A cross-sectional virtual survey to evaluate the outcome of online dental education system among undergraduate dental students across India amid COVID-19 pandemic

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Abstract

Purpose: A questionnaire-based study was conducted to understand the pros and cons of online education among undergraduate dental students across India. The study was also proposed to assess the mental and physical well-being of the students amid the COVID-19 pandemic lockdown.

Methods: A total of 533 undergraduate dental students across India participated in a cross-sectional study by means of virtual survey. A self-designed questionnaire was created using google forms. The questionnaire consisted of 25 questions and was divided into two parts, first, regarding the academic outcome of online dental education and second, psychological and physical well-being of the students in reference to online dental education. A descriptive statistical analysis was done using IBM SPSS statistics software.

Results: In the present study, 91.6% students reported that the format of dental education was shifted to online lectures due to the COVID-19 pandemic. 86.4% students suggested that they preferred offline lectures rather than online lectures. Psychological and physical well-being were affected in both male and female students; however, male students were affected more significantly than females.

Conclusion: The study concluded that the education of dental students was adversely affected as a result of COVID-19 pandemic. The physical and psychological well-being of the students has also been affected, with males being affected in a higher proportion. The study concluded that the quality of online education should be enhanced and must be student centred to meet their education requirements. Also, there is a need of regular counselling and other measures to alleviate the students from the psychological stresses.

Keywords
COVID-19 infection, lockdown, online dental education, psychological aspect
A global health emergency took place with outbreak of the newly discovered emerging respiratory disease, COVID-19. The highly contagious disease with symptoms like cough, fever, dyspnea and severe pneumonia was detected first in Wuhan, China, from where the disease was rapidly transmitted to the different parts of the world. A large number of individuals were at risk as the modes of transmission of the disease were respiratory droplets and close contacts. The rapid increase in the number of patients worldwide attracted attention to the disease and was declared as Pandemic by World Health Organization (WHO) on 11th March 2020. On 30th January 2020, the first case of COVID-19 was reported in India, which had also rooted from China. To contain the disease, as a preventive measure, a mandatory lockdown was announced on 25th March 2020 across India.

The state of lockdown had a prominent effect on the educational sector where the traditional systems have been replaced by online educational systems. All the students, including medical and dental, were instructed to quarantine themselves at home to ensure their safety. Cobb SC and Liu et al stated that in-person continuing education had remained the most preferred format, but recently, online education system gained a lot of popularity, even in undergraduate course in Dentistry worldwide. Online education has become popular as it is accessible and flexible to the students. It provides knowledge and opens the door to acquire education by the student in such a pandemic where colleges have been shut down temporarily. The online education approach has overcome the problems associated with the traditional education system at almost every place. Live virtual classrooms are delivering the lectures through personal terminals such as laptops, smartphones, computers via the internet. Yilmaz et al stated that online education has become one of the most dynamic, enriching forms and well-received methods of distance education.

The use of Massive Open Online Courses (MOOCs) has evolved nowadays even for healthcare education. In a study by Chan et al, it was concluded that the students enrolled to MOOCs were highly committed and motivated to learn through various innovative educational resources, such as videos, learning activities and interactive animations. Also, the participants were eager to learn further using this methodology. Another method being used for medical students is Flipped Classrooms (FC) where the students are first exposed to subject using online classes later face to face class is devoted for active learning. Ramnanan et al concluded that medical students preferred this method over lecture-based instruction and voted for active learning. Ramnanan et al concluded that medical students preferred this method over lecture-based instruction and voted for active learning.

Since Dental colleges in India are responsible to ensure that the students meet the outcomes set out by the Dental Council of India, they are trying their best to provide education through all possible means. Haroon et al stated that use of manikins and virtual reality/augmented reality (VR/AR)-based stimulation devices along with haptic technology has become very helpful for the dental students. But, the mental health and well-being of the students are as important as their education. Many of the dental students, worldwide, have developed fear regarding their academical performances and upcoming examinations. Also, these students have been more anxious than other students, as they have a deeper knowledge of the disease. The students are facing anxiety, loneliness, apprehension and anger as they have been locked up for a long period across many countries.

Thus, a questionnaire-based study was conducted to understand the pros and cons of online education on the B.D.S students across India. Further, it was necessary to assess the mental and physical well-being of the students amid the COVID-19 pandemic lockdown to alleviate them from the stresses through various means.

A cross-sectional observational study by means of virtual survey was conducted in India to assess the quality of online education system and mental and physical well-being of B.D.S. students across the country amid the COVID-19 pandemic. The present study obtained the ethical clearance from the Institutional Ethical Committee (IEC Project code: EC202011).

The sample size required for the present study was calculated using the following formula for sample size calculation:

\[ n = Z^2 \frac{1}{2} - \frac{(\alpha/2)}{52/d^2} \]

where, Z, standard normal score with 95% confidence interval (CI) (\(\alpha = 0.05\)); S, standard deviation of the variable; d is maximum acceptable error.

To take account of potential errors and sample loss, which is common in cross-sectional studies, a final sample size was estimated to be 385 based on a confidence interval of 95% and a margin of error of 5% with an estimated response rate of 50% using a statistical software (PASS Sample size 2020, NCSS, USA). In order to pick the study subjects from our sampling frame (list of all dental colleges across India), a simple random sampling methodology was used and 533 subjects responded to the questionnaire that constituted the final study sample.

A self-designed questionnaire in English language made specifically for the study was created online using google forms (www.google.com/forms/about/). A senior specialist in Dental education and a Psychologist was consulted to verify the content of the questionnaire.

The participants included in the present study were the B.D.S. students from first to final year across India in dental colleges. Those students who were willing to participate in the study and give informed consent were included in the study. The URLs of the questionnaire were circulated online using google forms. The questionnaire was sent to the study participants via Social Media Applications like email and WhatsApp and not handed over personally because of city “Lockdown” to prevent the spread of the virus.
The participants were given one-week time to fill the questionnaire and return it. A completely filled questionnaire was to be submitted online, only to the investigator.

The descriptive survey was divided into two sections: Section A was regarding the academic outcome of online dental education and Section B was on the psychological and physical well-being of students. The participants were informed about the purpose of the study through the instructions written at the head of the questionnaire. After clicking on the link, the students first had to fill the demographic details. The first section of the survey assessed the conduct, quality, difficulties and suggestions regarding the online education system from the student point of view. The second section of the questionnaire assessed different dimensions of mental health: anxiety, knowledge of stress management, behavioural patterns, academic stress, family relationship as well as peer relationships. The 4-point Likert scale was used to understand the psychological health of the students where 1 meant strongly agree and 4 meant strongly disagree.

The descriptive statistical analysis was conducted through counts and percentages and by using online software IBM SPSS Statistics (Version 20.0. IBM Corp., Armonk, NY, USA). The significance level was set as <.05. Feature engineering was done to the collected data. Exploratory data analysis was conducted. Insights were gathered using descriptive statistics and frequency analysis. The reliability of the Likert scale was checked by Cronbach’s alpha value. Intercorrelation between the variables in the Likert scale was done. Mann–Whitney test was done on the psychological data.

## RESULTS

The survey was sent to 1000 undergraduate dental students across India, out of which 533 individuals participated in this study. The response rate was 53.3% where female subjects (415, 77.9%) were in clear majority than male subjects (116, 21.8%). In India, the population of female students in dentistry is greater than males, which is also reflected in our study. All the participants included were from first to final year B.D.S students from various dental institutions across India.

Out of 533 students, 488 students reported that online classes have been conducted in their respective colleges out of which 86.1% of students attended the classes regularly. 49.2% of students faced difficulties in understanding through online lectures. However, 55.5% students were able to grasp <50% of the knowledge from the lectures. Internet connectivity has been the most common problem encountered by professors while conducting lectures as well as students while attending online lectures which led most of the students feel the need of reconducting the lectures in person, once the situation settles. Also 86.4% of students suggested that in-person lectures have been more convenient and understandable than online lectures. The practical demonstrations have been provided to only 8.3% of the students, and 72% of students had no access to practical classes. 65.7% students suggested the requirement of pre-clinical work demonstrations. Pre-clinical work comprised of procedures that could be performed on casts and typhodonts.

When participants were asked whether the quality of education had been affected adversely, 76.2% of the students affirmed. 73% of students were aware of the precautions to be taken in dental professions amid the COVID-19 pandemic. The webinars related to COVID-19 have been conducted by various medical and dental professionals, where 74.4% of students attended them regularly. 86.3% of the students have remained anxious regarding the academics and university examinations. Table 1 summarises the descriptive results of the responses to the questionnaire, and Table 2 summarises the responses of the questionnaire by the students. The categorical labels used for statistics are mentioned in Table 3.

Analysis of the question related to the difficulties faced by students (question 6) while attending the online lectures was done using Likert scale (Figure 1, Table 3), where Cronbach’s alpha value was 58.3% which was very less for any conclusive statement (Tables 4 and 5). Thus, these data were used only for exploratory data analysis.

Analysis of the question related to the psychological and physical well-being of the students (question 19) was also done using Likert scale (Figure 2, Table 3), where Cronbach’s alpha value was 76.6% which was reliable; thus, Mann–Whitney test was conducted on the data. Low Inter-item co-relation was seen which suggested that the variables had low co-relation within them which leads to the conclusion that they all are significant (Tables 4 and 6).

When we conducted Mann–Whitney test to assess the physical and psychological well-being of students, we observed that females experience severe level of headache when compared to males ($p = .713$). It was observed that males experienced more strain on eyes when compared to female ($p = .405$). According to the results, it was seen that the body posture was affected more in males as compared to females ($p = .198$). The study showed that male students were more depressed ($p = .286$), lonely ($p = .194$) and anxious ($p = .679$) than females due to the lockdown.

## DISCUSSION

The COVID-19 pandemic has affected the professional courses adversely. Due to the lockdown, there has been a change in the mode of education. Virtual education system has replaced the in-person education in almost all the professional courses including dentistry.

To the best of our knowledge, this has been the first study conducted to assess the outcome of online education system and the physical and psychological well-being of the students among undergraduate dental students across India amid COVID-19 pandemic.

In the present study, the impact of COVID-19 pandemic on online education was observed among the students across Dental colleges in India. In a similar study, it was found that, during the pandemic, online dental education increased significantly even in countries abroad.

In the present study, we found that students preferred offline education system when compared to online education due to lack...
From the examination point of view, most of the students have been anxious about the academics and upcoming university examinations, due to the lack of interaction with concerned faculties and uncertainty regarding examination dates, as has also been conferred by Choi et al, when assessed the impact of the COVID-19 on final year medical students, examinations and placements in the United Kingdom.\textsuperscript{16} It was also seen in a recent study that, to combat the economic strain caused by the pandemic, patients are likely to postpone elective dental treatment resulting in, inability of dental students to complete their clinic requirements.\textsuperscript{17}

### TABLE 1

Descriptive results of student's responses to the questionnaire

| Questions                                                                 | Mean  | SD    | N  |
|----------------------------------------------------------------------------|-------|-------|----|
| **Gender**                                                                | 0.78  | 0.414 | 531|
| **SECTION A**                                                             |       |       |    |
| 1. Are online lectures of all the subjects being conducted in your colleges? | 1.08  | 0.276 | 531|
| 2. If yes, do you attend the online classes on regular basis?              | 1.14  | 0.347 | 531|
| 3. How are the lectures scheduled in a week?                               | 3.36  | 1.439 | 531|
| 4. Are you satisfied with your schedule of online lectures?                | 1.85  | 0.896 | 531|
| 5. Have you experienced difficulties in the way of teaching in online lectures? | 1.75  | 0.819 | 531|
| 6 a. Rate how the following factors affected you while attending online lectures. [Internet connectivity] | 2.38  | 0.791 | 531|
| 6 b. Rate how the following factors affected you while attending online lectures. [Limited time slots] | 2.04  | 0.895 | 531|
| 6 c. Rate how the following factors affected you while attending online lectures. [Lack of concentration] | 2.20  | 0.848 | 531|
| 6 d. Rate how the following factors affected you while attending online lectures. [Audibility] | 2.20  | 0.833 | 531|
| 7. How much knowledge/understanding of the lectures/ sessions are you able to grasp? | 2.56  | 0.756 | 531|
| 8. Do you want the lectures being conducted during lockdown to be repeated once colleges reopen? | 1.95  | 0.931 | 531|
| 9. According to you, has the lockdown affected the quality of education?  | 1.39  | 0.735 | 531|
| 10. According to you, what is a better option for theory lectures?        | 0.15  | 0.362 | 531|
| 11. Are you provided with recorded lectures or e-content of topics covered in the online lectures? | 2.25  | 0.856 | 531|
| 12. Are practical demonstrations being conducted in the online lectures?  | 2.11  | 0.518 | 531|
| 13. Do you feel the need of online demonstrations of pre-clinical work?   | 1.53  | 0.785 | 531|
| 14. Do you prefer giving online examinations if the current condition does not improve? | 1.94  | 0.767 | 531|
| 15. Have you attended any webinars related to your course other than your regular lectures? | 1.63  | 0.987 | 531|
| 16. Have you attended any webinar related to COVID-19 conducted by medical/dental professionals? | 1.25  | 0.435 | 531|
| 17. Are you aware of the precautions to be taken for COVID-19 in Dental practice? | 1.25  | 0.435 | 531|
| **SECTION B**                                                             |       |       |    |
| 18. Are you anxious about university examinations and academics that have been affected due to lockdown? | 1.23  | 0.594 | 531|
| 19 a. Rate how the following health and psychological factors affected you during this pandemic? [Headache] | 2.90  | 1.082 | 531|
| 19 b. Rate how the following health and psychological factors affected you during this pandemic? [Strain on eyes] | 3.24  | 1.016 | 531|
| 19 c. Rate how the following health and psychological factors affected you during this pandemic? [Body posture] | 2.92  | 1.063 | 531|
| 19 d. Rate how the following health and psychological factors affected you during this pandemic? [Depression] | 2.78  | 1.120 | 531|
| 19 e. Rate how the following health and psychological factors affected you during this pandemic? [Loneliness] | 2.72  | 1.130 | 531|
| 19 f. Rate how the following health and psychological factors affected you during this pandemic? [Anxiety] | 2.95  | 1.100 | 531|
| 20. Have you attended any lectures/webinars to reduce the stress you are facing due to the current COVID-19 pandemic? | 1.66  | 0.473 | 531|
| 21. Do you want your college to conduct such lectures/webinars to relieve your stress? | 1.80  | 0.885 | 531|
| 22. Do you feel stressed as not being able to meet your friends/colleagues/teachers? | 1.76  | 0.898 | 531|
| 23. Do you attend any online meets with your family and friends?           | 1.82  | 0.839 | 531|
| 24. Have you tried to meet your friends residing nearby your place?        | 1.94  | 0.618 | 531|
| 25. Did this questionnaire help you to impart your experience during this COVID 19 pandemic? | 1.52  | 0.858 | 531|

Abbreviations: SD, standard deviation, N, analysis number.
### TABLE 2 Responses of the participants

| Questions                                                                 | Responses |
|---------------------------------------------------------------------------|-----------|
| **Section A**                                                             |           |
| Are online lectures of all the subjects being conducted in your colleges? |           |
| Yes                                                                       | 488 (91.6)|
| No                                                                        | 45 (8.4)  |
| If yes, do you attend the online classes on regular basis?               |           |
| Yes                                                                       | 459 (86.1)|
| No                                                                        | 74 (13.9) |
| How are the lectures scheduled in a week?                                 |           |
| Daily                                                                     | 122 (22.9)|
| Twice a week                                                              | 25 (4.7)  |
| Thrice a week                                                             | 23 (4.3)  |
| As scheduled in timetable                                                 | 264 (49.5)|
| Randomly                                                                  | 99 (18.6) |
| Are you satisfied with your schedule of online lectures?                 |           |
| Yes                                                                       | 257 (48.2)|
| No                                                                        | 95 (17.8) |
| Partially satisfied                                                       | 181 (34)  |
| Have you experienced differences in the way of teaching in online lectures? |           |
| Yes                                                                       | 262 (49.2)|
| No                                                                        | 143 (26.8)|
| May be                                                                   | 128 (24)  |
| How much knowledge/understanding of the lectures/sessions are you able to grasp? |           |
| 100%                                                                     | 58 (10.9) |
| >50%                                                                     | 150 (28.1) |
| <50%                                                                     | 296 (55.5) |
| 25%                                                                      | 29 (5.4)  |
| Do you want the lectures being conducted during lockdown to be repeated once colleges reopen? |           |
| Yes                                                                       | 245 (46)  |
| No                                                                        | 70 (13.1) |
| Some of them                                                             | 218 (40.9)|
| According to you, has the lockdown affected the quality of education, adversely? |           |
| Yes                                                                       | 406 (76.2)|
| No                                                                        | 47 (8.8)  |
| Maybe                                                                    | 80 (15)   |
| According to you, what is a better option for theory lectures?            |           |
| In-person lectures                                                        | 451 (86.4)|
| Online lectures                                                          | 82 (15.4) |
| Are you provided with recorded lectures or e-content of topics covered in the online lectures? |           |
| Yes                                                                       | 144 (27)  |
| Never                                                                    | 110 (20.6)|
| Sometimes                                                                | 279 (52.3)|
| Are practical demonstrations being conducted in the online lectures?     |           |
| Yes                                                                       | 44 (8.3)  |
| No                                                                        | 384 (72)  |
| Sometimes                                                                | 105 (19.7)|
| Do you feel the need of online demonstrations of pre-clinical work?      |           |
| Yes                                                                       | 350 (65.7)|

(Continues)

### TABLE 2 (Continued)

| Questions                                                                 | Responses |
|---------------------------------------------------------------------------|-----------|
| Have you attended any webinars related to your course other than your regular lectures? |           |
| Yes                                                                       | 338 (63.4)|
| No                                                                        | 113 (21.2)|
| One                                                                       | 25 (4.7)  |
| >1                          | 57 (10.7) |
| Have you attended any webinar related to COVID-19 conducted by medical/dental professionals? |           |
| Yes                                                                       | 398 (74.4)|
| No                                                                        | 135 (25.3)|
| Are you aware of the precautions to be taken for COVID-19 in Dental practice? |           |
| Yes                                                                       | 389 (73)  |
| No                                                                        | 32 (6)    |
| Somewhat                                                                 | 112 (21)  |
| Section B                                                                 |           |
| Are you anxious about university examinations and academics that have been affected due to lockdown? |           |
| Yes                                                                       | 460 (86.3)|
| No                                                                        | 26 (4.9)  |
| Sometimes                                                                | 47 (8.8)  |
| Do you attend any online meets with your family and friends?             |           |
| Yes                                                                       | 241 (45.2)|
| No                                                                        | 142 (26.6)|
| Sometimes                                                                | 150 (21.8)|
| Have you tried to meet your friends residing nearby your place?          |           |
| Yes                                                                       | 117 (22)  |
| No                                                                        | 329 (61.7)|
| Sometimes                                                                | 87 (16.3) |

### TABLE 3 Reference to categorical labels

| Responses                             | Categorical labels |
|---------------------------------------|--------------------|
| Yes                                   | 1                  |
| No                                    | 2                  |
| Partially satisfied/maybe/somewhat/sometimes | 3              |
| None                                  | 1                  |
| Least                                 | 2                  |
| Neutral                               | 3                  |
| Most                                  | 4                  |
| 25%                                   | 1                  |
| <50%                                  | 2                  |
| >50%                                  | 3                  |
| 100%                                  | 4                  |
| Online lectures                       | 1                  |
| Offline lectures                      | 2                  |
It was also observed that many students attended webinars on COVID-19 pandemic and preventive measure to update their knowledge for the same. This kind of educational instrument has been shown to provide an opportunity for dental students and practitioners to build and retain the theoretical and clinical dental expertise during the period of COVID-19 isolation.
Our study revealed that students were depressed and lonely because of the pandemic. Similar finding was observed in a study by Chen B et al where they investigated mental health status of young people where they concluded that most of the people were at medium risk of developing depression.\textsuperscript{20} It has also been observed that students can get very stressed and become negatively impacted by the fear of getting infected by the virus, and therefore, counselling services and psychological support may increase following COVID-19 pandemic.\textsuperscript{21}

When we compared the responses in terms of gender, the males were seen more prone to depression rather than females. Male students felt more lonely than female students as they were not able to meet their friends. However, a study conducted by Marelli S et al showed different results, wherein, when they assessed the psychological impact of COVID-19 emergency in Italy, they found that females were affected more than males.\textsuperscript{22}

However, the study had certain limitations, as there are very less studies conducted on online dental continuing education, the study could not be compared. Thus, more studies should be conducted to understand the effect of online education throughout the world. Further studies can be conducted on similar lines on dental post-graduates and other dental technician course students.

The study strongly suggested that there is a need to improve the quality of student centred online dental education system. Demonstrations of pre-clinical work should be also be conducted by the colleges for better understanding of the subject. Measures should also be taken to alleviate the students from psychological and physical stresses.

5 | CONCLUSION

Within the limitations of the study, it was seen that most of the colleges conducted online classes for the students. The study concluded that the quality of education was adversely affected by virtual education. The offline in-person education is still the most preferable format of education amongst dental students. It was also concluded that the mental and physical well-being of undergraduate students have also been affected due to this pandemic and they are anxious regarding the academic performance and upcoming university examinations. So, there is a need for regular counselling to students. It was also observed that male students were more prone to depression and loneliness than female students.

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AUTHOR’S CONTRIBUTION

KS and RN did the experimental design, evaluated the results, writing and editing the manuscript. SP and VM helped modify the manuscript. All authors read and approved the final manuscript.
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