

# Diploma Thesis

**Evaluation of dental education during the pandemic of COVID 19 -  
results from an online survey among dental students.**

submitted by

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for the attainment of the academic degree

**Doktor der Zahnheilkunde  
(Dr. med. dent)**

at the

**Medical University of Graz**

conducted at the

**University for dental medicine and oral health Graz  
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Graz, am 10.08.2022

Sebastian Glockner eh

## Acknowledgements

I would like to thank my supervisor Univ. Prof. Payer who always offered me expert guidance and support during this diploma thesis. Thanks to Univ. Prof. Mattheos from Bangkok for the inspiring collaboration as well as Univ. Prof. Lorenzoni. Thanks for your constructive input.

Many thanks to my parents for supporting me along the way not only financially but especially mentally. You were my major support.

Special thanks to my siblings Karoline and Georg who encouraged me with practical knowledge and enjoyment from the beginning.

I also want to thank my friends who stood by my side through good and bad times while studying. Most notably Martin, Franz and Fritz. I don't want to miss a day or night...

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## Zusammenfassung

Einleitung: Seit dem erstmaligem Auftreten des Covid-19 Virus Ende 2019 hat sich viel verändert. So waren auch die zahnärztliche Patientenversorgung und die Ausbildung von Studenten während der Covid-19-Pandemie in mehrfacher Hinsicht betroffen. An den meisten Universitäten war es nicht möglich mit physischer Präsenz zu unterrichten. Da bisher keine Leitlinien verfügbar waren, haben die Universitäten unterschiedliche Strategien für den Umgang mit der Pandemie entwickelt. Ziel der Diplomarbeit war es im Rahmen einer Studie, Einblicke in die Zufriedenheit von Zahnmedizinstudent/Innen während der Covid-19-Pandemie in Hinblick auf die Kontinuität ihres klinischen Praktikums zu erhalten.

Material & Methoden: Für diese Querschnittsstudie wurde ein validierter Fragebogen entwickelt und verwendet. Dieser wurden in 3 Hauptkategorien unterteilt: Demografische Daten, Lockdown, nach dem Lockdown. Student/Innen aus 7 verschiedenen zahnmedizinischen Fakultäten in Europa und Asien nahmen anonym per E-Mail an der Befragung teil.

Ergebnisse: Insgesamt nahmen 286 Studierende von 7 verschiedenen Universitäten in Europa und Asien an dieser Umfrage im Rahmen der Studie teil. Mit der Pandemie bedingten Umstellung der Lehrtätigkeit auf Online-/Fernunterricht an den Hochschulen nahm die von den Studierenden empfundene Arbeitsbelastung ab (30,9 %, n=67) oder blieb gleich (24,4 %, n= 53). Andererseits hatten 20,3 % (n=44) der Studierenden den Eindruck, dass die Arbeitsbelastung etwas oder weitgehend zugenommen hat (15,7 %, n= 34), während nur 8,8 % (n=19) einen Rückgang feststellten.

Die Mehrheit der Studierenden (70,9 %) scheint bereit zu sein, zumindest auf einige der Anforderungen der klinischen Ausbildung zu verzichten, um ihren Abschluss rechtzeitig zu erreichen. Außerdem fühlten sich 80,3 % der Studierenden zuversichtlich, die klinische Ausbildung nach der Unterbrechung des Lockdowns wieder aufzunehmen.

Conclusio: Die wahrgenommene Arbeitsbelastung und der Zeitaufwand für die zahnärztliche Ausbildung während der Pandemie gingen allgemein zurück. Trotzdem

konnte mittels Erweiterung der digitalen Lehre der Lehrplan und die Lernziele eingehalten werden. Die Universitäten sollten daher in Erwägung ziehen, das Online-Lehrangebot in der zahnärztlichen Ausbildung auszuweiten.

## Abstract

**Introduction:** A lot has changes since the first appearance of the Covid-19 virus in end of 2019. Dental patient care and university student training facilities were affected in multiple ways during the Covid-19 pandemic. At most universities teaching with physical presence wasn't possible. As so far no guidelines were created each country and university had different strategies for handling the pandemic. The aim of this thesis was to get insights into the contentment of dental students during Covid-19 in regard of the continuity of their clinical internship during the pandemic.

**Material and Methods:** This cross-sectional study used a validated questionnaire. Participants were recruited at seven different dental schools. Questionnaires were divided into 3 main categories: Demographics, Lockdown, After Lockdown. Students were invited to participate anonymously by e-mail.

**Results:** A total of 286 students from 7 different universities in Europe and Asia participated in this survey. As universities adjusted teaching activities to online/distance learning, the workload perceived by students decreased (30.9%, n=67) or remained the same (24,4%, n= 53). On the other side, 20.3%, (n=44) of students felt that the workload somewhat or largely increased (15,7% , n= 34) while only 8,8% (n=19) felt a decrease. The majority of students (70,9%,) appear to be willing to compromise at least some of the clinical training requirements, in order to graduate in time. Furthermore, 80,3% of students felt confident to resume clinical training after the disruption of the lockdown.

**Conclusion:** The perceived workload and time spent on dental education during the pandemic generally decreased. Nevertheless, the curriculum and learning objectives were achieved by expanding the range of digital learning sources in dental education. Universities should seriously consider to extend online education in dental trainings

# 1. Introduction:

## 1.1. Definition of terms

For the better understanding of online teaching and digital learning there are several terms you need to be aware of.

“distance learning”:

The term "distance learning" can be translated into German as "Fernstudium" in the context of higher education and, in comparison to "remote teaching", tends to take the perspective of students who learn or study "far away from the university". The terms "Fernstudium" or "Distance Learning" or also "remote teaching" refer to the circumstance of the spatial separation of teachers and students, which can be overcome with the help of Internet technology, even if, for example, traditional learning media such as books can also be used.

“E-learning”:

"E-learning" includes any kind of learning with electronic or digital aids and media, for example the use of a vocabulary trainer on a cell phone. E-learning service facilities at universities are thus partly responsible for the corresponding infrastructures; as a rule, they support teachers and students with questions on the use of, among other things, learning management systems. E-learning" is understood by the University of Graz as "teaching/learning processes motivated by media didactics and supported by adequate information and communication technologies in order to promote the acquisition of knowledge and skills that is flexible in terms of time and place and, as far as possible, oriented towards interaction and collaboration".

“Virtual teaching”:

"Virtual teaching" refers to courses in "virtual space", events that do not take place in real rooms but, for example, in virtual worlds that can be experienced with 360-degree glasses.

“online teaching”:

The term "online teaching" originally referred to parts or phases of courses that are supported or conducted "online", that means with the help of Internet technologies, for example the use of a mobile app in teaching (e.g. for feedback). In many publications, the term "online teaching" is equated with Distance Learning since March 2020.(1)

“clinical internship”:

Denotes hands-on work on patients of dental students.

## 1.2. Pandemic

A pandemic is the occurring of a disease over a wide geographic area. Wide spreading over entire regions, countries and continents or even worldwide. If the disease outbreaks remain limited in space and time, scientists speak of an epidemic. A pandemic thus refers to a global epidemic.

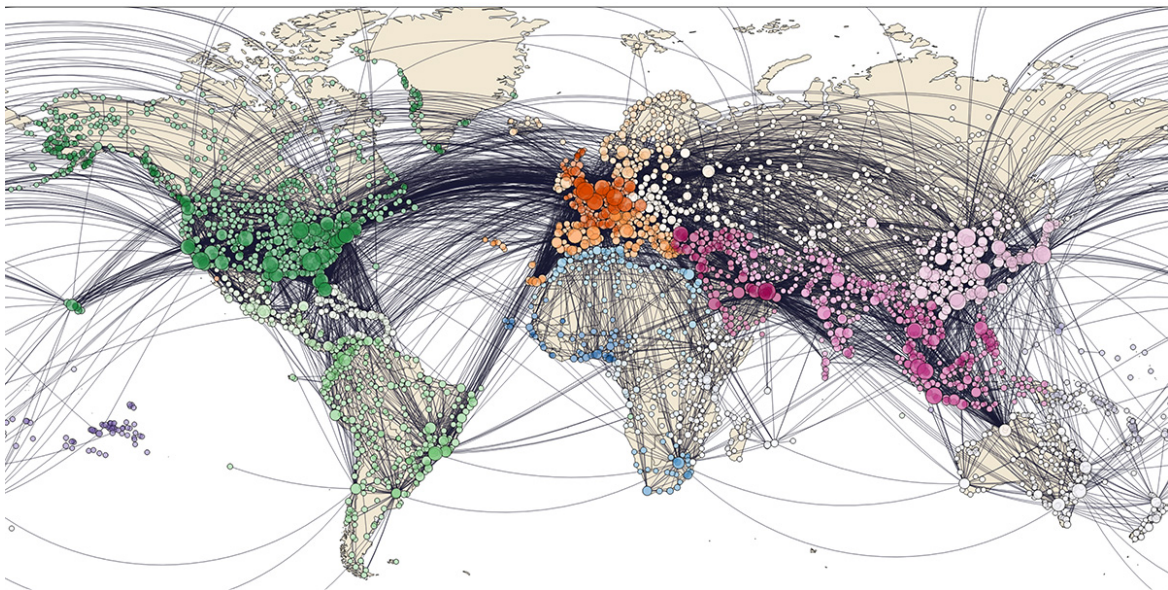
The term goes back to the ancient Greek term *pandemia*, which means "the whole people". It therefore refers to infectious diseases that affect the majority of the population.

Today's living conditions play a role spreading: worldwide trade, global mobility or environmental damage and also poor hygiene circumstances favor the emergence and spread of infectious diseases. If a pandemic spreads, a rapid response is needed.

The causes of a pandemic are pathogens that have not previously been present in the human population or have not been present for a very long time. The human immune system is not prepared for these pathogens and humans are therefore not adequately protected against disease. Often, these are viral or bacterial strains that, up to this point, have only been found in animals. Examples of this are the avian flu viruses or swine flu viruses. The genetic material of the viruses can change genetically, the viruses mutate. As a result, they can also spread to humans and in some cases cause severe illnesses.(2)

Global mobility network using the example of worldwide air traffic. Each node represents an airport location, and the links between the nodes correspond to the flight

connections. Due to increased global mobility, the geographic distance to the point of origin of a disease outbreak often no longer correlates with the theoretically expected time of an outbreak elsewhere in the world. Mathematical models and algorithms can be used to account for global connectivity. Computer simulations can then make statistical predictions about the dynamic spatial and temporal spread patterns of modern pandemics.(3)



*Figure 1 dynamic spatial and temporal spread patterns of modern pandemics.*

### 1.2.2 Pandemics that have occurred in the past

Although people even back in the beginning of the 18<sup>th</sup> century tried to protect themselves with cloths and doctors with masks over their mouths - both, however, remain without effect. In Marseille at the beginning of the 18th century - when the bubonic plague was once again raging in Europe - plague doctors shielded themselves with long leather dresses, gloves and face masks with beaks. With spices and herbs in fumigating pans, vinegar water washes and the burning of entire towns, people try to get to grips with the plague, which is unknown to them.

It was not until the end of 1894, at the beginning of the third pandemic, that the Swiss physician and biologist Alexandre Yersin discovered the plague pathogen - the bacterium *Yersinia pestis*, named after him. He thus confirms the assumption already made by Robert Koch that the plague is caused by bacteria. And it was not until 1942

that the first antibiotic against bacteria came onto the market - the active ingredient penicillin, discovered by the Briton Alexander Fleming. By then, in the middle of the Second World War, the next - and for the time being last - outbreak was already spreading in Europe. Today, the plague pathogen no longer causes pandemic proportions, but still people die from it, especially in Africa and Asia.

With infected U.S. soldiers fighting the Germans in World War I, the Spanish flu comes to Europe in the summer of 1918. And German soldiers also bring the flu virus with them to Germany as vacationers on the front lines or as wounded soldiers.

A total of 300,000 people died in Germany, and there are as many as 50 million victims of Spanish flu worldwide.

Advances in medicine and appropriate hygiene measures have now succeeded in containing a number of infectious diseases. But when it comes to repressing new epidemics and pandemics with behavioral measures today, experts still fall back on many of the measures that were already used in the fight against the plague and cholera: "When we look at the control measures against Corona in the spring of 2020, we are at the level of the early modern era: defense against epidemics by means of containment measures," said medical historian Karl-Heinz Leven, for example, at the beginning of the pandemic.(4)

### 1.2.3. Covid-19

COVID-19 was first reported in December 2019 in Wuhan, China, and subsequently spread worldwide. The coronavirus was officially named severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) by the International Committee on Taxonomy of Viruses based on phylogenetic analysis. SARS-CoV-2 is believed to be a spillover of an animal coronavirus and later adapted the ability of human-to-human transmission(5)

The clinical manifestations of the disease in symptomatic patients, usually starts after less than a week, consisting of cough, nasal congestion, fatigue, fever and other signs of upper respiratory tract infections. The infection can progress to severe disease with dyspnoea and severe chest symptoms corresponding to pneumonia.(6)

Because of the rapidly increasing number of cases outside of China, on the 11th of March 2020 the WHO General director officially called the outbreak a pandemic.(7)

On the 16th of March many countries in Europe imposed a lockdown, lasting for several weeks. Therefore in many different industries the normal work rhythm interrupted for helping to stop the spread of the Virus.

As of May 26 2022, there have been 524.8 Million confirmed cases of COVID-19 and 6.2 Million deaths reported to WHO.(8)

#### 1.2.4 Covid-19 and its effect on dental education

In order to stop the spread of the Virus, many countries in Europe imposed a lockdown on the 16<sup>th</sup> of March , lasting for several weeks. As a consequence, major disruptions occurred in many different industries including higher education where more than 1.5 billion students and youth across the planet have been affected by university and school closures(9). Universities and dental schools worldwide had to quickly adjust to the sudden disruption and find ways to ensure continuity of education. Dental schools had to maintain and ensure the health of students and patients, while setting up contingency plans for continuity of education, mainly through online delivery of parts of the curriculum. Theoretically and non-clinical teaching can be performed via online media, while pre-clinical simulation and clinical training require in general physical presence and contact.

Clinical training in particular was mostly suspended worldwide at some stage during the pandemic - except for patient emergency treatments. Both closure as well as resumption of clinical education took place at different time points in different parts of the world, while the faculties dealt with the disruption in different ways. Without a doubt these circumstances had a huge impact on the learning experience and the quality of dental education and imposed a huge burden for both students and teachers.

The aim of the survey was to assess the impact of the pandemic on the learning experience as reported by the students of seven dental schools in Europe and Asia. Furthermore, the study aimed to identify different approaches of conducting dental education during the restrictions of the pandemic, investigate their outcomes and identify respective best practices and effective strategies.

### 1.3. Management during Lockdown at the university clinic for dentistry and oral health of Graz Medical University

At the university clinic for dental medicine and oral health, a well thought through and quickly adapted emergency care plan was created and ensured the safe provision of emergency patient care.

The top priority of the entire Covid-19 management was to protect employees from infection with SARS-CoV 2 while continuing to meet the dental care mandate.

Patient care was reduced to acute and urgent treatments, essentially acute pain, post-operative bleeding and trauma.

For clinical operations, 5 interdisciplinary teams were formed, which alternated on a daily basis. It was important that these teams did not overlap and married couples or cohabiting couples were not divided among different teams. In case of a Covid-19 infection within a team, the so-called reserve teams were formed and could step in on call and replace the respective team. Clinical internships were suspended during the lockdown, all scheduled patients were cancelled for student education. But students were allowed to participate in the emergency patient care on voluntary basis.

#### 1.3.1. Applied hygiene protocol in Dental Treatments

Not only were the acute treatments planned and coordinated, but standard operating procedures for the implementation of the treatments were established. These standards assured the safe treatment of patients during the pandemic.

After triaging the patients, special hygiene measures were necessary for treating dentists and their assistants.

“2+3 hand washing rule”

Washing hands before the patient examination

Washing hands before patient treatment

Washing hands after patient contact/treatment

Washing hands after contact with surrounding surfaces (chairs, unit, trays, ...)

If necessary, again as a completion (time-delayed between last and next patient)

General protective measures were established. Treating dentists and assistants had to wear:

- Disposable surgical hood
- Disposable mouthguard/mask (no suspicion, surgical disposable mouthguard)

- Safety goggles (alternatively or additionally face shield)
- Work clothes
- optional FFP2 or FFP3 mask for treatments with contra-angle handpiece

special protective measures

- Additional FFP2 or FFP3 mask
- Disposable surgical gown

The virus can be detected in saliva, even before COVID-19 symptoms appear, with the consequent high risk of virus transmission in asymptomatic/ presymptomatic patients. Therefore reducing oral viral load could lead to a lower risk of transmission via salivary droplets or aerosols and therefore contribute to the control of the pandemic. (10)

That's why obligatory mouth rinses before dental treatments were established. 1%hydrogen peroxide or Chlorhexidine were used for the 1 minute lasting rinse.

In treatments if possible Cofferdam was used. Especially during Endodontics and excessive irrigation of the tooth). Due to aerosol formation instead of ultrasonic/sound scaler alternative hand instruments were used. Preferably large volume suction attachments were used to remove possible sources of infection like saliva. Using powder jet devices and turbines were also avoided. If anticipated: treatments with larger aerosol/droplet formation were set up as last patient of the day.

If possible intraoral x-ray were avoided because of saliva contamination, coughing, retching. When preparing Orthopantomographs it was considered only doing ¼, ½, or a complete scan to avoid unnecessary contamination.

Disinfection of treatment rooms/waiting areas:

If possible: elevators should be avoided as small rooms are more likely to be contaminated.

The frequency of disinfection of rooms (so called wipe disinfection) was increased. Windows were opened frequently to ventilate rooms. (11)

### 1.3.2. Corona Mode concept

Preamble: The "Corona Mode" concept is an attempt to describe and define the goals, functions and organization of the operation of the University Clinic for Dentistry and Oral Health, adapted to the current phase of the Covid-19 pandemic. The concept is a dynamic process and is subject to continuous coordination with the guidelines and requirements of our operating companies (KAGes and MedUniGraz), and in particular with the clinic management, both in terms of content and timing. Phases 1, 2 and 3 are intended to describe the operation in the acute spread of the pandemic, in the semi-stable phase of a delayed spread and in the probably longer lasting stable pandemic phase with a low spread of infection. The aim of the concept is to be prepared for each phase in the organization of the hospital in terms of patient care, study and research. The concept also includes the temporary location of the MKG (department for oral and maxillofacial surgery) outpatient clinic in the area of the dental clinic (1st floor, training unit 3), but not the stationary area of MKG surgery.

#### 1.3.2.1. Phase 1

Acute Corona Mode- Emergency operation (Rapidly increasing infection rates)

Goal was the sustainable fulfillment of the care mandate with regard to dental / maxillofacial emergencies in the acute crisis situation, while ensuring staff and patient protection and taking into account general guidelines and regulations or requirements of the operators.

This emergency operation was successfully carried out from 16.03.- 20.04.

Patient care:

- Preparation for dental and maxillofacial emergencies only.
- Coordination with private practices/ health centers of the social insurances/ dental association
- Ongoing adjustments
- Daily targeted morning briefing for supplying day team/daily update via email
- Development/summary/broad communication of clinic-specific Corona treatment recommendations derived from guidelines/literature
- Triage of patients begins before entering the building - Covid-19 (suspected) patients were picked up from staff in protective gear and taken to isolation room,

treated there with appropriate protective precautions, and discharged with ambulance service

- Individual admission of patients with acute symptoms (maximum of one accompanying person) - organized via intercom and security.
- After individual admission, immediate hand disinfection, surgical mask and temperature measurement
- Waiting in the waiting area dandelion and cogwheel at minimum distance with OP mask
- Treatment according to our recommendations/guidelines taking into account
- Hygiene and protection guidelines

#### Personnel resources:

- Daily changing, independent interdisciplinary teams (physicians/dentists including external lecturers, students, nurses, assistants, dental technicians, secretaries and general staff)
- No overlapping of personnel between the teams - the aim is to interrupt possible infection chains
- Infection-related total daily team changes easily possible because of reserve teams on call
- Daily duty roster coordination by duty roster managers
- On-site personnel resources limited to the minimum necessary
- Staff reserve at home available and on duty at all times to replace absences
- Outside faculty temporarily reduced to measure of teaching in conservative/surgical
- Emergency treatments reduced
- Temporary ban on secondary employment for all staff members - goal is to
- Interruption of possible infection chains

#### Treatment areas

- Reduction to initial admission, isolation room, procedure room and trepanation chair
- Prosthetic outpatient clinic and orthodontic outpatient clinic for isolated emergencies
- Operation of a maximum of one treatment chair per room

- Special protective equipment in the isolation room, in the procedure room and at the trepanation chair

#### Waiting area:

The handling of patients waiting for emergency treatments was challenging. In order to counteract the spread of Covid 19, it was unavoidable to reduce the number of patients in the waiting areas to a minimum. Due to the steadily increasing patient frequency, a thoroughly planned concept was necessary. Thus, it was important to keep the minimum distance and not exceed the maximum number of waiting patients of 15.

Due to restrictions and to avoid the virus from spreading further there were adjustments in managing dental education and students at the university as well. Clinical internships in conservative/surgical emergency treatments for volunteer students were workable. But no clinical internship beyond acute and emergency treatment was offered. Students and external lecturers were fully integrated in day teams. No difference was made between them and staff members. Lectures were streamed live as per schedule – using the online platform/tool Webex. Lecture notes were updated on VMC (virtual medical campus) the online learning platform to ensure easy access for students. For motivation to prepare or complete theses appropriate supervision was assured. Although there were no exercises and no exams were held– everything was put on hold.

At the medical university of Graz next to training students research and further education make up a large part of responsibility. During lockdown the university also had to face adjustments in these areas.

#### Research

- Proactive impetus and motivation of scientific staff to drive research projects forward
- Coordination by the head of the Research Coordination Board

#### Postgraduate training / congresses

- Until further notice, all continuing education and congress activities (co-)organized by the clinic with presence are cancelled.
- Active participation in webinars.

### 1.3.2.2. Phase 2

Corona Mode Subacute - extended emergency operation (delayed spread of infection).  
Goal: in addition to dental / oral surgery emergency treatments, care of ongoing clinic patients with regard to urgent treatments that can no longer be postponed, while ensuring staff and patient protection and taking into account general guidelines and regulations or specifications of the operators.

### 1.3.2.3 Phase 3

Corona Mode-Chronic - restricted normal operation (low spread of infection).  
Goal: Corona normal operation including full clinical internship while ensuring staff and patient protection and/or consideration of general guidelines and regulations and/or operator specifications. (11)

## 1.4. Participating Universities

### 1.4.1. Medical University of Innsbruck (Public University in Innsbruck, Austria)

In total a number of 3443 students study at the Medical University of Innsbruck.

There is an infrastructure for 40 dental students per year.

After completion of the study of dentistry, the academic degree "Doctor of Dentistry", Latin "Doctor medicinae dentariae", abbreviated as "Dr. med. dent." is awarded. The study program begins in the winter semester, since the content of the compulsory courses is coordinated with the beginning of the winter semester.

The diploma program in dentistry has a standard duration of twelve semesters. The study program is divided into three study sections, of which the 1st study section comprises two semesters, the 2nd study section four semesters and the 3rd study section six semesters.

The study program is modular. In the 3rd study section, students complete a 72-week practical dental training. The students are offered the possibility of continuous and direct practical training on patients or on suitable life-like models and phantoms. The practical courses of the 3rd study section in the modules Dental Prosthetics I to III as

well as Conservative Dentistry I to III are designed to build on each other and must be completed consecutively.

In addition to the positively passed examinations, a positively evaluated diploma thesis is a prerequisite for completion of the dental degree program.

Objectives of the individual study sections:

First study phase (1st - 2nd semester)

In the first stage of study, the theoretical and practical knowledge and skills are taught in the introductory module "Basic Training in Dentistry, Oral Medicine and Maxillofacial Surgery 1", the testing of which, over and above an assessment of aptitude for studying dentistry, allows the assessment of the student's ability to later practice dentistry. Furthermore, basic scientific knowledge and understanding of the human body are taught, supported by clinical and general medical case demonstrations. Already at this early stage of the studies, special attention is paid to the development of psychosocial skills and the ethical foundations of medical practice. Bridge courses via e-learning are offered for students who need to consolidate their science education.

Second study phase (3rd - 6th semester)

In the 2nd study stage, the knowledge and understanding of the human organism in health and disease is imparted and deepened, supplemented by basic aspects of a medicine that will be more digitally influenced in the future. In the module "Basic education in dentistry, oral and maxillofacial medicine 2", basic knowledge of dentistry and the profession is taught and deepened. In addition, students acquire clinically applicable knowledge in a topic- and patient-oriented manner in interdisciplinary small group teaching (problem-oriented learning).

Third study phase (7th - 12th semester)

The 3rd study period is dedicated to specific dental training.(12)

#### 1.4.2. Medical University of Vienna (Public University in Vienna, Austria)

A total of 7792 students study at the Medical University of Vienna. For dentistry there are 80 students at the preclinic and 70 students in clinical training per year.

The diploma program in dentistry lasts 12 semesters including an internship of 72 weeks. The study program is divided into three study phases; the first study phase comprises two semesters, the second study phase four semesters and the third study

phase six semesters. The 72-week internship is to be completed in the third study section.

#### The 1st study phase

- Manual skills as well as oral hygiene instead of POL (problem based learning) in the 2nd semester.
- Dental propaedeutic course 1 instead of block 6
- Z-SIP 1b instead of SIP 1b (adjusted summative integrated exam for dentistry)
- manual skills
- oral hygiene
- physical health examination

#### The 2<sup>nd</sup> study phase

The second study phase comprises 4 semesters, i.e. semesters 3 to 6. The first two, semesters 3 and 4, correspond to the currently valid curriculum for human medicine at Medical University of Innsbruck with the exception of:

- no FIP 2 (formative integrated exam)
- Z-SIP 2 instead of SIP 2 (adjusted summative integrated exam for dentistry)
- Initial Dental Examination instead of Physical Medical Examination
- Practical Repetitorium instead of Famulaturpropädeutikum
- Z-Organmorphology instead of Organmorphology I (adjusted for dentistry)
- In the 5th semester, separate subject blocks of the dental medicine program, offered exclusively for the dental medicine field of study, hereafter referred to as Z blocks, begin.

#### The 3<sup>rd</sup> study section

Enrollment in the third phase of study in dentistry is linked to the successful completion of the first and second phases of study. The number of study places for the third study

phase at the University Dental Clinic Vienna is limited to 70 per academic year for all seminars and practical courses and for the 72-week practical course for reasons of space and staffing.

Places are allocated according to the following criteria:

Of the available places, a contingent of 20 places will be allocated in accordance with the following allocation criteria to those students who have completed the second stage of their studies immediately before the beginning of the current academic year within the time limit specified in this curriculum (1.6.). A second quota of 50 seats will be awarded in accordance with the award criteria below to all students who do not meet the criteria for a seat in the first quota. If a quota is not exhausted, the available places will be allocated to the other quota. The allocation shall be made according to the time of completion of the second study section as amended by this curriculum; in addition, the averaged percentage points from the theoretical examination and the practical courses of Z-Prop. 2 shall decide. In addition, in the event of a tie in points, the decision shall be made by lot.

Those sequence criteria for admission to the third study section which were completed according to an earlier version of this curriculum and assessed with the calculation "Pass" are considered to have been completed with "Satisfactory" (= 80 %) in the sense of this curriculum.

The registration - with a registration period of at least one week - for admission to the third stage of studies must be made after announcement by the curriculum director, but at the latest by 28.7. If not all places have been allocated, they can be allocated by the curriculum director by September 30 according to the above principle.(13)

#### 1.4.3. Medical University of Graz (Public University in Graz, Austria)

At the Medical University of Graz there is a total number of 4350 students, which include 24 dental students per year.

The Diploma Program in Dentistry consists of three study phases with a study duration of 12 semesters. (1) The first study phase comprises two semesters and is at least 90% identical to the first year of study in the field of human medicine. Its purpose is to provide knowledge and basic understanding regarding the human organism and to provide the theoretical prerequisites for understanding clinical presentations. Initial

training in medical skills and communication are also included, as well as professional field exploration. (2) In the context of the occupational field exploration, the occupational profiles relevant to dentistry and the examination of manual skills are also addressed. An essential component is the "Introduction to Dentistry" and the "Hospitalation".

The second phase of study comprises four semesters. In it, students acquire knowledge about the healthy and diseased organism. As far as possible and reasonable, the topic-centered, patient-oriented, interdisciplinary teaching with the inclusion of clinical presentations and use of the new forms of teaching such as problem-based learning serves as a basis. The fundamentals of the structure, function of the masticatory organ and the prophylaxis-oriented approach to dentistry are taught. Basic specific dental skills are also learned. (3)

The third phase of study comprises three years of study and has the task of imparting scientific knowledge and practical skills for specialist dental work as well as deepening scientific training.(14)

#### 1.4.4. Sigmund Freud University Vienna (Private University in Vienna, Austria)

In total 3741 students study at the Sigmund Freud University Vienna, including 50 dental students per year.

At SFU students have to complete a bachelor's degree program before continuing the master's degree program. successful completion of modules and skills lines is required for the bachelor. Modules are blocks of courses in which direct basic medical knowledge from the preclinical and clinical areas is taught; in actual patient treatment, this extends to diagnosis. In the skills lines, which are designed longitudinally over all semesters of the bachelor's program, skills are taught that serve the personal development and communication skills of the students, the training of technical and scientific skills and the early contact with patients.

The Master of Dental Medicine program consists of three years of study and is based on their sequencing. The modules and skills lines of study years 1-2 must be completed in the designated order. The third year of study focuses on practical training. It includes clinical training, in which the diagnostic and therapeutic skills learned up to that point

are expanded and practiced in the SFU Dental Clinic/Outpatient Clinic for Dentistry and in external placements.(15)

#### 1.4.5. University of Pécs (Public University in Pécs, Hungary)

In total a number of 20000 students study at the university of Pécs, including 20 dentistry students per year.

The curriculum of the five-year program (10 semesters) is designed to unify the basic and clinical sciences, as it is believed that scientific and professional development cannot be sharply separated but should proceed concurrently throughout the program. In the basic module of first two years the students are taught basic sciences – medical and dental courses – which constitute the foundation of clinical dentistry. In the pre-clinical module students become more familiar with the intensive clinical study of each of the various disciplines of dentistry that they continue with in the clinical module with more emphasis on the assessment and management of patients. Furthermore, in this final module students participate in elective programs, clinical conferences and hospital-based placements. After the successful completion of the program, students are awarded the title Doctor of Dentistry.

Basic module:

Foundation subjects (Physics, Chemistry, Biochemistry, Cell biology)

Morphology

Anatomy

Histology

Molecular biology

Pathology (General and Oral pathology, General and Oral Pathophysiology)

General and Oral Microbiology

Functional biology (Physiology, Oral biology),

Behavioural studies (Psychology, Sociology, Ethics)

Pre-clinical module:

Introduction into Clinical Studies (Internal medicine, Surgery, Dental pre-clinics),

Diagnostics (Laboratory Diagnostics, Pathological diagnostics, Diagnostic imaging, General and Oral radiology),

Public Health (economics)

Pharmacology (pharmacotherapy, toxicology)

Core curriculum - Clinical module:

Complex knowledge of diseases and therapies (Medical genetics, Internal medicine, Surgery, Dermatology, Ophthalmology, ENT, Diseases of Oral Mucosa, Paediatrics, Obstetrics, Gynaecology, Neurology, Psychiatry, Oxiology, etc.)

Optional subjects

Core curriculum - Dental clinical module:

Preventive Dentistry

Oral Diagnostics

Maintenance dentistry (Conservative dentistry, Endodontics, Parodontology, etc.),

Oral surgery (Dental surgery, Maxillofacial surgery, etc.)

Restorative dentistry (implants)

Paediatric dentistry

Orthodontics

Optional Subjects(16)

#### 1.4.6. University of Zagreb (Public University in Zagreb, Croatia)

In total a number of 72480 students study at the University of Zagreb, including 20 study places for dental students per year.

The integrated undergraduate and graduate university study enables students to gain knowledge and skills needed to become doctors of dental medicine. Its main goal is to provide the necessary knowledge from biology, preclinical, clinical medical and dental subjects. During the integrated six-year study program, students should obtain 360 ECTS credits

The courses are divided into four basic groups: basic courses, preclinical courses, general medical courses and dental courses. Basic courses amount to 805 teaching hours (16% of the total hours). General medical courses amount to 1015 hours (20%) whereas the greatest number of teaching hours belong to the dental group of courses— 3295 hours (64%).

The integrated university study program has proven to be optimal in reaching the educational goals. The study program is organized in Croatian language for up to 90

students, with the planned student quota of 85 Croatian and EU students and 5 non-EU students. Starting with the year 2017, we are enrolling up to 20 students in the study program fully taught in English.(17)

#### 1.4.7. Chulalongkorn University of Bangkok (Public University in Bangkok, Thailand)

In total a number of 37626 students study at the Chulalongkorn University Bangkok, including 140 study places for dentistry students per year. It is the first dental school in Thailand and was established in 1940. The faculty also provides dental services to the general public.(18)

## 2. Material & Methods:

This multicentre, cross-sectional study was approved by the ethical committee Graz, Austria (1370/2020) and Chulalongkorn University, Thailand.

Participants were recruited at seven different Dental schools (Chulalongkorn University Bangkok (Thailand) with 100 participants, the highest number of participants with 85% were in the group of 21-24 years olds, 67% percent of them female and 33% male, Medical University of Graz (Austria) lockdown 16. 3. 2020- 20. 4. 2020, with 56 participants, the highest number of participants with 45% were in the group of 25-29 years olds, 62% percent of them female and 38% male, Medical University of Innsbruck (Austria) lockdown 16. 3. 2020 - 20. 4. 2020, with 23 participants, the highest number of participants with 52% were in the group of 25-29 years olds, 61% percent of them female and 39% male. Medical University of Vienna (Austria) lockdown 16. 3. 2020 - 20. 4. 2020, with 12 participants, the highest number of participants with 66% were in the group of 25-29 years olds, 58% percent of them female and 42% male. Sigmund Freud University Vienna (Austria) lockdown 16.3.20-20.4.20, with 24 participants, the highest number of participants with 54% were in the group of 21-24 years olds, 50% percent of them female and 50% male. University of Zagreb (Croatia) lockdown 16. 3. 2020 - 27. 4. 2020, with 33 participants, the highest number of participants with 91% were in the group of 21-24 years olds, 85% percent of them female and 15% male and University of Pécs (Hungary) lockdown 28. 3. 2020 - 29. 4. 2020, with 38 participants, the highest number of participants with 74% were in the group of 21-24 years olds, 58% percent of them female and 42% male. Data was collected by means of an Online Survey (Survey Monkey; San Mateo, USA) between October 2020 and July 2021. Students were invited to participate anonymously by one e-mail sent from each schools administration.

### 2.1 Inclusion / Exclusion criteria

Undergraduate and postgraduate dental students attending the clinical part of dental education and thus having initiated work on patients prior or during the pandemic.

Undergraduate and postgraduate dental students in the preclinical stage of education and/ or without experience on patient treatment.

## 2.2 Questionnaire Development

A tailor made questionnaire for the purpose of the study was developed in English by the Medical University of Graz and Chulalongkorn University. The questionnaire included 33 items in the form of two open-ended text questions, four Yes/No questions, eighteen Visual Analogue Scale questions, and nine multiple-choice questions.

The questionnaire was organised into 3 main sections: a) Demographics (age, gender, stage / semester of studies, location during the pandemic), b) Perceptions and activity during Lockdown (teaching and learning, clinical exposure, perceptions and effectiveness), c) Perceptions and activity upon resumption of face to face teaching (assessment of teaching and learning, confidence with clinical practice, future implications)

All questions were first reviewed for face validity by a group of experts not involved in its development in the University of Graz and Chulalongkorn University. Questions were modified to satisfy consensus of the expert group. The questionnaire was then translated in Thai and reverse translated to English by dentists in both institutions to ensure accuracy of the expression. Finally, the English and Thai versions were further validated by means of a small group of 10 students in each university.

Chulalongkorn University distributed to its students the Thai version of the questionnaire, while the German version was made available to University of Graz, Medical University of Innsbruck, Medical University of Vienna, Sigmund Freud University Vienna. The University of Zagreb (Croatia) and the University of Pécs (Hungary) received the English version of the questionnaire. All three versions of the questionnaire were made available electronically by means of an Online Survey (Survey Monkey; San Mateo, USA) between October 2020 and July 2021. Students were invited to participate anonymously by one e-mail sent from the respective institution administration.

Each university administration identified undergraduate and postgraduate dental students attending the clinical part of dental education and thus having initiated work on patients prior or during the pandemic. These students received one initial email with

the essential informed consent and instructions how to fill in the online questionnaire. First and second reminders were sent on 1 and 2 weeks thereafter.

Undergraduate and postgraduate dental students in the preclinical stage of education, attending non-clinical programs and/ or without experience on patient treatment were not invited.

Statistical analysis was performed using IBM SPSS Statistics Version 26 (IBM Corp., Armonk, N.Y.). To statistically assess descriptive statistics the following statistical tests were applied: one way analysis of variance and the Kruskal-Wallis test were calculated for continuous data. Chi Square test and Fishers Exact test were used for categorical outcome. A p-value of  $p < 0.05$  was defined as the cutoff for statistical significance.

### 3. Results

In total 283 participants from 7 Universities in Europe and Asia participated in this survey. Of these, 10 postgraduate students, 1 at Medical University of Graz, 5 at Sigmund Freud University of Vienna, 1 at Medical University of Innsbruck, 2 at University of Zagreb, 1 at University of Pécs, participated in the study. However, there is no significant distinction from undergraduate students. The majority of participants (67,3%, n=189) were between 21-24 years old, 22,4% (n=63) were between 25-29 years old, 6% (n= 17) were 30 and older and 4,3% (n=12) were 20 years old or younger. Most of the participants (50,7% n= 145) studied in the 7-9 semesters, 30,1% (n=86) were in the 10-12 semesters, 17,1% (n=49) studied in the 4-6 semesters and only 2,1% (n= 6) were in the 12 semesters and above. 64,7% were female respondents and 35,3% male. During the lockdown more than half of the participants (59% n=154) were based in the same city as the university. The majority of the students were based in the same city as the university during the lockdown, while 21,1% were in their hometown (other, rural), and 15,3% in their hometown (other, urban centre). Only 4,6% were based in another city than the university. Overview of the demographics of the participants is presented in Table 1

	Number of participants	% of participants
Age		
<20	12	4,3
21-24	189	67,3
25-29	63	22,4
>=30	17	6
Gender		
female	185	64,7
male	101	35,3
Study level		
graduate	10	3,6
undergraduate	271	96,4
Semesters of studies		
4-6	49	17,13

7-9	145	50,7
10-12	86	30,1
>12	6	2,1
During the lockdown I was based in		
My hometown (other, urban centre)	40	15,3
My hometown (other, rural)	55	21,1
Other city than the university	12	4,6
Same city as the university	154	59

Table 1 Demographics

### 3.1 Clinical exposure

In general clinical training was interrupted during lockdown. At some Universities however participants were still involved in emergency treatments as part of their clinical training amounting to 16,7% of the sample (n=38) ( $p < 0,001$ ) (Figure 2).

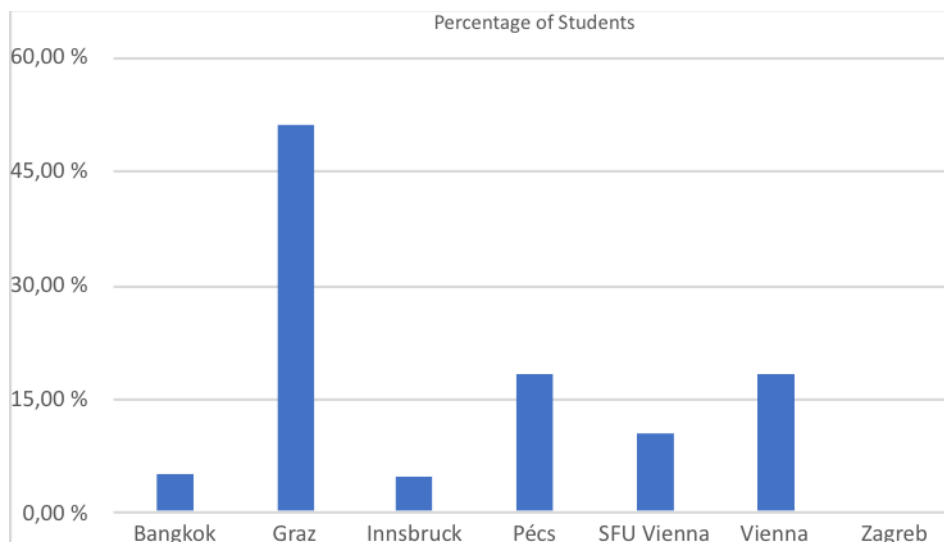


Figure 2 Percentage of students participating in the delivery of emergency care

This was typically the older students, as nearly 26% of the students that were older than 24 years joined the staff in delivering emergency patient care, compared to 12,1% of the younger students ( $p = 0,016$ ).

It is important to mention that 30,3% (n=68) of the students had the option to join voluntarily the staff conducting emergency patient care. Every university handled the clinical internship individually during the lockdown, and some universities have not scheduled students for emergency treatments.

Participants with an agreement of more than 73%, felt that their university continued to ensure adequate patient care for emergencies, even when they were not involved themselves ( $p < 0,001$ ). During this period of time, working on patients was particularly challenging because of the need to rule out possible infection with Covid -19. Thus, the universities had the task of protecting their staff, including students volunteers, from infection and thus provide the necessary protective equipment. Overall the universities provided the required protective gear for working safely on the patients with a range from 40% to 94%. An overview of the responses is shown in Table 2

In the post-lockdown period, after all universities had to interrupt their normal clinical training during the lockdown, patient volume for the students differed significantly among universities ( $P = 0,033$ ). The individual responses of the universities is shown in Fig. 3

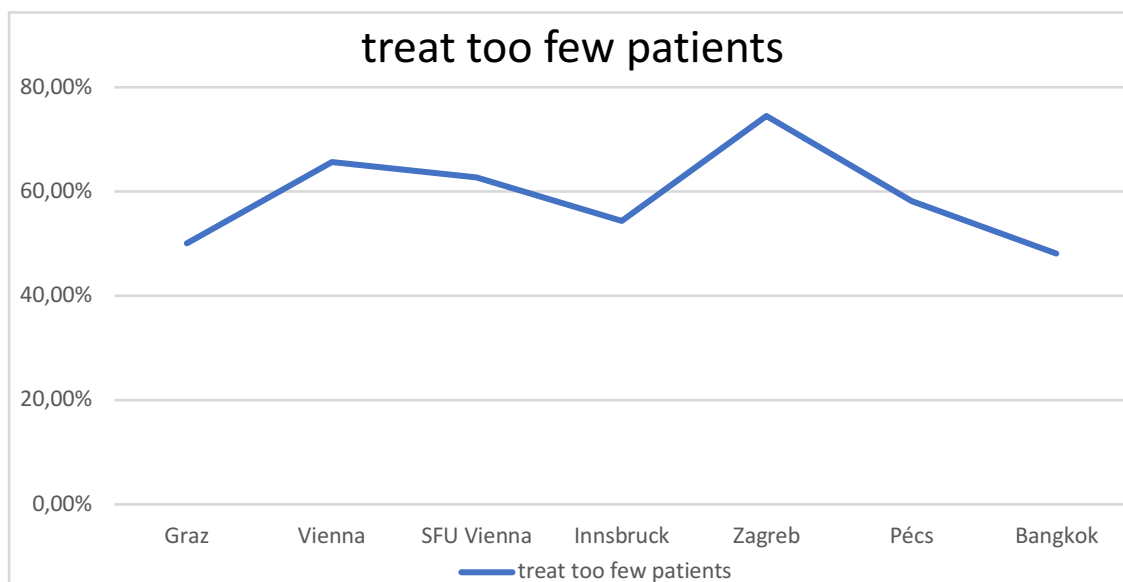


Figure 3 Patient frequency during clinical internship

Lockdown, Clinical exposure		
Question	Number of participants	% of participants
7. When the university shut down, I had the option to join voluntarily the staff conducting emergency patient care		
yes	68	30,3%
no	157	69,7
8. Did you conduct any emergency patient treatments during the time the university was shut?		
Yes	38	16,7%
no	189	83,3%
	Number of participants	Percentage agreement
9 .The University provided me with the required protective gear for working safely on the patient		
Medical University of Graz	22	89,2%
Medical University of Vienna	1	40%
Sigmund Freud University Vienna	2	94%
Medical University of Innsbruck	1	84%
University of Zagreb		
University of Pécs	5	62,4%
Chulalongkorn University Bangkok	3	71,3%
<b>10 The University continued to ensure adequate patient care for emergencies.</b>		
Medical University of Graz	43	83,8%
Medical University of Vienna	9	70,7%
Sigmund Freud University Vienna	18	76,9%
Medical University of Innsbruck	19	72,8%
University of Zagreb	21	62,4%
University of Pécs	28	67,4%

Chulalongkorn University Bangkok	69	83,8
<b>11 At the moment I treat too few patients</b>		
Medical University of Graz	42	50,1%
Medical University of Vienna	9	65,7%
Sigmund Freud University Vienna	18	62,7%
Medical University of Innsbruck	18	54,4%
University of Zagreb	21	74,5%
University of Pécs	28	58,2%
Chulalongkorn University Bangkok	66	48,1%

Table 2 Responses clinical exposure

### 3.2 Teaching and Learning

Most of the students (86.1%, n=204) were able to attend all required online learning activities organized by their universities during the lockdown phases. Their main motivation (54.3%, n=108) for attendance was their confidence in the benefit from attending online classes, while a smaller number of students (30,7%, n=61) attended because it was obligatory. Only 6.5% of the students had nothing better to do, 5% needed the intellectual stimulation and only 3.5% needed the interaction. Whether the university was in the students' view taking all actions possible to ensure the continuity of dental education, opinions differed significantly between the students in each University ( $p < 0,001$ ) Students at SFU Vienna agreed by a high percentage (83.4%), while Chulalongkorn University and Medical University of Graz also showed more than 70% of the students in agreement in this view.

Likewise, students' satisfaction with the effectiveness of the utilized online learning tools followed a diverse pattern, with 80.6% (n=20) of students at SFU Vienna, 66.1% (n=70) at Chulalongkorn University Bangkok, 65.8% (n=48) at Medical University Graz, 62% at the Universities of Zagreb (n=28) and Pécs (n=25) and 36.9% (n=9) at the Medical University of Vienna ( $p = 0,001$ ).

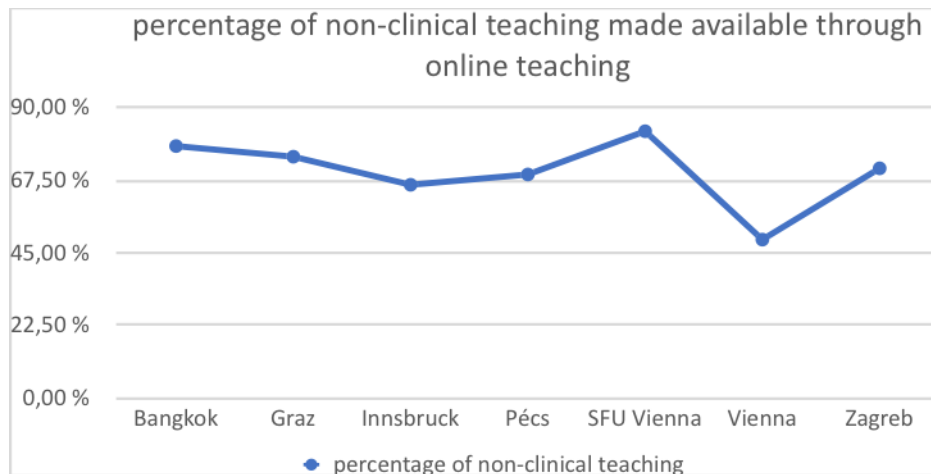


Figure 4 The percentage of the non-clinical teaching made available through online learning

The survey further detected major differences in motivation of students from their universities to participate in online learning activities. Between universities the approval of participants concerning the motivation by the universities ranges from 23.1% to 72.1% with an average of 51.4%. 53.7% of the participating students at Chulalongkorn University Bangkok reported successful motivation, 57.4% at the Medical University of Innsbruck and 67.7% at the Medical University of Graz ( $p < 0,001$ ).

The majority (51.4%,  $n = 110$ ) of students felt that they could stay focused on their dental training during online learning activities.

On a positive note, most of the participants reported they had access to an environment which allowed studying and working online without disturbances.

The overall approval of the present survey at the seven participating universities was over 72%.

At two universities (Bangkok and Vienna) the approval was around 50%, three universities had an approval of over 70% (Pécs, Zagreb, Graz) and two universities reached even over 80% (SFU Vienna, Innsbruck) ( $p < 0,001$ ).

The majority of students (61.6%,  $n = 133$ ) felt that being able to see their professor visually during online lectures affected their concentration positively.

As the universities adjusted the teaching to online/distance learning, the workload as perceived by the students somewhat decreased (30.9%  $n=67$ ) or remained the same (24.4%,  $n=53$ ). On the other side, students felt that the workload somewhat (20.3% ,

n=44), or largely (15.7% , n=34) increased while only 8.8% (n=19) felt that it largely decreased.

At the Chulalongkorn University Bangkok 58 % felt that the workload increased, 42% at University of Zagreb, 50% at the University of Pécs felt that the workload decreased, 77% at the University of Vienna, 60% at the Medical University of Innsbruck.

At the Medical University of Graz 41.7% thought that the study workload stayed the same, at the SFU Vienna 40% ( $p < 0,001$ ) (Figure 5).

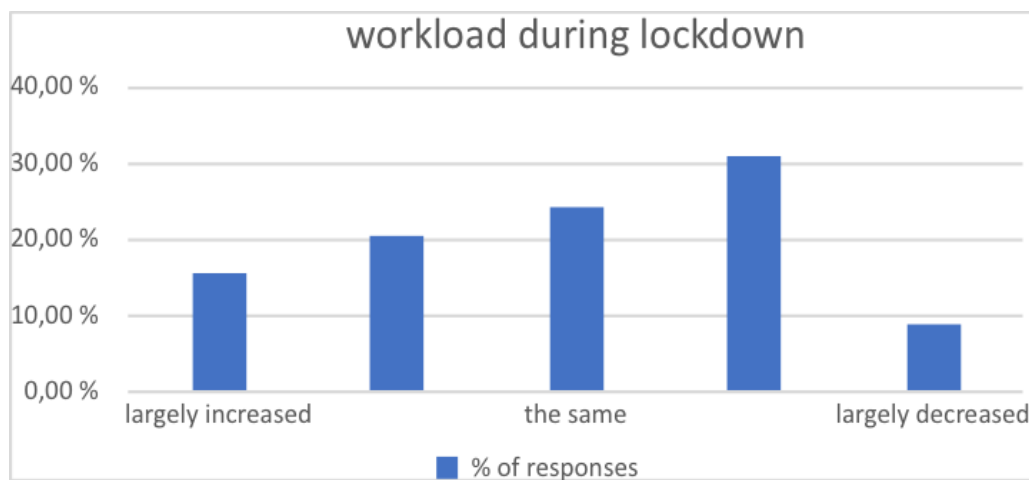


Figure 5 The study workload during the lockdown from the students perspective

It is noticeable that the participants older than 24 years reported more frequently decrease of workload during the pandemic, whereas 74% of the participants aged 24 years or younger indicated a similar or increased workload, a difference that was statistically significant ( $P = 0,015$ ). With regards to gender, 36.6% of male and 26.5% of female participants felt a decrease in workload ( $p = 0,050$ ) (Figure 6). An overview of the responses is shown in Tables 3, 4, 5, 6

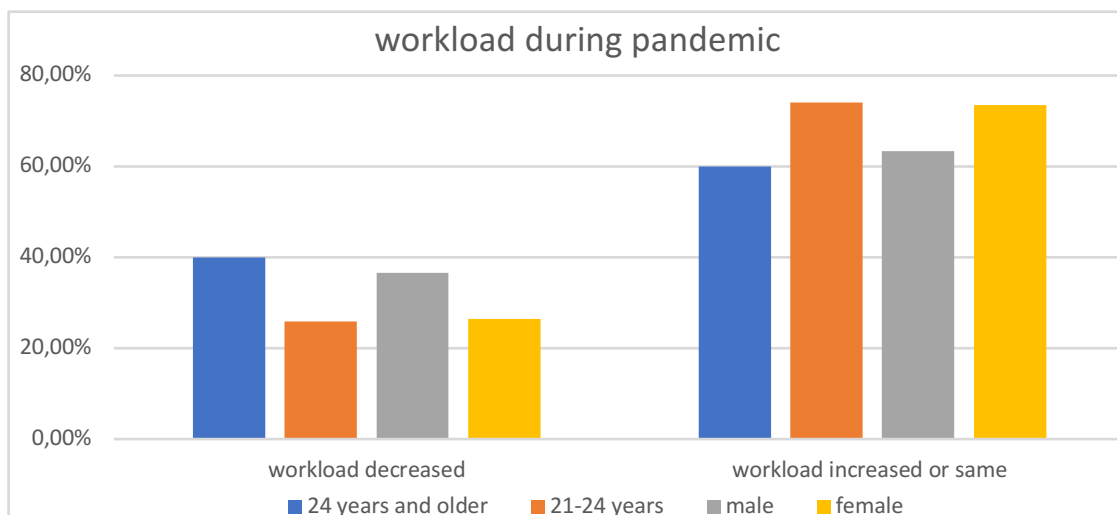


Figure 6 Students' perception of the change in the study workload during the lockdown based on age and gender groups

Lockdown, teaching and learning		
Question	Number of participants	% of participants
<b>12 I have attended all expected on-line learning activities organized by the University during the lockdown</b>		
yes	204	86,1%
no	33	13,9%
<b>13 If yes, What was your main motivation for attending all online education from your University?</b>		
It was obligatory	61	30,7%
I believe I would benefit from attending	108	54,3%
I had nothing better to do	13	6,5%
I needed the interaction	7	3,5%
I needed the intellectual stimulation	10	5%

Table 3 Responses teaching and learning 1

<b>15 The University took all possible</b>	Medical University of Graz	47	0	100	71,8	31,4
	Medical University of Vienna	9	0	86	32,3	29,3

<b>actions to ensure continuity of my education</b>	Sigmund Freud University Vienna	20	19	100	83,4	22,5
	Medical University of Innsbruck	17	0	100	57,0	33,9
	University of Zagreb	28	23	100	66,6	23,0
	University of Pécs	25	0	100	65,1	35,2
	Chulalongkorn University Bangkok	70	6	100	77,1	19,2
<b>16 The University has utilised online learning effectively.</b>	Medical University of Graz	48	0	100	65,8	30,8
	Medical University of Vienna	9	0	79	36,9	26,3
	Sigmund Freud University Vienna	20	18	100	80,6	21,8
	Medical University of Innsbruck	17	0	100	64,6	32,0
	University of Zagreb	28	13	100	62,9	26,7
	University of Pécs	25	0	100	62,1	30,4
	Chulalongkorn University Bangkok	70	0	100	66,1	22,8
<b>17 What percentage of the non-clinical teaching was made available to you through on-line learning during the lockdown ?</b>	Medical University of Graz	48	20	100	74,9	22,4
	Medical University of Vienna	9	0	92	49,2	28,2
	Sigmund Freud University Vienna	20	49	100	82,8	16,8
	Medical University of Innsbruck	17	5	100	66,2	30,1
	University of Zagreb	28	0	100	71,3	26,4
	University of Pécs	24	5	100	69,4	30,5
	Chulalongkorn University Bangkok	70	20	100	78,2	19,7
<b>18 The University has organised diverse and engaging online learning activities.</b>	Medical University of Graz	47	0	100	61,8	30,7
	Medical University of Vienna	9	0	64	26,6	28,2
	Sigmund Freud University Vienna	19	13	100	71,8	28,2
	Medical University of Innsbruck	17	0	100	51,2	39,3
	University of Zagreb	28	0	100	53,6	27,4
	University of Pécs	25	0	100	49,4	33,8
	Chulalongkorn University Bangkok	69	3	100	63,3	22,5
<b>19 The University has been successful in motivating me to participate in the online learning activities</b>	Medical University of Graz	48	0	100	67,7	29,6
	Medical University of Vienna	9	0	71	23,1	27,0
	Sigmund Freud University Vienna	20	2	100	72,1	28,3
	Medical University of Innsbruck	17	1	100	57,4	28,2
	University of Zagreb	28	0	100	44,2	30,1
	University of Pécs	24	0	100	41,3	32,7
	Chulalongkorn University Bangkok	70	0	100	53,7	25,7

Table 4 Responses teaching and learning 2

<b>20 It affects my concentration positively when I can see my professor visually during online lectures</b>	YES		NO	
	n	%	n	%
Medical University of Graz	28	58,3	20	41,7
Medical University of Vienna	6	66,7	3,0	33,3
Sigmund Freud University Vienna	17	89,5	2	10,5
Medical University of Innsbruck	13	76,5	4	23,5
University of Zagreb	19	67,9	9	32,1
University of Pécs	13	52	12	48
Chulalongkorn University Bangkok	37	52,9	33	47,1
	133	61,6	83	38,4

*Table 5 Response seeing professor visually during online lectures*

Question	University	N	min	max	mean	SD
<b>21 The lecturers tried to create an interactive and engaging learning environment.</b>	Medical University of Graz	48	0	100	68,8	29,6
	Medical University of Vienna	9	1	79	41,9	24,9
	Sigmund Freud University Vienna	20	16	100	68,7	23,4
	Medical University of Innsbruck	17	0	100	60,5	30,8
	University of Zagreb	28	4	100	48,0	27,5
	University of Pécs	24	3	100	44,9	29,5
	Chulalongkorn University Bangkok	69	0	100	60,4	25,1
<b>22 I could stay focused during online learning activities</b>	Medical University of Graz	48	0	100	59,2	29,2
	Medical University of Vienna	9	0	91	38,4	32,5
	Sigmund Freud University Vienna	20	15	100	57,3	27,0
	Medical University of Innsbruck	17	0	98	50,9	26,1
	University of Zagreb	28	0	100	45,5	33,1
	University of Pécs	24	0	95	44,0	28,7
	Chulalongkorn University Bangkok	69	0	100	46,1	28,6
<b>23 I had the environment to study and work online without disturbances</b>	Medical University of Graz	48	8	100	79,7	27,3
	Medical University of Vienna	9	1	100	51,7	35,4
	Sigmund Freud University Vienna	20	18	100	81,1	23,7
	Medical University of Innsbruck	17	30	100	83,4	20,4
	University of Zagreb	28	0	100	77,1	29,1
	University of Pécs	24	0	100	73,5	30,0
	Chulalongkorn University Bangkok	68	0	100	58,3	30,9
<b>24 During the corona situation my concentration and motivation was worse than usual.</b>	Medical University of Graz	47	0	99	37,0	29,5
	Medical University of Vienna	9	0	100	62,6	38,7
	Sigmund Freud University Vienna	19	0	100	48,5	33,4
	Medical University of Innsbruck	16	0	100	49,6	34,2
	University of Zagreb	28	0	100	62,6	33,8
	University of Pécs	24	0	100	59,9	31,2
	Chulalongkorn University Bangkok	68	0	100	65,5	31,9
<b>26 The online learning platform</b>	Medical University of Graz	48	10	100	80,9	24,2
	Medical University of Vienna	9	19	93	58,3	22,2

<b>utilised by the University was easy to use</b>	Sigmund Freud University Vienna		20		27		100		80,0		21,8	
	Medical University of Innsbruck		18		26		100		80,9		20,5	
University of Zagreb		28		0		100		75,1		26,7		
University of Pécs		24		4		100		77,1		27,6		
Chulalongkorn University Bangkok		70		0		100		68,7		20,6		
<b>25 My study workload during the lockdown was</b>	largely increased		somewhat increased		the same		somewhat decreased		largely decreased			
1 University	n	%	n	%	n	%	n	%	n	%		
Medizinische Universität Graz	2	4,2	8	16,7	20	41,7	15	31,3	3	6,3		
Medizinische Universität Wien					2	22,2	3	33,3	4	44,4		
Sigmund Freud Universität Wien	1	5	3	15	8	40	8	40				
Medizinische Universität Innsbruck	2	11,1	3	16,7	2	11,1	7	38,9	4	22,2		
University of Zagreb	6	21,4	6	21,4	7	25	8	28,6	1	3,6		
University of Pécs	3	12,5	3	12,5	6	25	10	41,7	2	8,3		
Chulalongkorn University Bangkok	20	28,6	21	30	8	11,4	16	22,9	5	7,1		
total	34	15,7	44	20,3	53	24,4	67	30,9	19	8,8		

Table 6 Responses during lockdown

### 3.3 After Lockdown

The majority of students (70.9%, range 65.8% -76.6%) appear to be willing to compromise at least some of the clinical training requirements, in order to graduate in time. Furthermore, 80.3% of students felt confident to resume clinical training after the disruption of the lockdown, in particular those aged 24 years and older ( $p=0,018$ ).

In general female students felt a higher disruption of their education during the pandemic ( $p=0,014$ ) and were less confident to continue clinical training in comparison to their male colleagues ( $p=0,001$ ).

It is apparent that those participants who felt a decrease in workload during online education, did not have the same concentration and motivation as before the pandemic ( $p=0,009$ ). The same group of students further stated that they felt a severe disruption of their education ( $p=0,009$ ) and that they observed lesser efforts taken by their universities to ensure the continuity of the education ( $p=0,022$ ).

An overview of the responses is shown in Table 7.

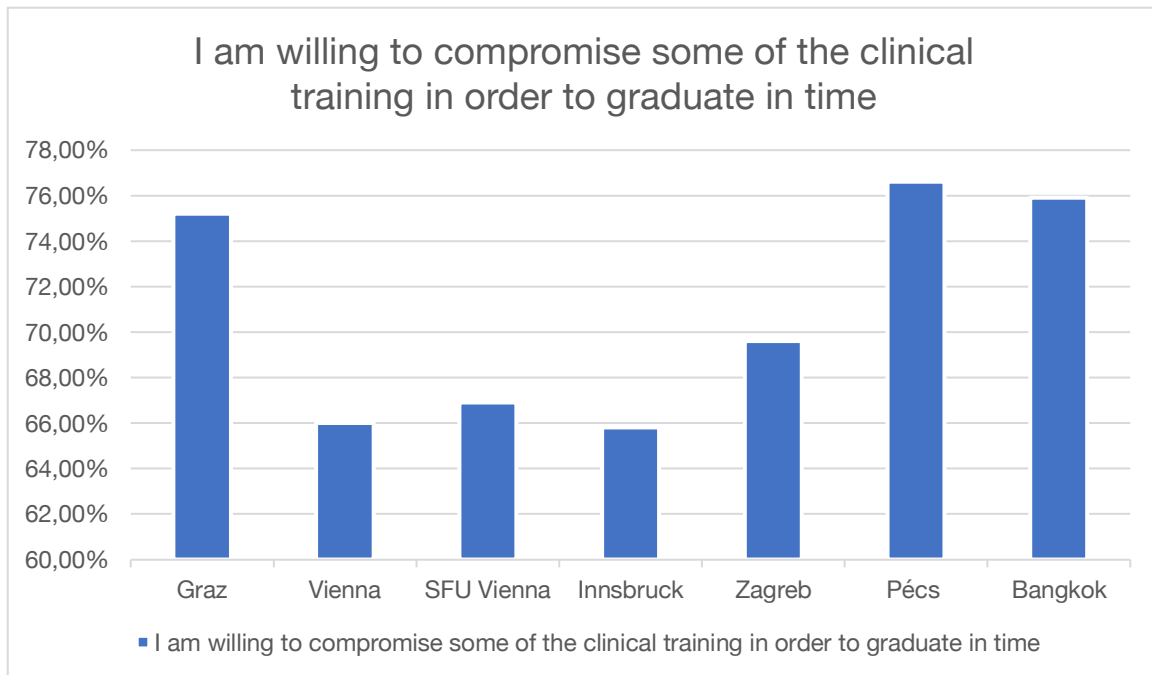


Figure 7 students compromising clinical training

Question	University	N	min	max	mean	SD
<b>27 I feel that my education as a whole has been severely disrupted</b>	Medizinische Universität Graz	44		100	44,5	31,2
	Medizinische Universität Wien	9	56	100	81,3	16,9
	Sigmund Freud Universität Wien	20		100	39,3	27,4
	Medizinische Universität Innsbruck	18	30	98	57,1	21,1
	University of Zagreb	26	6	100	67,4	32,2
	University of Pécs	24		100	52,5	31,7
	Chulalongkorn University Bangkok	69		100	60,5	28,9
<b>28 The University has offered a reliable pathway to compensate for any loss of education / training during the lockdown</b>	Medizinische Universität Graz	46		100	57,5	31,7
	Medizinische Universität Wien	9		54	20,3	23,2
	Sigmund Freud Universität Wien	19	8	100	71,8	28,6
	Medizinische Universität Innsbruck	18	3	100	54,6	31,3
	University of Zagreb	27		100	36,6	30,7
	University of Pécs	24		100	48,4	30,3
	Chulalongkorn University Bangkok	69		100	60,7	25,8
<b>29 I am willing to compromise</b>	Medizinische Universität Graz	46	8	100	75,2	27,4
	Medizinische Universität Wien	9	3	100	66,0	30,2

<b>some of the clinical training requirements, in order to graduate in time</b>	Sigmund Freud Universität Wien	16		100	66,9	37,2
	Medizinische Universität Innsbruck	18		100	65,8	36,4
	University of Zagreb	19	29	100	69,6	23,1
	University of Pécs	24	11	100	76,6	24,4
	Chulalongkorn University Bangkok	58		100	75,9	25,6
<b>30 I feel confident to continue my clinical training</b>	Medizinische Universität Graz	46	22,2	100	83,4	21,9
	Medizinische Universität Wien	9	76	100	89,6	9,1
	Sigmund Freud Universität Wien	16	65	100	92,7	10,1
	Medizinische Universität Innsbruck	18	53	100	89,2	16,4
	University of Zagreb	19		100	61,7	27,2
	University of Pécs	24	10	100	76,4	25,7
	Chulalongkorn University Bangkok	58		100	68,8	21,7
<b>31 I would like to see the online learning as it was practiced during the lockdown to continue when normality resumes</b>	Medizinische Universität Graz	46		100	50,2	35,5
	Medizinische Universität Wien	9		70	29,0	25,5
	Sigmund Freud Universität Wien	19	4	100	66,6	34,9
	Medizinische Universität Innsbruck	18		100	55,8	36,1
	University of Zagreb	27		100	61,3	35,7
	University of Pécs	23	1	100	62,3	28,9
	Chulalongkorn University Bangkok	67		100	60,1	29,5

Table 7 Responses after lockdown

	Number of participants	% of participants
33. What can the University do to ensure the best conditions for resuming and completing your education?		
Intensify learning (more teaching hours/week)	30	14,3%
Reduce clinical training requirements	49	23,4%
Increase clinical exposure	99	47,3%

Prolong duration of studies	19	9%
other	12	5,8%

*Table 8 Response conditions for resuming education*

## 4. Discussion

The present study shows an overview on how seven different universities in Europe and Asia adapted their program for dental education during Covid-19. The explosive surfacing of the Covid-19 pandemic forced the dental institutions to adapt their curriculum in a fast and innovative way to ensure the continuity of dental education. It is important to mention, that the program for dental education differs from the program for medical education. Dental education requires a high amount of practical dental clinical education that the students convene in physical settings and cannot be replaced by telehealth formats, which were occurring for our medical colleagues.(19) In the beginning of the pandemic and its associated emergency patient treatments, protective gear for working safely on the patient was necessary. Because of the shortage of masks and personal protective equipment it was a (first time) challenge for the universities to provide all the students and emergency staff with the required protective gear. Despite the challenge, the dental institutions managed to ensure working safely for the staff conducting emergency patient care.

The universities tried their best to continue education as usual during the pandemic and lockdown, but however the workload and time spent on education overall decreased.

In fact 39,7% of participants felt a decrease in workload.

Comparing the data of the present study with “Impact of COVID-19 on dental education in Europe”(20) that represented 34 countries in Europe, shows that 50% (n=435) of the students reported spending less time on education. The data further demonstrates that the clinical exposure to patients of dental students cannot completely be compensated with online teaching. Nevertheless the seven universities managed to deliver an average of over 70% of the non-clinical teaching through online learning during the lockdown. However, 56.9% (n=119) of the students from the seven Universities in Europe and Asia, would like to see online learning as it was practiced during the lockdowns to continue also when normality resumes.

It seems that for some students online teaching is an advantage because they are able to participate at online lectures at home. A few students would like the online lectures to be recorded, so they are available and can be repeatedly reviewed also at a more convenient time.

Students were also asked which online learning activities should be implemented in the normal curriculum after the pandemic. Especially theoretical and non-clinical content was suggested to be provided online when normality resumes. Some students would prefer lectures to be recorded so they could watch and review at a more convenient time.

Comparing these statements to the opinion of the participants of “Impact of COVID-19 on dental education in Europe”(20) , they believe that online teaching will continue in future, in fact 39% of the students thought that it should play a significant role in future dental education.

For the majority of students however, the best conditions for resuming and completing their dental education would be to increase the hours of clinical exposure in working with patients on the one hand and to adapt the requirements for completion of their clinical training.

In conclusion the present study shows that the participating universities overall managed to ensure dental education during this black swan event, even though there was no recorded guideline concerning such an exceptional situation. Dealing with dental education depends on the stage of the pandemic and the characteristics of each country. (21)

At the end of the pandemic there will definitely be a high amount of gained experience, to retrospectively analyse how dental education managed the challenges during the pandemic.

A drawback of the present investigation however is that no specific analyses of methods and measures taken by universities to cope with the pandemic has been performed.

However another clear result of this survey is a highly positive feedback of students on the incorporation of online training and digital tools in dental education and in most parts of every day's life. Thus, universities should seriously consider to extend online education in dental trainings.

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## Survey about teaching

<b>A.) Demographics</b>																								
Name of University:																								
I am ___ years old, <input type="checkbox"/> Male <input type="checkbox"/> Female																								
Study level:																								
- Undergraduate student (Bachelor's degree)																								
- Graduate Student (Master's degree, PHD)																								
Semester of studies in Jan 2020:																								
During the lockdown I was based in :																								
- same city as the university																								
- my hometown (other, urban centre)																								
- my hometown (other, rural)																								
- other country than the university																								
- other...text																								
<b>B.) Lockdown</b>											0	1	2	3	4	5	6	7	8	9	10	Y	N	
											I fully disagree										e	o		
											I fully agree										s	s		
<b>a.) Clinical Exposure</b>																								
When the University shut down, I had the option to join voluntarily the staff conducting emergency patient care																								
Did you conduct any emergency patient treatments during the time the University was shut?																								
If yes: The University provided me with the required protective gear for working safely on the patient											0	1	2	3	4	5	6	7	8	9	10			
The University continued to ensure adequate patient care for emergencies.																								
At the moment I treat too few patients																								
<b>b.) Teaching and Learning</b>																								
I have attended all expected on-line learning activities organized by the University during the lockdown																								
<b>If yes: What was your main motivation?</b>																								
- it was obligatory																								
- I believe I would benefit from attending																								
- I had nothing better to do																								
- I needed the interaction																								
- I needed the intellectual stimulation																								
- other (text)																								
<b>If no: What was the main reason?</b>																								
-																								
											0	1	2	3	4	5	6	7	8	9	10			
The University took all possible actions to ensure continuity of my education																								
The University has utilised online learning effectively.																								

