motivated to engage in distance learning, how to proceed with the certification of the graduating dental students' competency, and how to prepare the staff and students for returning the campus and resuming the clinical practice in accordance with a new normality.

As the students and the accompanying faculty members in an exchange program between the University of Toronto Faculty of Dentistry and Zhejiang University School of Stomatology, the authors had joined the undergraduate and graduate classes in University of Toronto from January through March, 2020. However, the program was cancelled earlier than planned, following the announcement of the temporally closing of public schools by the Ontario government and as a contingency measure in the pandemic to the faculty. All the program participants returned to China safely and then back to campus in early May. They witnessed the step-by-step recovery of Zhejiang University.

In this article, the modifications to the dental education were compared between the University of Toronto Faculty of Dentistry and the Zhejiang University School of Stomatology, and the similarities and differences were discussed. The following aspects were involved: pre-clinical classes, pre-clinical laboratory training, assessment, clinical activities, research activities and student feedback. While Zhejiang University is gradually recovering from the lock down, its experiences can be shared with other universities and colleges which are still temporally closed and provide a model of a gradual phased approach to reopen the campus and to resume clinical activities and research works. As a positive response to COVID-19 pandemic, it is also suggested to take the opportunity to inspire a new normality of dental education that could break the barriers of time and space.

Results

2.1 Pre-clinical Classes

Both of the University of Toronto and the Zhejiang University temporarily closed the faculty or the school in response to the infection prevention measures announced by the administrative authorities,[10-13] when the local epidemic situation was exponentially deteriorating. All the pre-clinical classes were transferred to an online mode via established or establishing online platforms respectively, in assistant with other software, applications and education management systems.

On March 16, the University of Toronto Faculty of Dentistry temporarily suspended all pre-clinical classes for DDS (Doctor of Dental Surgery), IDAPP (International Dentist Advanced Placement Program) and graduate students, including didactic classes, laboratory training in-person lectures and seminars, except one pre-clinical practical test of Prosthodontics on March 16 and a few small group seminars for graduate on March 19. (Figure 1)

Since then, the faculty have been delivering all the didactic classes, quizzes, group discussions, and seminars online through an established online teaching and learning system Quercus,[14] which is powered by the Canvas learning management system.[15] Quercus was officially put into use across the university's three main campuses in Sep. 2018,[15] and then has been used as a common helpful supplement to the daily education activities throughout the campus for almost two years. At the contingent closing of the faculty, the well-established Quercus was changed into the main field of teaching activities. With customized instructor and student interfaces and the course materials deposited during the last two years, such a quick shift in teaching mode posed little challenge for both the instructors and the students in term of the technique. However, there still was a learning curve for both instructors and students to "talk" to a screen instead of real persons. In addition, not only the conference module of Quercus, but also other conference applications, such as Skype[16] and Zoom[17], were used separately or in various combination during the online teaching process. Beginning the week of April 6, term tests were resumed and carried out remotely through Quercus, and final exams for DDS students took place at originally scheduled time via ExamSoft.[18] For invigilation, the students were asked to run Zoom on their cell phone simultaneously, so that one invigilator could watch 20 students in the exam.

Since the epidemic in mainland China were approaching the climax, the Zhejiang University School of Stomatology postponed the students' return to campus after the Spring Festival holiday. Online classes started on February 24, the scheduled starting time of the spring term. Currently, even after students have returned to the campus in organized groups between May 4 and 10, online course delivery is still continuing. (Figure 2) Online delivery is carried out mainly through two platforms: Ding Talk[19] and Learning in ZJU version 2.0.[20] Ding Talk is a kind of live video conferencing, on which live lectures and seminars can be held and videoed, then the videos are uploaded to the newly-developed Learning in ZJU version 2.0 web platform. The videos are accessible for the students to review and will be edited into MOOC in the future. After-class questions and discussions are done in Ding Talk, while tests, quizzes, homework assignments, and the online mid-term exams are conducted through the Learning in ZJU version 2.0. Besides live lectures, streaming videos pre-made by the Zhejiang University and published in the Chinese University MOOC website[21] are also utilized. In term of invigilation of the online examination system, strict rules have been set for the mouse pointer tracking in the Learning in ZJU version 2.0, briefly speaking, once the mouse pointer controlled by the student leaves the examination page more than twice, the exam interface will close automatically. At the same time, two invigilators are arranged to supervise fifty students via a real-time video call in Ding Talk.

The Learning in ZJU version 2.0 is developed on the base of tronclass platform in Nov 2019 and was first put into use in the dental education in Jan 2020, the time that was in the climax of the COVID-19 pandemic in China. Due to the developing nature of the Learning in ZJU version 2.0, the instructors and student volunteers have been active helpfully in building up and improving the online education platform, conducting trial lectures and debugging to ensure its quality and efficiency. More and more learning materials have been uploaded into the online platform as the online courses are going on. More and more functions have been built into it, including the statistical analysis of the learning records of the students and the portable version in smartphones, which is similar to the counterpart of Quercus.

2.2 Pre-clinical lab training

The Pre-clinical lab training of the two universities were suspended along with the didactic classes. The University of Toronto Faculty of Dentistry plans to make up these lab classes in the future, on condition that the local epidemic will settle down and the students are allowed to attend school. (Figure 1)

The dental students of Zhejiang University also had the pre-clinical lab training postponed for about three months. The instructors of the *Periodontology* attempted to demonstrate practical techniques via live video, and even a portion of the practical test was completed through video. However, the off-line practical training and tests are still arranged in the future. In supplement to insufficient lab training, some lab hours were assigned to reviewing literatures. Currently, as the students have returned to campus, condensed and supplementary laboratory training have been provided for both the undergraduate and graduating class students since May 26. (Figure 2)

2.3Assessment

In according with the change of teaching methods, the assessment methods were adjusted.

The University of Toronto Faculty of Dentistry developed a new examination and task schedule for the term tests of various subjects. Some instructors proposed to change the evaluation formula of courses or term grade points to reduce the number of term tests, such as more weight or credits on daily performance, homework, online active response or final written exam. All the adjustments to the assessment method would not be approved until most of the student voted to accept them in advance. An optional Credit/Non Credit grading system was also implemented for some courses providing the students an alternative between keeping grades or switching them to the Credit/Non Credit.

The Zhejiang University School of Stomatology also adjusted the composition of the final grades, for example, taking the literature reviewing reports and online oral presentations as parts of the daily assessment. The fulfillment of self-studying MOOC videos was also included. Similarly, the students' consent was one of mandatory prerequisites to adopting these adjustments. A final written exam of the graduating grade was carried out in July, while no practical assessment was required for this grade. Due to the strict policy of Zhejiang University in terms of the control of the repetitive ratio and the potential risk of exam leak, the questions of the written exam were not pulled out of any standardized databases.

However, in contrast to the number of four students failed in 2019, all the graduating students this year passed the written exam. This may indicate, at least as far as the theoretical and didactic part is concerned, the quality of the dental education was not compromised during the pandemic.

2.4 Clinical Activities

According to the announcement by Royal College of Dental Surgeons of Ontario (RCDSO) on March 15,[22] it was strongly recommended that all non-essential and elective dental services be suspended immediately and that emergency care be maintained in dental clinics, which had the necessary safety precautions and personal protective equipment (PPE) in place. Remote patient screening was also suggested prior to patients' referral to the emergency room.

In the University of Toronto Faculty of Dentistry, all patient care service in the clinics have been suspended since March 16, exception for emergency care for the students' own patients or immediate post-operative care. The graduate specialty residents must coordinate with their program directors about the clinical emergency cases before providing any service under supervision. As of April, only a small number of approved essential personnel were working at the dentistry building, continuing to provide emergency services and oral pathology biopsy services to patients. The elective dental treatment is expected to be resumed as early as July 6, if the pandemic will settle down. (Figure 1)

The range of dental services in the Affiliated Stomatology Hospital of Zhejiang University varied in accordance with the national and local epidemic situation. (Figure 2) Following the instructions of the National Health Commission of PRC, only emergency service was offered at its headquarters from January 31to March 1. As the official epidemic prevention level went down, some dental services were resumed under the strictest PPE controls in the headquarters on March 2, but ultrasonic scaling, implant surgeries and tooth preparation with high-speed rotatory instruments were still forbidden. On the same day, both the two divisions re-opened for emergency services. In order to serve more patients, night shifts have been arranged since April 26. Full range of dental services have been available in the headquarters since May 19. However, by now, only online-booked patients were allowed to visit the hospital.

Strict preventive measures have been taken in the Affiliated Stomatology Hospital of Zhejiang University. Every staff member, including the dental workforce, administrative staff and logistics sections, must be negative in the COVID-19 nucleic acid test prior to his/her return to work. No one is allowed to enter the hospital, unless a mask is on, the body temperature is lower than 37.3°C/99.1°F, and the Health QR code is green. The Health QR code is launched by the Chinese application Alipay aiming to track people's real-time health conditions and other information related to the epidemic, including the contact and travelling history. Negative COVID-19 nucleic acid test result is mandatory for inpatients before admission. More separate operating rooms have been isolated and prepared for the high-risk treatments, such as aerosol generating procedures (AGPs). Strict PPE standards have been executed throughout the hospital with consideration to the infection risk during the various treatments.

Graduate students who live in Zhejiang province were allowed back to clinical practice according to their own wishes as early as April 1. Graduate students returning from other regions and all the undergraduate students went through fourteen-day quarantine. The nucleic acid test results must turn out negative before any of these students resumed clinical practice. Undergraduate students in the graduating class had been in internship rotation since last year, but their remaining rotation were transferred to laboratory practice on phantoms and typodonts. In plus their absence during the temporary closure of the campus, there will be a total of five-month loss of clinical practice from February to their graduation at the end of June. Considering these students are in a “5+3” consecutive dental program, proper modifications in the three-year graduate period may be a remedy for the loss of clinical rotation during the five-year undergraduate period, but no specific plan has been raised up yet.

2.5Graduation and graduate degree defense

For the DDS4 students at University of Toronto, their graduate degree defenses were done online, and a virtual convocation and award ceremony was held on June 5. The Licensing were postponed due to the pandemic.

For dental students in the graduating year of Zhejiang University, the graduate assessment schedule includes two steps: written examination and clinical rotation assessment. An on-site written examination was held on June 11, but the clinical evaluation is missing. In March, a few graduate degree defenses of PhD were done online, but the on-site defenses of graduate residency were done during May 26 through May 29.

2.6Research Activities

Despite restricted access to the research laboratories, the University of Toronto Faculty of Dentistry has conducted the scholarly activities as much as possible. In April, a small number of their labs were approved to conduct essential research, including a COVID-19-related investigation. The faculty are planning to restart the research that cannot be done remotely with a gradual approach. On May 8, the faculty announced the cancellation of summer research program 2020, an annual event through which the undergraduate students can gain hands-on research experience in basic, clinical and public health research. (Figure 1)

In the Zhejiang University School of Stomatology, the research labs were locked down on February 5. Only one staff was appointed to inspect the laboratory and maintain the machinery weekly. The research laboratory partially reopened on February 25, and were restricted to the access of maximum fifteen faculty or staff members each day. Considering the research continuity and the need of graduation, the laboratories began to accept the application of graduate students on March 17. Priority was given to those who live locally or had been through home quarantine with negative nuclear acid testing and no COVID19-related symptoms. Although the upper limits expanded to thirty persons per day, undergraduates were not approved at that time. Since May 25th, the research laboratories have been

accessible to all the graduate students and undergraduate students who take part in the research work. (Figure 2)

2.7 Supports.

The University of Toronto Faculty of Dentistry offered an information guide on COVID-19 on its website.[23] Scholarly resources on COVID-19 were compiled by the University of Toronto Dentistry Library and other medical libraries worldwide to help students better understand the rapidly evolving evidence sources and help them with decision-making in the future. From this point of view, the resource update and information integration of Zhejiang University still needs to be improved.

The University of Toronto encourages students experiencing difficulties during this special period to seek the help of teachers and faculty through the My Student Support Program (MYSSP) or the Good2Talk platform; [24] The MYSSP provides students with immediate and/or ongoing confidential 24-hour support for any school, health, or general life concern.[25] Good2Talk is also a platform that provides confidential psychological support. Besides, the faculty members and staff can access support through the Employee & Family Assistance Program (EFAP).[26]

The faculty also organized online staff-student meetings to discuss about student concerns. Under the pandemic circumstance, students of the faculty also supported each other through a series of online activities. They started to use the Zoom to send their weekly class-wide conference calls, and they exchanged messages, resources or communicated the progress of test preparation. On April 7, DDS1 class organized an online talent show where they shared skills or showed off hobbies. Moreover, the Dental Students' Society hosted the annual feel-good DSS Awards Night to present awards and thanks to instructors and faculty members and students. Online contact during this special period is of great significance to everyone engaged.

After the outbreak of COVID-19 in mainland China, the dental students in the Zhejiang University School of Stomatology witnessed the countless sacrifices of people's lives, especially the medical workforce. Facing the unprecedented impact on the public health system, the dental students were home staying merely as a member of the family and community to cooperate with the epidemic prevention work, but not as future medical workforce. Not until online courses began at the end of February, did the students reconnect closely with their teachers and classmates. A couple of online lectures in the topic of infection prevention in dental health care were arranged to prepare the students for clinical practice in the new normality.

2.8 Connection with Community and Society

The University of Toronto Faculty of Dentistry made decisions to support the health and well-being of the community by donating PPE, while retaining a needed core supply. In April, they sent out their three general anesthesia machines to local hospitals so that the ventilators can be utilized for patient care.

To relieve the load of the hospital, the Affiliated Stomatology Hospital of Zhejiang University provided free online consultation to the public.

2.9 Student Feedback

In the University of Toronto, dental students' responses to the distance learning diverged a lot. For examples, some students reported little difference between the online mode and the traditional one, while some preferred to ask questions at any time during live classes and get answers in time, and some others complained that they would be easily distracted during online learning. Worries about the progress of the pre-clinical labs were quite common, and anxiety was expressed by those students who had not finished all the clinical cases or earned graduating credits. In contrast, some students took this period as an opportunity to connect with other dental professionals from different places by participating in free dental continuing education courses offered through online platforms.

The dental students of Zhejiang University were basically satisfied with the quality and efficiency of online courses delivery, and they cherished more chances to make personal presentations. A student mentioned that the additional current and topical literature review was very helpful for the inspiration of critical thinking and evidence-based clinical decision. Besides, the writing skills was also improved. Opposite views included that remote collaboration within groups was inefficient, and the demonstration via videos was not clear and the assistance of an animation or illustration was in need. Similar to the students at the University of Toronto, they were worried about the sub-qualified study at home and the lack of laboratory training. For the graduating class, the absence of five-month clinical rotation was regarded as a big loss, but the remedy during the following three-year graduate and resident period seemed helpful to relieve the anxiety.

Discussion

In order to cut off the chain of virus transmission, maintaining social distance is very critical[2]. Therefore, it is necessary to suspend daily face-to-face activities, and transfer to online education mode as much as possible to ensure the education continuity[8]. In other words, whether or not it will compromise the quality of teaching to a certain extent, it is the best choice to suspend in-person activities and try to carry out remotely.

Both the University of Toronto and the Zhejiang University adjusted their teaching modes promptly to the respective epidemic situation. From a timeline perspective, COVID-19 mainly affected the beginning of a new semester of the Zhejiang University, and the final exams, laboratory training and graduate degree defenses resumed at the end of May. In contrast, the second half of this semester of the University of Toronto was affected, including final exams, graduation assessments, and degree defenses.

The daily teaching activities of both universities include primarily online knowledge delivery and online examinations, via online education management systems. Therefore, under the influence of the COVID-19 pandemic, both of them rely on the online systems not only to optimize the functions, content migration

and resources creation, but also to make the quality and convenience of online teaching meet students' academic needs as much as possible.

Compared to the Quercus[14] of the University of Toronto, “Learning in ZJU”[20], the online education platform of Zhejiang University, was relatively immature, but the Spring Festival holidays provided a development period to improve and optimize its online performance. It seems that the epidemic became an opportunity to promote the modern online education management system.

Quercus[14] is more than a cooperation system, but an app pool and a deposit of various teaching and learning information and materials[15]. In the University of Toronto, it is mandatory for every instructor to set up the course interface with the curriculum, syllabus, announcements, pdf versions of slides, videos, reference materials, assignment, etc., which are annually updated prior to the classes and accessible to every student in the class. The students can also participate in the customization of the course web content. Such a well-established online system can serve as an important competency to handle contingency situations.

The benefits of online education modes are obvious. With more and more online resources released by various universities and institutions, the space and time barriers of dental education are gradually broken[27]. As it mentioned above, dental students at the University of Toronto can conveniently learn CE resources online during lock-down. Similarly, dental students in the Zhejiang University also appreciated free options to "sit in" a variety of elective courses.

Students at both universities encountered various challenges. Psychological challenges included the anxiety caused by the continuous uncertainty of the pandemic, and the empathy for the people and the frontline medical workforce to fight against the COVID-19. More pressure was experienced by students in mainland China. To a certain extent, it interfered with the efficiency of learning. In addition, the epidemic also challenged the students to quickly adapt to the new education mode. If the surrounding is not the most suitable for learning, self-discipline is even more necessary.

However, there are positive influences on students, such as realizing the importance of mutual support among people, a deeper understanding of the specificity of the dental practice environment, recognizing the importance of infection prevention in clinical activities, and cherishing the campus time. In addition, it is also an opportunity for dental practitioners and university management staff to build up stronger connection with students.

The pandemic also arose a critical thinking on dental education and dental care system. Berry Quinn et al.[28] expressed that the COVID-19 pandemic would change the shape of the oral health workforce. For dental workforce education, public health education must play a more and more important role. For the future clinical services, the oral health care team need to be redeployed to assist infection control in inter-disciplinary teams.[28] The Zhejiang University School of Stomatology took cautious steps to restart the

clinical rotation, since the instructors did not think the undergraduates had been armored with enough infection control training to protect themselves.

Here are some suggestion to the future dental education: to improve online teaching and examination platforms with high-quality education resources; to provide a more mature and feasible alternative assessment system; to promote the production of visualization materials more suitable for distance learning; to carry out inter-university cooperation, international cooperation, and to use various platforms with open education resources; to integrate infection control education into the whole system theoretically and practically.

In this article, only a small-scale survey of dental students in the University of Toronto Faculty of Dentistry and the Zhejiang University School of Stomatology was conducted, since it was not a good time to do a large sample questionnaire survey, so no statistical data is provided.

According to the Singaporean daily the Straits Times, a joint paper released by the Singapore's National Centre for Infectious Diseases (NCID) and the Academy of Medicine concludes that after 11 days of getting infected, most patients are no longer infectious despite still testing positive, which could cause changes in current discharge policies and cut down the time spent in hospitals for patients who tested positive for COVID-19.[29] This conclusion has caused high concern and controversy. With deeper understanding of the virus, the epidemic prevention policy will be continuously reassessed and adjusted from time to time. In addition, how to cope with the asymptomatic infection in dental health care also needs more research to clarify.

Conclusion

The contingency modifications to the dental education systems in the University of Toronto Faculty of Dentistry and the Zhejiang University School of Stomatology were compared with consideration in the timeline of the local COVID19 epidemic situation. Although differences existed in details, both universities have tried the best to meet the academic needs of students with protecting their health. Dental institutions should take the COVID-19 pandemic as an opportunity to focus more on infection control education, and to inspire exploration of a new normality for advanced and open dental education, spanning time and space.

Methods

This study received Ethics Approval Letter from Medical Ethics Committee of Stomatology Hospital, Zhejiang University School of Medicine (2020-18). The information and data in this study comprise three origins. Firstly, online interviews or email-contact with the deans and the course directors from University of Toronto and Zhejiang University were conducted in terms of the contingency modifications. Then the feedback to the modifications were surveyed among dental students of the two universities in a small scale. The representative questions included, “what adjustments have been made to your courses? How

do you feel about these adjustments? Do you have any concerns and what do you think we can learn from this unusual period?” In addition, official announcements from various authorities and related entities were also collected as an important source of information. All the information was summarized and integrated on May 30.

Declarations

6.1 Ethics approval and consent to participate

The research was approved by the Medical Ethics Committee of Stomatology Hospital, Zhejiang University School of Medicine, China. Issued No.(2020)-(18).

6.2 Consent for publication

Not applicable.

6.3 Availability of data and materials

The datasets used during the current study are available from the corresponding author on reasonable request.

6.4 Competing interests

No conflict of interest needs to be declared by the authors.

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6.6 Authors' contributions

JZ and XZ should be considered joint first author and were major contributors in writing the manuscript. JZ, XZ and NZ performed online interviews with the deans and the course directors from University of Toronto Faculty of Dentistry and Zhejiang University School of Medicine. SW, GY, JW, YW and HY conducted a survey among dental students from the two universities and sort out feedback. All authors read and approved the final manuscript.

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Figures

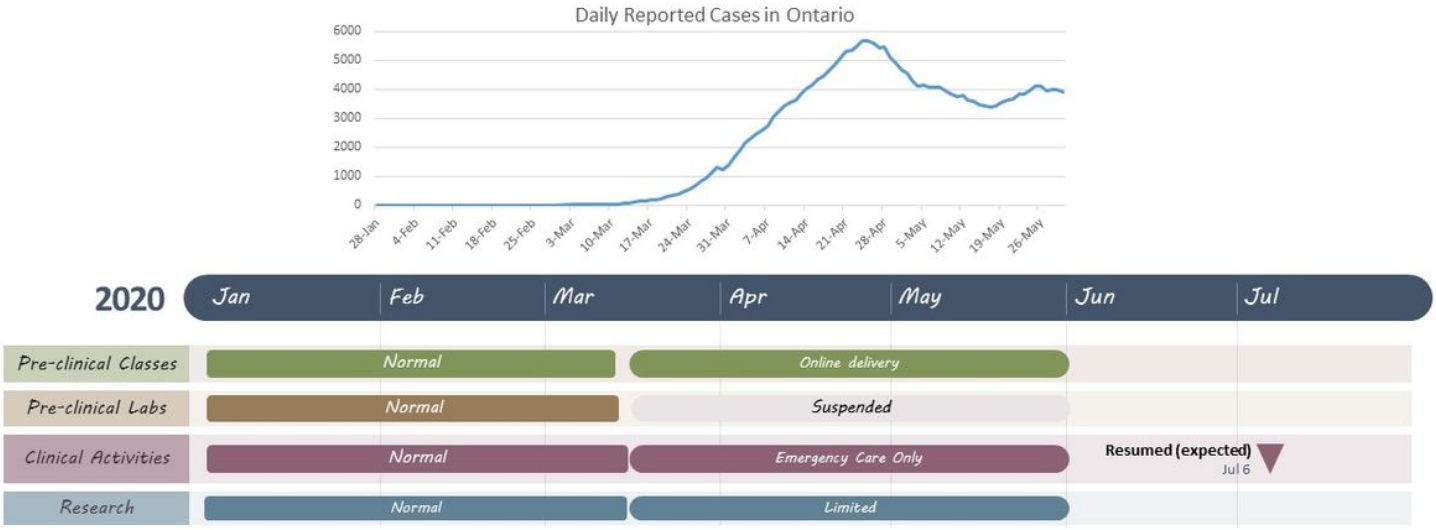

Figure 1

Dental education journey of the University of Toronto Faculty of Dentistry during the pandemic. The upper line chart presents daily reported confirmed cases in Ontario. Data Sources: Government of Ontario. Status of cases in Ontario. At: https://www.ontario.ca/page/how-ontario-is-responding-covid-19#section-0. Accessed: May 30, 2020.

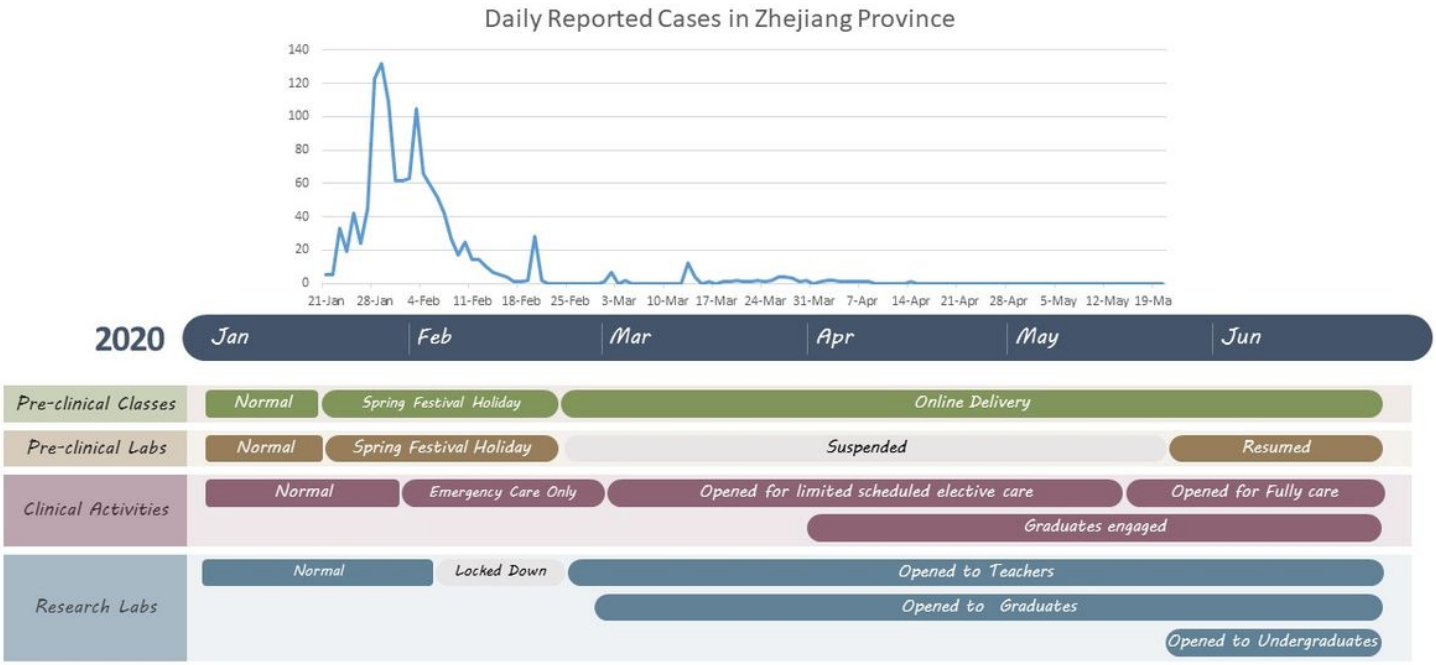

Figure 2

Dental education journey of the Zhejiang University School of Stomatology during the pandemic. The upper line chart presents daily reported confirmed cases in Zhejiang Province. Data Sources: Health Commission of Zhejiang Province. At: http://www.zjwjw.gov.cn. Accessed: May 30, 2020.