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Impact of the COVID-19 Pandemic on Dental Education: Psychological and Clinical Challenges for Dental Students in Jordan

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ABSTRACT

Objectives: This study aimed at assessing the psychological impact of COVID-19 pandemic on dental students in Jordan, examining their knowledge and perceptions of the pandemic, and evaluating its effects on their clinical training.

Materials and Methods: In this cross-sectional study, an online survey was prepared and distributed to dental students and interns from two dental schools in Jordan. The survey was structured based on relevant literature into questions covering demographic information, knowledge of COVID-19, university's informative support, and concerns and perceptions about dentistry during the pandemic. The psychological status of students was measured using the short-form version of the Depression, Anxiety, and Stress Scale (DASS).

Results: Of the 332 dental students surveyed, 230 (69.3%) were females and 102 (30.7%) were males. Approximately two-thirds (67.5%) of students expressed interest in receiving more guidance on COVID-19, while more than a half (58%) of them were dissatisfied with the informative support offered by their schools during the pandemic. On a scale from 0-10, students reported a high potential influence of COVID-19 outbreak on dental practice in the short term (mean 8.9 ± 1.7), but a reduced impact in the long term (mean 6.9 ± 2.3). Based on DASS results, participants showed moderate levels of depression (mean 19.0 ± 12.2), anxiety (mean 10.4 ± 9.9), and stress (mean 19.6 ± 12.4), and these scores were significantly higher in females.

Conclusions: The COVID-19 pandemic significantly impacted dental students' clinical training and psychological well-being. Universities need to provide accessible mental-health support and implement strategies that balance safety with effective clinical training to minimize stress during health crises.

Keywords: COVID-19, Dental students, Psychologic stress, Anxiety, Depression, Education.

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1. Introduction

The COVID-19 outbreak has had a substantial disruptive impact on society, posing major challenges across all sectors, including economic, academic, and medical fields (1-3). While the global emergency triggered by the pandemic seems to have eased since May 2023, the pandemic itself has not ended (4). Since its onset, the world has recorded over 750 million

confirmed cases and approximately 7 million deaths due to COVID-19 (4).

Since the onset of COVID-19, social restrictions have been put in place to reduce human interaction, resulting in major disruptions to daily life, including education, as many countries around the world implemented lockdowns (5,6). After effectively controlling the outbreak, countries worldwide witnessed a resurgence of COVID-19 cases, characterized by a significant rise in reported cases and the emergence of new virus variants (7). This global health emergency has placed immense psychological pressure and mental strain on the public (8–11), especially to students, with delays in reopening universities and with the introduction of alternative unconventional methods for teaching and learning (3). Many countries have opted to close public schools, colleges, and universities as an emergency response and have suggested shifting to technology-based learning (e-learning), which has affected the education of billions of students (12,13).

The training of healthcare students, including those in dentistry, has been greatly affected, as clinical and hands-on elements cannot be adequately taught through online platforms (14). Furthermore, dental students are at a higher risk of COVID-19 infection due to the nature of their work, which includes procedures that generate aerosols (15). The pandemic has highlighted the vulnerability of the dental community to career-associated infections, adding to the mental strain and anxiety among dental students and practitioners, which may influence both their short- and long-term career planning (16). A number of studies have been conducted on the psychological impact of the pandemic on the mental health and on the status of dental students (17-22). Nevertheless, there is no similar study that has been conducted on dental students in Jordan. Hence, the aim of this study was to assess the psychological impact of the COVID-19 pandemic on dental students in Jordan, explore their knowledge and perceptions regarding the pandemic, and evaluate its effects on their clinical training. This study seeks to identify key areas where support and guidance are needed to ensure the well-being and academic success of dental students during global health crises.

2. Materials and Methods
2.1 Setting, Sample, and Procedure

A cross-sectional survey-based design was prepared and used to collect data from dental students and dental interns in the two dental schools in Jordan, the University of Jordan and Jordan University of Science and Technology. Participants were invited electronically *via* official university e-mail list to take part in the study and the data was stored on excel sheets. Students in their first, second, or third years of training were excluded, as their studies are primarily theory-based and do not include clinical practice. Fourth- and fifth-year dental students, as well as interns, were invited to participate, since clinical training in Jordanian dental schools begins in the fourth year.

Ethical approval was obtained from Institutional Review Board (IRB) at Jordan University of Science and Technology. Information about the study was provided and participants' consent was assumed upon their agreement to continue filling the survey and reading the aims of the study. The survey was available for two weeks and all responses were anonymous.

2.2 Survey Development and Measures

The survey was delivered online *via* Google Forms and all questions were provided in English with an Arabic translation to facilitate its understanding. The survey was pilot-tested with five students and updated based on their feedback. Three major sections were included in the survey. The first section gathered information on socio-demographic and academic characteristics, such as gender, study year, and university affiliation. The second section contained questions aimed at evaluating participants' knowledge of COVID-19, satisfaction with the support provided by their universities during the pandemic, and their concerns and perceptions regarding both the short- and long-term impacts on dentistry. These questions were created following an examination of existing and pertinent literature regarding the COVID-19 pandemic (23-28). However, due to the scarcity of COVID-19-specific studies prior to data collection, this section was enhanced with expert contributions; a number of questions were created by dental specialists utilizing the information accessible regarding the pandemic's impact. Face validity and content validity were established by having three dental experts thoroughly reviewing the survey items for clarity, relevance, and comprehensiveness.

The third section of the questionnaire focused on assessing psychiatric status and included the 21 items

from the short-form version of the Depression, Anxiety, and Stress Scale (DASS) developed by Henry et al. (29). The DASS has demonstrated reliability, with satisfactory psychometric properties and internal consistency (30). The DASS comprises three self-report sub-scales, each containing 7 items, aimed at measuring the emotional states of depression, anxiety, and stress. The depression sub-scale evaluates dysphoria, hopelessness, devaluation of life, self-criticism, and lack of interest. The anxiety sub-scale evaluates autonomic arousal, skeletal-muscle effects, situational anxiety, and the subjective experience of anxious feelings. The stress sub-scale is sensitive to levels of chronic non-specific arousal and measures difficulty relaxing, nervous arousal, and a tendency to be easily agitated, over-reactive, impatient, and irritable. Scores are determined by adding the scores for the relevant items and multiplying the total by two. The final score for each sub-scale is then assessed based on its severity rating index, resulting in one of the severity labels: normal, mild, moderate, severe, or extremely severe (29).

2.3 Statistical Analysis

A descriptive analysis was conducted using the means and standard deviations for continuous variables, and frequencies and proportions for categorical variables. The DASS sub-scales were compared across the different levels of gender, education, and location variables using t-tests and analysis of variance (ANOVA). Cronbach's alpha was evaluated for the DASS sub-scales of depression, anxiety, and stress. A Cronbach's alpha value greater than 0.7 indicates good internal-consistency reliability for a scale (31). The Spearman correlation coefficient was used to assess the relationship between the DASS sub-scales and perceptions about COVID-19. A correlation value below 0.3 was considered as weak, between 0.3 and 0.7 as moderate, and above 0.7 as strong (32). A confirmatory factor analysis was conducted on the DASS items to determine the loading of each item on its respective sub-scale, with item loadings greater than 0.3 deemed satisfactory. The analysis was performed using R software (version 4.02) and SPSS (version 25) (33). All tests were two-sided, and a p-value of less than 0.05 was considered significant.

3. Results

3.1 Demographic Information

A total of 332 dental students and interns participated in the online survey, resulting in a response rate of 72.4%. The demographic characteristics of the participants are summarized in Table 1. Among them, 230 (69.3%) were identified as females, and the majority (n=272, 81.9%) were enrolled at Jordan University of Science and Technology. In terms of academic standing, 149 (44.9%) were fourth-year students, 144 (43.4%) were in their fifth year, and 39 (11.7%) were interns.

Table 1: Characteristics of the sample (n=332)

Variable	n (%)
Gender	
Male	102 (30.7)
Female	230 (69.3)
Educational Institution	
Jordan University of Science and Technology	272 (81.9)
University of Jordan	60 (18.1)
Level of Education	
4th year	149 (44.9)
5th year	144 (43.4)
Intern	39 (11.7)

3.2 Knowledge about COVID-19

Participants reported using various sources to gather information about COVID-19. The most frequently cited sources were television channels (72.1%) and

social media (68.8%). Other sources included publications and journals (46.8%), search engines (30%), lecture webinars (26.7%), and YouTube (18.9%). The majority of students considered their understanding of cross-infection control measures related to the COVID-19 pandemic as adequate (n=223, 67.2%), while 76 (22.9%) rated it as very good, 31 (9.3%) as limited, and 2 (0.6%) as poor.

3.3 Guidance and Support from Academic Institutions

More than a half of the respondents (57.8%) felt that the guidance and support provided by their university during the COVID-19 pandemic were inadequate for the safe delivery of dental care afterward. Furthermore, 67.5% of participants expressed a desire for additional lectures and guidance on COVID-19 from their university.

3.4 Perceptions about COVID-19

Approximately one-third of students indicated that their confidence in executing dental procedures was adversely affected by concerns about contracting COVID-19. Specifically, 115 (34.6%) reported significant impacts, 153 (46.1%) noted some impact, and 64 (19.3%) claimed no impact. When asked whether their worries about the virus influenced their procedural efficiency, 77 (23.2%) responded affirmatively, 135 (40.7%) were uncertain, and 120 (36.1%) said no.

On a scale from 0 to 10, students reported a substantial potential short-term effect of the COVID-19 outbreak on dental practice (mean 8.9 ± 1.7) and expressed discomfort about resuming dental training and clinical activities post-outbreak (mean 3.7 ± 3.3). Using the same scale, they anticipated that COVID-19

would impact the dentist-patient relationship (mean 6.9 ± 2.4) and that patients would exhibit increased anxiety about visiting dental clinics after the pandemic (mean 8.2 ± 2.0).

Participants perceived a moderate potential long-term effect of the COVID-19 outbreak on dental practice, with a mean score of 6.9 ± 2.3. The number of students who would recommend a career in dentistry to others declined from 199 (59.9%) to 176 (53.0%) after the pandemic. Additionally, 35 (10.5%) students considered abandoning their dental training or career due to pandemic-related fears. Regarding future career plans, over a half expressed interest in further specialty training (n=178, 53.6%), while 81 (24.4%) aimed for private practice, 56 (16.9%) sought academic positions, and 17 (5.1%) focused on research and basic science. Only 33 (9.9%) students reported having different career aspirations prior to the pandemic.

3.5 DASS Scores

Table 2 presents the descriptive statistics, Cronbach's alpha values, and correlations among the DASS sub-scales. Participants exhibited moderate levels of depression (mean 19.0 ± 12.2), anxiety (mean 10.4 ± 9.9), and stress (mean 19.6 ± 12.4). Strong correlations were identified between stress and anxiety ($r = 0.810$, $P < 0.001$) and between stress and depression ($r = 0.828$, $P < 0.001$), while anxiety and depression also showed a robust correlation ($r = 0.707$, $P < 0.001$). The Cronbach's alpha values for the depression, anxiety, and stress sub-scales were all above 0.7 (0.89, 0.84, and 0.92, respectively). Additionally, the item loadings from the confirmatory factor analysis for these constructs exceeded 0.3, confirming the adequacy of the measurement models.

Table 2: The descriptive statistics, Cronbach's alpha, and correlation between the depression, anxiety, and stress scale (DASS) sub-scales

| DASS Scale | Mean ± SD | Median (IQR) | Cronbach's alpha | Spearman Correlation | | |
				1 Depression	2 Anxiety	3 Stress
1. Depression	19.0 ± 12.2	18 (10, 29)	0.89	-	-	-
2. Anxiety	10.4 ± 9.9	8 (2, 18)	0.84	0.71**	-	-
3. Stress	19.6 ± 12.4	20 (10, 30)	0.92	0.83**	0.81**	-

* $p < 0.05$, ** $p < 0.001$.

Female participants reported higher average levels of

depression (20.3 vs. 15.8, P=0.002), anxiety (11.3 vs.

8.3, P=0.01), and stress (21.2 vs. 16.1, P<0.001) compared to male participants (Figure 1A). ANOVA analyses indicated significant differences among fourth-year, fifth-year, and intern students across all three DASS sub-scales (Figure 1B). *Post-hoc* tests revealed that interns had lower average stress levels than fourth-year (12.6 vs. 19.0, P=0.009) and fifth-year students (12.6 vs. 22.2, P<0.001). Similarly, interns exhibited

lower average anxiety levels compared to fourth-year (6.1 vs. 10.7, P=0.03) and fifth-year students (6.1 vs. 11.2, P=0.01). However, interns had lower depression scores compared to fifth-year students (13.9 vs. 20.7, P=0.005), but not compared to fourth-year students (13.9 vs. 18.6, P=0.08). There were no significant differences in the three sub-scales based on the university attended.
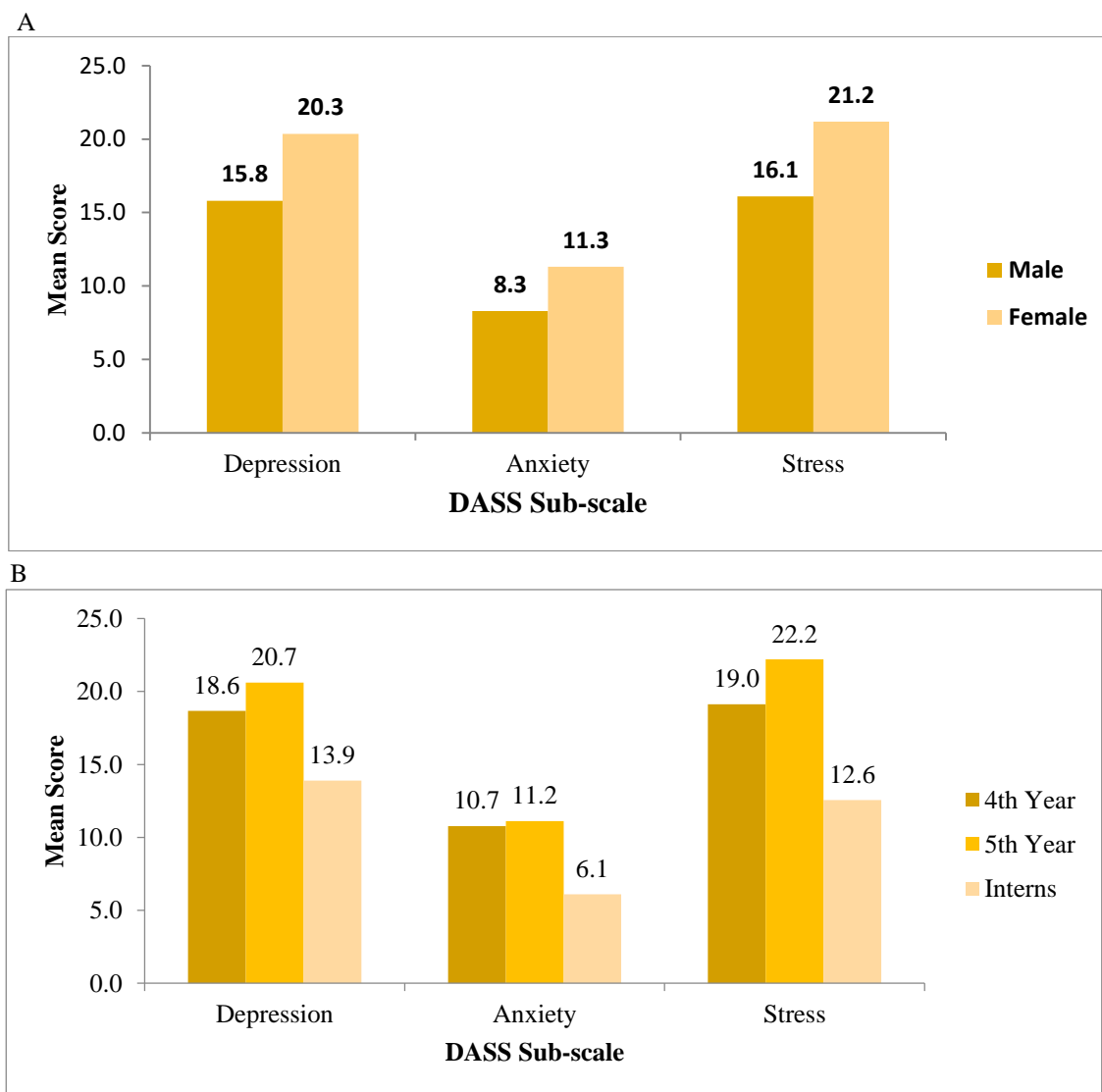
A

B

Figure 1: Mean depression, anxiety, and stress scale (DASS) scores by A) gender and B) educational level

3.6 The Association between DASS Scores and Perceptions about COVID-19

Students' perceptions regarding the potential short-term effects of the COVID-19 outbreak on dental practice showed a positive, yet weak, correlation with depression (r=0.11, P=0.04), but no correlation was

identified with stress or anxiety. Conversely, the perceptions of potential long-term impacts of the COVID-19 outbreak on dental practice were positively correlated with depression (r=0.15, P=0.005), anxiety (r=0.23, P<0.001), and stress (r=.20, P<0.001).

Figure 2 illustrates the DASS scores of students

categorized by their future career aspirations. Students who planned to pursue specialty careers recorded the lowest DASS scores, followed by those interested in academic careers and research programs in basic science. ANOVA analyses revealed significant differences among the groups concerning their future career plans, specifically regarding depression ($F = 3.06$, $P = 0.03$), anxiety ($F = 4.75$, $P = 0.003$), and stress scores ($F = 3.29$, $P = 0.02$).
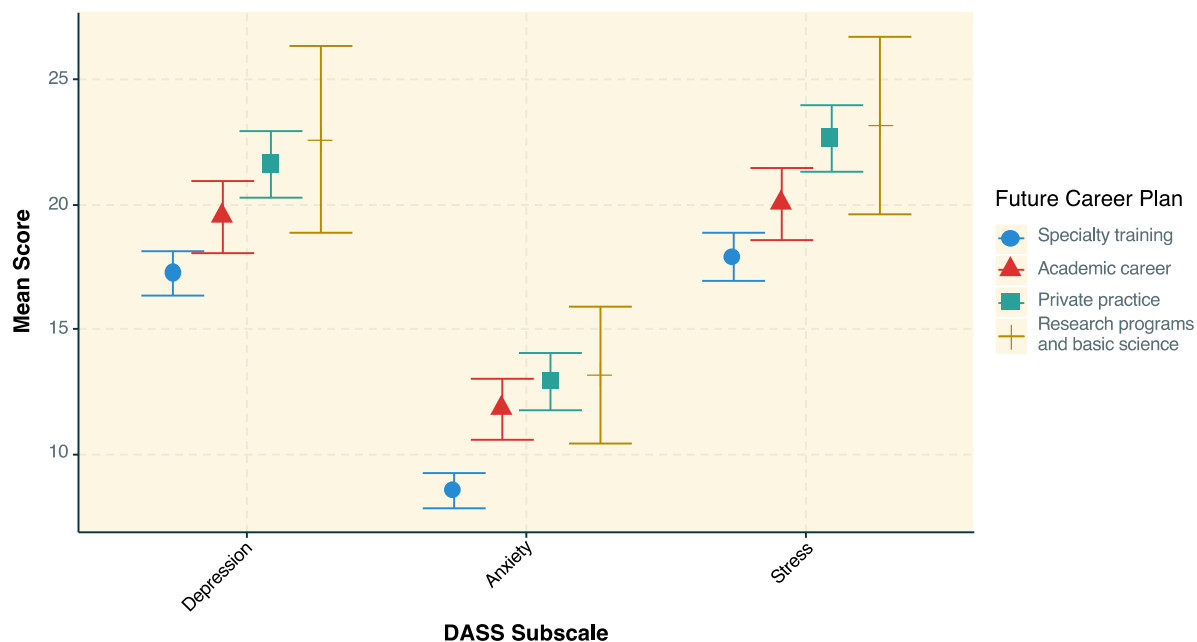

Figure 2: Dentistry students' depression, anxiety, and stress scale (DASS) scores by future career plans. Data points represent means and error bars represent standard deviations

4. Discussion

The COVID-19 pandemic is the most severe public-health crisis of the 21st century to date. The nature of dental procedures, close contact with patients, and exposure to bodily fluids place dental students at significant risk and under substantial pressure (14,34). This study assessed the impact of the pandemic on dental and intern students in Jordan by examining their perceptions and psychological stress levels through a cross-sectional survey conducted at two major universities in Jordan.

Over a half of the students reported that the information provided by their schools was inadequate and expressed a need for additional training and information. Dental students had also previously indicated low levels of support from faculty (35), Dental schools previously did not emphasize infection control in their curricula, resulting in students receiving insufficient training on the topic before the pandemic (36). A large number of staff and students in Australia

and Jordan believed that the universal precautionary measures and personal protective equipment (PPE) used in clinics were not effective in preventing cross-infection with COVID-19 (34). The COVID-19 pandemic provided dental-education institutions with an opportunity to develop a safer and more effective learning environment for their students in all circumstances (37).

Students identified television and social media as their primary sources of information about COVID-19, similar to the general population's reliance on mass media. Secondary sources included publications, journals, search engines, dental webinars, and YouTube (38). This issue may be influenced by cultural factors and resource availability. Research from other countries reveals different approaches to seeking information. For instance, an online survey conducted among students and clinical staff at an Australasian dental school found that sources of information on preventing COVID-19 transmission in dental-teaching clinics included updates

from the Faculty of Dentistry, the Ministry of Health, the Centers for Disease Control and Prevention (CDC), the World Health Organization (WHO), scientific publications, and social media updates (34).

The majority of students in our study expressed concerns about their confidence and proficiency in performing dental procedures following the onset of the pandemic. The outbreak significantly disrupted the clinical training of dental students who had not yet fulfilled the clinical requirements needed for their program completion and had not taken their final exams (14). Loch et al. and Hattar et al. reported that over a half of the students believed that the COVID-19 pandemic had negatively impacted their clinical performance (34, 39). The impact on clinical performance may be attributed to the increased time spent on disinfection procedures, which took away from clinical training, unexpected patient cancellations, worries about fulfilling clinical requirements, and concerns about potentially transmitting the virus to more vulnerable or at-risk patients (6, 34, 40).

In this study, students anticipated a significant short-term impact on their dental practice. They believed that the pandemic would increase patient anxiety and adversely affect the patient-dentist relationship. A smaller portion of respondents believed that the effects would be felt in the long term. Only a minority of students contemplated abandoning their dental training due to pandemic-related fears or altering their career paths because of the pandemic. Similarly, Loch et al. found that only 7% of students and 5% of staff expressed doubts and regrets about their choice of dentistry or clinical dental education as a career (34).

In this study, we utilized the pre-validated DASS scale to evaluate the psychological well-being of dental students and interns in Jordan. Our findings indicated that the students experienced moderate levels of stress, anxiety, and depression. This aligns to an extent with previous research that has shown that dental students exhibit higher levels of stress, anxiety, and depression compared to the general population (41, 42). The reason behind that claim is knowing that dentistry is a high-stress profession, where dental students encounter various career-related stressors and academic pressures that intensify over time, such as heavy coursework, the expectation to excel, mastering clinical procedures, and managing challenging patients, alongside common stressors associated with the global health crisis, school

closures, and difficulties in practicing their clinical skills. Notably, the current survey revealed that levels of depression, anxiety, and stress were significantly higher in females than in males. This has been evaluated and confirmed by a recent study on COVID-19 effect on females' stress (43). Another cross-sectional study involving dental students from various universities in Saudi Arabia discovered that female students exhibited significantly higher levels of depression, anxiety, and stress compared to their male counterparts (44). As for career plans, our study showed that students who plan for research programs and basic science had the highest levels of stress, anxiety, and depression compared to other groups. Therefore, this group might be experiencing more challenges or difficulties in their clinical training.

This study had several strengths and limitations. The sample size was relatively large, making it representative of dental students from the two major universities in Jordan, which enhances the generalizability of the findings. However, it is important to note that most of the sample members came from a single university. In addition, the use of a cross-sectional design limits the ability to make causal relationships between the study variables, such as gender and year of study and stress, and there was no baseline data on the students' mental health before testing. Additionally, relying solely on data gathered from an online survey heightened the potential for reporting bias and restricted the collection of more valuable information. However, efforts were made to gather as much relevant data as possible by adopting methods used by other researchers. Future studies with longitudinal designs and the use of other data-collection methods (e.g. personal interviews) are warranted.

5. Conclusions

The current study confirms the impact of the COVID-19 pandemic on the clinical training and psychological status of dental students. There is an urgent need for universities to make psychological counseling and mental-health support facilities readily available to all their students to ensure their well-being through such difficult times. New strategies need to be set forth that strike a balance between safety and infection control precautions and clinical training to ensure that students have a satisfactory experience with minimal stress levels during a health emergency.

Conflict of Interests

The authors have no conflict of interests relevant to this article.

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