



# Impact of COVID-19 on theoretical knowledge and clinical practice in dentistry of Piracicaba Dental School students: a cross-sectional study

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**Aim:** To assess the opinion of the students on the impact of COVID-19 pandemic on theoretical knowledge and clinical practice in dentistry at the Piracicaba Dental School – FOP/UNICAMP. **Methods:** A questionnaire was applied using the *Google Forms* platform, containing 20 questions related to the impacts of the pandemic on knowledge, mental health, and clinical and laboratory practice of dentistry. The satisfaction of the students with teaching was also evaluated. A total of 120 questionnaires were analyzed using R software, through tables and graphs of absolute and relative frequencies distribution. **Results:** COVID-19 affected the lives of 99% students who participated in the study. Due to distance learning resulting from the COVID-19 pandemic, 50% of the students considered locking or dropping out of college. Operative dentistry was the curricular component most affected by distance and lack of clinical practice. Although most students agreed that the workload of practical disciplines was or would be replaced, 95% felt some kind of deficit in clinical and laboratory practice even with the replacement of the workload. In addition, 93.3% of the students were afraid of not becoming a qualified professional due to the deficiencies on theoretical knowledge and clinical practice caused by the pandemic. **Conclusions:** Students showed dissatisfaction with the deficiency of clinical and laboratory practice resulting from the pandemic in operative dentistry curricular component. They reported fear and insecurity with their future professional lives. The indication of remote classes for dentistry should only be carried out in emergencies because this is an essentially practical course that suffers losses in learning.

**Keywords:** Coronavirus. COVID-19. Teaching. Education, distance. Dentistry. Dentistry, operative.

## Introduction

In December 2019, a new strain of virus, called *Severe Acute Respiratory Syndrome Coronavirus 2* (SARS-CoV-2) was identified in China. It was later discovered that this strain could cause COVID-19. It spread around the world rapidly, causing many deaths<sup>1,2</sup>. In 2020, the spread of the coronavirus was declared by the World Health Organization as a disease of worldwide relevance. Shortly afterward, in March of the current year, the situation progressed into a pandemic<sup>3</sup>.

Due to the high transmissibility of the virus and the high number of deaths, Brazil adopted measures to isolate the population, avoiding agglomeration, in an attempt to contain the spread of the virus<sup>4</sup>. To reduce the circulation of the virus, the Ministry of Education (MEC) suspended face-to-face activities. Distance learning was then implemented by several schools and universities, in which educators and students are not physically present, having their educational moments regulated by information and communication technology (ICT)<sup>5</sup>.

In 2017, the Federal Council of Dentistry (CFO) determined that subjects involving dentistry, and their theoretical–practical contents, must be taught in person<sup>6</sup>. However, with the worsening of the pandemic condition, the face-to-face modality could not be carried out. To address the situation, the MEC established carrying out these activities as the responsibility of the institution, which should be replaced or postponed to an opportune time<sup>7</sup>.

For health students, especially those in operative dentistry, direct contact with the patient is essential for the composition of their curriculum and theoretical/practical improvement, in addition to improving the relationship between the dental surgeon and their patients<sup>8-10</sup>. However, this interaction was not viable due to the higher risk of contamination with fluids, particles, and aerosols<sup>11</sup>. Thus, dentistry suffered a large deficit in teaching and learning during this period.

The laboratory training in dentistry represents the initial contact of undergraduate students with instruments and operative techniques, which will facilitate their future professional lives, clinical knowledge and safety in clinical care. In order to provide adequate practical training in the pandemic scenario, face-to-face clinical activities began to involve fewer people, delaying the completion of curricular components<sup>12</sup>. The discipline of operative dentistry was one of the most affected by this change in teaching, representing a challenging obstacle in the training of professionals, without any prejudice to the quality of academic training<sup>13</sup>.

Despite universities' efforts to minimize the negative impacts, students have felt hampered in the teaching–learning process, becoming insecure and anxious due to the absence of clinical activities<sup>14</sup>. Considering these issues, the present study aimed to evaluate the opinion of enrolled students considering the impact of the COVID-19 pandemic on theoretical knowledge and clinical practice in the field of dentistry at the Piracicaba Dental School (University of Campinas) – FOP/UNICAMP.

Materials and Methods

This study was approved by the Ethics and Research Committee of the Piracicaba Dental School – CEP/FOP, process number 5.342.420 (CAAE: 57027622.7.0000.5418). The materials and methods used in this study are shown in Table 1 to facilitate understanding.

Table 1. Materials and Methods.

Study design	A cross-sectional study was carried out with the application of a questionnaire
Setting	The questionnaire was prepared by the researchers, through the <i>Google Forms</i> platform, and applied in the period from 04/21/2022 to 07/04/2022 at the Piracicaba Dental School (FOP/UNICAMP)
Participants	The inclusion criteria for participants were students over eighteen years old, regularly enrolled at the Piracicaba Dental School (FOP/UNICAMP) during the data collection period, who were mandatorily enrolled, in the clinical and laboratory practice of operative dentistry.
Variables	<p>The research instrument consisted of 19 objective questions related to topics that encompassed the impact of the coronavirus pandemic on learning, mental health, and clinical and laboratory practice of operative dentistry, as well as the students satisfaction with the methods used by FOP/UNICAMP to minimize the effects of the pandemic in academic learning. The variables used was:</p> <ol style="list-style-type: none"><li>1. What is your family income? (Sum of the incomes of all people who live in the same environment as you)</li><li>2. Did you have adequate access to the internet during the distance activities promoted by FOP/UNICAMP?</li><li>3. What kind of internet did you use to participate in the distance activities promoted by FOP/UNICAMP?</li><li>4. Counting you, how many people live in your household?</li><li>5. Has the COVID-19 pandemic affected your academic life in any way?</li><li>6. In which part of your academic life did you feel most affected?</li><li>7. During the pandemic, did you consider locking your course or dropping out of dentistry due to distance learning resulting from the pandemic?</li><li>8. Has the practical workload of your subjects been replaced during the pandemic, or will it be after?</li><li>9. Did you feel any kind of deficit in laboratory and clinical practice even with the replacement of the workload?</li><li>10. Indicate which subjects were most affected by distance learning and clinical practice deficiency.</li><li>11. During the replacement of the hours of the operative dentistry discipline, were you able to carry out practical activities in the same way as before the pandemic?</li><li>12. Do you feel that the grading activities are corresponding to the level of education being offered?</li><li>13. In relation to the teaching offered by the discipline of operative dentistry, how satisfied are you?</li><li>14. Do you feel prepared to serve patients at the operative dentistry clinic?</li><li>15. Among the following procedures, which one do you think lacked more laboratory practice to favor clinical practice?</li><li>16. Regarding your mental health and its association with your present academic and future professional life, are you afraid of not being a sufficiently qualified professional due to the deficiencies in teaching caused by the pandemic?</li><li>17. Do you feel motivated to carry out procedures in the best possible way and complete your graduation, minimizing, as much as possible, the negative impacts of the pandemic?</li><li>18. Regarding your perception of the institution's attitudes towards the pandemic, do you believe that even with all the difficulty, what was within the reach of the institution was done to offer the best for students?</li><li>19. Comparing FOP/UNICAMP with other educational institutions and the teaching methods applied by them during the pandemic, do you think your institution had more appropriate attitudes?</li></ol>

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Data sources/ measurement	The link to the questionnaire was sent to the participants through social networks. A total of 120 questionnaires were analyzed. The data collected via <i>Google Forms</i> were exported to an Excel® for Windows.
Bias	To avoid bias, participants were not chosen. The questionnaire link was sent via social networks to all students who met the eligibility criteria, so when the number of participants required for the research was reached, based on the sample calculation, the questionnaire was closed, not allowing access. To ensure the blinding of the study, the researchers had no control over the participants identities.
Study size	The population (230 students) was determined based on the sample calculation where the total population enrolled in clinical and laboratory practice. The sample size was established with statistical confidence level of 95%, corresponding to 120 students.
Statistical methods	The data was analyzed using R <sup>*</sup> software, through tables and graphs of the distribution of absolute and relative frequencies <sup>15</sup> .

## Results

Table 2 shows the demographic profile of the students who were part of the sample of this study. Most belonged to families with incomes above five minimum wages (74.2%), with 75.8% having adequate access to the internet during the distance activities. There was an even higher frequency of the use of optical fiber (44.2%) or broadband (37.5%) to participate in the distance activities promoted by the faculty.

**Table 2.** Descriptive analysis of the demographic characteristics of the students (n=120)

Variable	Category	Frequency	Percentage
What is your family income? (Sum of the incomes of all people who live in the same environment as you)	One to two minimum wages	5	4.2%
	Three to four minimum wages	26	21.7%
	Five to six minimum wages	35	29.2%
	More than six minimum wages	54	45.0%
Did you have adequate access to the internet during the distance activities promoted by FOP/UNICAMP?	I totally agree	91	75.8%
	I partially agree	27	22.5%
	I partially disagree	2	1.7%
	I totally disagree	0	0.0%
What kind of internet did you use to participate in the distance activities promoted by FOP/UNICAMP?	3G/4G	1	0.8%
	Broadband	45	37.5%
	Optical fiber	53	44.2%
	Satellite	17	14.2%
	Other	4	3.3%
Counting you, how many people live in your household?	One to two people	18	15.0%
	Three to four people	82	68.3%
	Five to six people	15	12.5%
	More than six people	5	4.2%

The COVID-19 pandemic affected the academic life of 99.2% of the students (Table 3), especially considering the practical (39.2%) or practical and theoretical (56.7%) aspects. Additionally, 50.0% of the students considered dropping the course or dropping out of dentistry due to distance learning resulting from the pandemic. However, 90.8% believed that the practical workload of the discipline would be restored during or after the pandemic. Furthermore, 68.3% totally felt a deficit in laboratory and clinical practice, even with the replacement of the workload, and 26.7% felt this deficit partially. The dentistry subject was indicated by 70.0% of the participants as affected by distance learning and clinical practice deficiency (Figure 1).

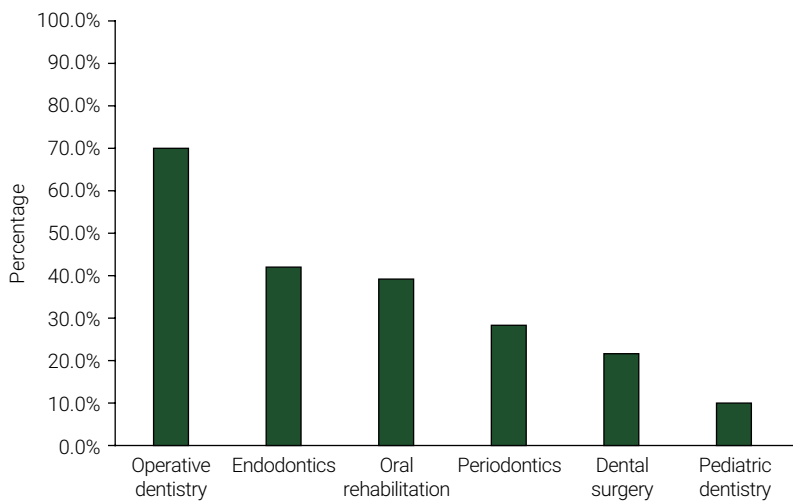
**Table 3.** Descriptive analysis of the impacts of Coronavirus pandemic on learning, mental health, and clinical and laboratory practice of Dentistry (n=120)

Variable	Category	Frequency	Percentage
Has the COVID-19 pandemic affected your academic life in any way?	I totally agree	107	89.2%
	I partially agree	12	10.0%
	I partially disagree	1	0.8%
	I totally disagree	0	0.0%
In which part of your academic life did you feel most affected?	Practical part	47	39.2%
	Theoretical part	5	4.2%
	Both	68	56.7%
During the pandemic, did you consider locking your course or dropping out of dentistry due to distance learning resulting from the pandemic?	I totally agree	30	25.0%
	I partially agree	30	25.0%
	I partially disagree	16	13.3%
	I totally disagree	44	36.7%
Has the practical workload of your subjects been replaced during the pandemic, or will it be after?	I totally agree	22	18.3%
	I partially agree	87	72.5%
	I partially disagree	7	5.8%
	I totally disagree	4	3.3%
Did you feel any kind of deficit in laboratory and clinical practice even with the replacement of the workload?	I totally agree	82	68.3%
	I partially agree	32	26.7%
	I partially disagree	5	4.2%
	I totally disagree	1	0.8%
¹Indicate which subjects were most affected by distance learning and clinical practice deficiency.	Dentistry	84	70.0%
	Endodontics	50	41.7%
	Prosthesis	47	39.2%
	Periodontics	34	28.3%
	Surgery	26	21.7%
	Pediatric dentistry	12	10.0%

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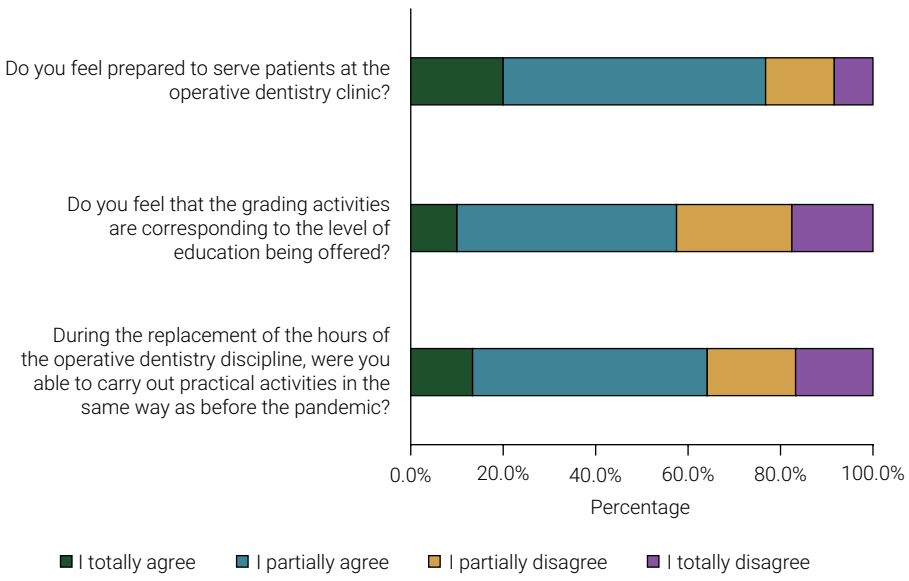
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During the replacement of the hours of the operative dentistry discipline, were you able to carry out practical activities in the same way as before the pandemic?	I totally agree	16	13.3%
	I partially agree	61	50.8%
	I partially disagree	23	19.2%
	I totally disagree	20	16.7%
Do you feel that the grading activities are corresponding to the level of education being offered?	I totally agree	12	10.0%
	I partially agree	57	47.5%
	I partially disagree	30	25.0%
	I totally disagree	21	17.5%
In relation to the teaching offered by the discipline of operative dentistry, how satisfied are you?	Completely satisfied	2	1.7%
	Very satisfied	52	43.3%
	A little satisfied	53	44.2%
	A little dissatisfied	4	3.3%
	Very unsatisfied	6	5.0%
	Completely dissatisfied	3	2.5%
Do you feel prepared to serve patients at the operative dentistry clinic?	I totally agree	24	20.0%
	I partially agree	68	56.7%
	I partially disagree	18	15.0%
	I totally disagree	10	8.3%
Among the following procedures, which one do you think lacked more laboratory practice to favor clinical practice? <sup>a</sup>	Preparations for indirect restorations	88	73.3%
	Intracardicular posts	87	72.5%
	Atypical direct restorations	75	62.5%
	Direct Class III and IV restorations	54	45.0%
	Class I and II direct restorations	18	15.0%
	Class V direct restorations	12	10.0%
Regarding your mental health and its association with your present academic and future professional life, are you afraid of not being a sufficiently qualified professional due to the deficiencies in teaching caused by the pandemic?	I totally agree	96	80.0%
	I partially agree	16	13.3%
	I partially disagree	3	2.5%
	I totally disagree	5	4.2%
Do you feel motivated to carry out procedures in the best possible way and complete your graduation, minimizing, as much as possible, the negative impacts of the pandemic?	I totally agree	41	34.2%
	I partially agree	54	45.0%
	I partially disagree	14	11.7%
	I totally disagree	11	9.2%
Regarding your perception of the institution's attitudes towards the pandemic, do you believe that even with all the difficulty, what was within the reach of the institution was done to offer the best for students?	I totally agree	10	8.3%
	I partially agree	45	37.5%
	I partially disagree	38	31.7%
	I totally disagree	27	22.5%
Comparing FOP/UNICAMP with other educational institutions and the teaching methods applied by them during the pandemic, do you think your institution had more appropriate attitudes?	I totally agree	8	6.7%
	I partially agree	51	42.5%
	I partially disagree	33	27.5%
	I totally disagree	28	23.3%

<sup>a</sup> The sum is greater than 100% because participants could choose more than one answer.

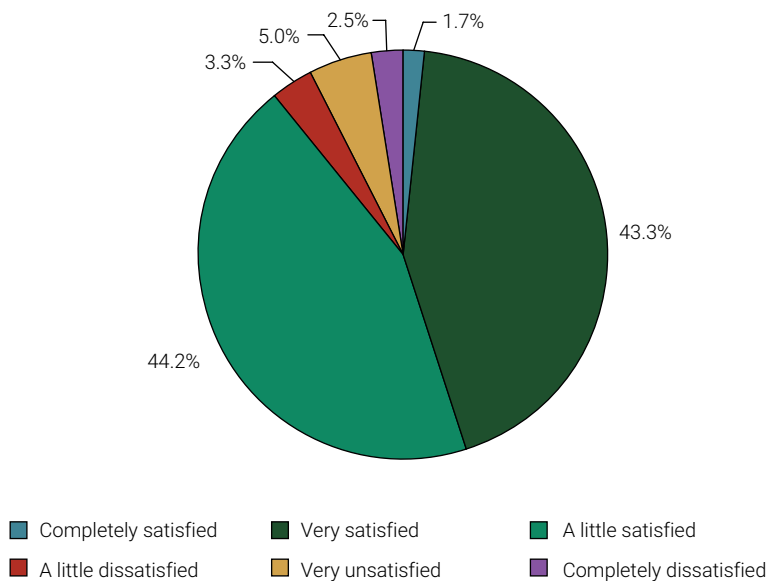


**Figure 1.** Frequency distribution of variables related to the subjects most affected by COVID-19 (n=120).

During the replacement of the workload of the operative dentistry subject, 13.3% of the students felt fully capable of carrying out practical activities in the same way as before the pandemic, and 50.8% felt partially capable (Figure 2). Moreover, 10.0% and 47.5% felt fully and partially, that the graded activities corresponded to the level of education being offered, respectively. As for the teaching offered by the dentistry discipline, 45.0% felt completely or very satisfied (Figure 3), but 23.3% did not feel prepared to care for patients in the operative dentistry clinic.

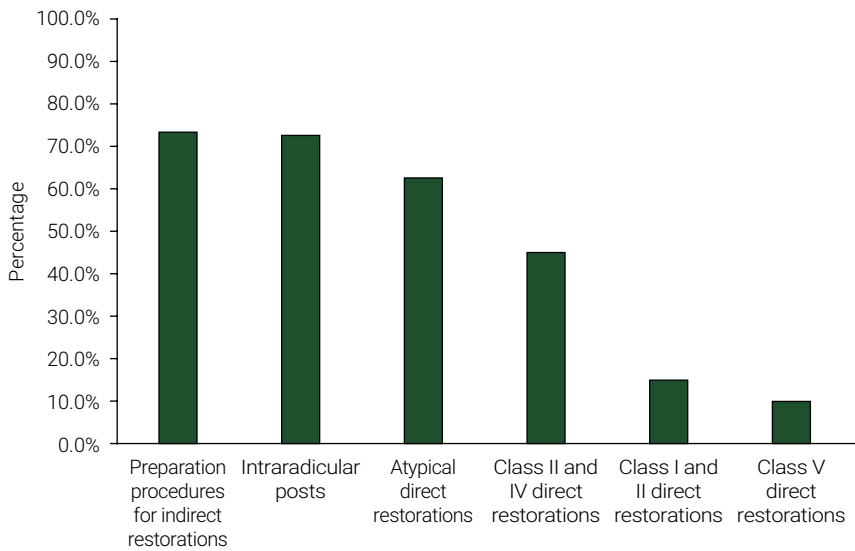


**Figure 2.** Frequency distribution of variables related to students' perception of the impact of COVID-19 on operative dentistry (n=120).



**Figure 3.** Frequency distribution of variables related to satisfaction with the teaching offered by operative dentistry.

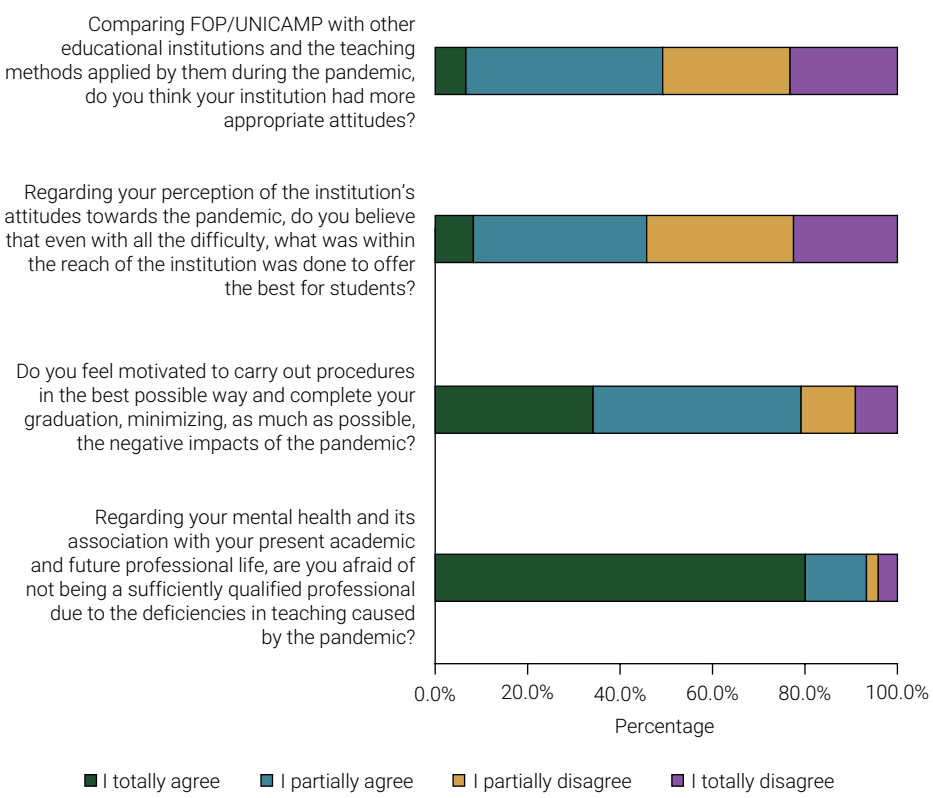
Figure 4 shows that most dental students opined for the lack of a greater laboratory practice to facilitate the clinical understanding of the procedures, especially in relation to the preparation for indirect restorations (73.3%), intraradicular posts (72.5%) and atypical direct restorations (62.5%).



**Figure 4.** Frequency distribution of procedures that students believed they lacked more laboratory practice due to the COVID-19 pandemic (n=120).



Figure 5 shows that 93.3% of students were afraid of not being a sufficiently qualified professional due to the deficiencies in teaching caused by the pandemic. However, 79.2% felt motivated to carry out the procedures in the best possible way and complete their graduation minimizing the negative impacts of the pandemic. Notably, 45.8% of the students believed that even with all the difficulties, the institution did the best under the circumstances to offer quality on students learning. Finally, 46.2% of the students agreed that when comparing FOP/UNICAMP with other educational institutions and teaching methods applied during the pandemic, the institution had more appropriate attitudes.



**Figure 5.** Frequency distribution of students' perception of mental health, motivation, and institutional attitudes towards the COVID-19 pandemic (n=120).

## Discussion

The unexpected changes in the education system caused by the COVID-19 pandemic were responsible for the great need for universities adaptation to the new reality. In a short period, it was essential to invest in virtual teaching platforms and the qualification of educators and students to guarantee adequate education<sup>16</sup>. Specifically in the area of dentistry, these changes were extremely significant, making practical teaching a challenge for dental students<sup>10</sup>.

In this study, 75.8% of the undergraduate students had adequate access to the internet during the activities promoted at a distance. This index is similar to the average of Brazilian households with internet access, which corresponded to a rate of 74%<sup>17</sup> in the pandemic scenario. Even with adequate internet access for most participants, the academic life of 99.2% of the students was affected. In addition, 50% of students considered dropping out of the course or dropping out of dentistry due to teaching deficits stemming from distance learning during the pandemic. This high rate can be justified due to the stress caused by the pandemic, as well as sleep deprivation and difficulty in maintaining an adequate study routine for an effective academic education<sup>18</sup>.

Distance education allows greater democratization of Brazilian higher education, where the difficulties caused by physical distance are reduced<sup>19</sup>. However, despite distance learning having been an essential tool to promote the theoretical workload of dentistry courses during the pandemic, the practical component of teaching was deficient in the vast majority of institutions<sup>10</sup>. Although 90.8% of the participants in this research believed that the practical workload was or would be replaced, 68.3% totally felt a deficit in laboratory and clinical practice even with the replacement of the workload, and 26.7% felt this deficit partially. This fact can be justified since the students remained without clinical and laboratory practice for a long period of time. Thus, the return to activities involved the delay of academic training. The graduation caused greater stress and anxiety in the students to fulfill the delayed workload.

Another factor that may explain this deficit in the general teaching practice in the institution is the difficulty in adapting to a practical reality. The main disadvantage of remote classes was the difficulty of concentration on the part of the students. Teachers' connection with students may have been impaired by the use of online classes. In addition, distance learning allowed, for the most part, the recording of classes, favoring the difficulty of concentration and leading students to divert attention more easily<sup>20,21</sup>. Thus, when returning to the face-to-face modality, the adaptation of undergraduate students becomes more difficult, interfering in the quality of practical learning.

Among the disciplines that make up the dentistry course, dentistry is one of the ones that most demands the practical development of the student<sup>12</sup>. According to FOP/UNICAMP, the discipline of dentistry emphasizes aspects of health promotion and a curricular structure focused on the integration of basic, clinical and preclinical areas<sup>22</sup>. In the present study, 70.0% of the participants believed that the discipline of dentistry was affected by distance learning and lack of clinical practice. In addition, only 13.3% of students felt fully able to perform practical activities in the same way as before the pandemic, during the replacement of the workload of the dentistry discipline, and 50.8% felt partially capable. This was because dentistry is a discipline that requires practice.

Regarding the evaluation methods used by the institution, 10.0% and 47.5% of the participants, respectively, felt totally and partially that the evaluation activities corresponded to the level of education offered. This difficulty in carrying out the assessment activities can be explained because, during the pandemic, students had contact with remote, more technological methods, adapting to a different reality from con-

ventional assessment methods. Discussion of these methods has been emphasized since before the pandemic. Authors state that it is necessary to update the teaching and assessment methods to more technological versions, which are able to ensure the attention of the student, especially after the pandemic period<sup>23-26</sup>.

Concerning student satisfaction, 45.0% felt completely or very satisfied with the teaching offered by the institution during the pandemic, considering the discipline of dentistry. This reflects the safety that academics have demonstrated for dental care, 23.3% of the students did not feel prepared to attend the patients in the dental clinic. In addition, most students reported the lack of laboratory practice enabling clinical practice in the preparation procedures for indirect restorations (73.3%), intraradicular posts (72.5%) and atypical direct restorations (62.5%). Since these procedures are more complex, they require more practice<sup>27</sup>, but with a restricted workload, the training of these procedures had to be divided among all themes.

Relating to the mental and professional health of students, 93.3% of students reported fear of not being a sufficiently qualified professional due to deficiencies in teaching caused by the pandemic. This does not correspond to studies carried out before the pandemic on the perception of professionals' preparation for post-training life, where 60% of students reported feeling properly trained to exercise the profession adequately<sup>28,29</sup>. In the present study, 79.2% of the students felt motivated to carry out the procedures in the best possible way and complete their graduation while minimizing the negative impacts of the pandemic. Despite all the difficulties, the majority of future dentistry professionals reported being able to do their best in their professional lives and graduation.

Regarding students' perception of the quality of the educational institution in the pandemic period, 45.8% of students believed that even with all the difficulty, the institution was indeed capable of offering the best in terms of education for students. In addition, 46.2% agreed that FOP/UNICAMP had more appropriate attitudes when compared to other educational institutions and the teaching methods applied during the pandemic.

In this context, the discipline of dentistry adopted a series of measures to replace all the practical content that could not be taught during the remote period. From this survey, it was intended to reevaluate the traditional teaching methods so that the damage to students during this period was minimized.

The results of the present study cannot be taken as a generalization, considering that the students' opinion was based on the institutional context, which can vary according to the educational institution. A limitation of the present study was the lack of questions that involved aspects of the study environment used for remote classes, such as the presence or absence of external factors that could interfere with the quality of learning. Thus, the need for more studies on this subject is reinforced, taking into account the other areas of dentistry.

## Conclusion

The COVID-19 pandemic affected most participants during the period of social isolation, especially concerning the area of operative dentistry and its practical processes.

The deficit was noticed especially in the training of more complex procedures. The results of this study allows the creation of new strategies to minimize the effects of the pandemic on education. In addition to guiding dentistry institutions on the indication of remote classes only in cases of emergencies, since it is an essentially practical course that suffers significant losses in learning when the clinical practice and laboratory are not performed.

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## Conflict of interest

The authors have no conflicts of interest to declare.

## Data availability

The data reported in this article are available upon request to the corresponding author.

## Author's contributions

Jéssica Cristine Linarelli led the writing, interpreted the data, reviewed, and edited. Hemanuely Albuquerque dos Anjos conceptualized, interpreted the data, reviewed, and edited. Débora Alves Nunes Leite Lima conceptualized, interpreted the data, reviewed, and edited. All authors read and approved the final manuscript.

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