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Original Research Article

Comparative analysis of the overall level of preparedness of Dental graduates for their cognitive, communication, and professional skills in terms of offline and online education: a non-randomized controlled trial

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Coronavirus; dental; dentistry; distant; education; e-learning; online; offline; pandemic; preparedness.

Abstract

Introduction: The recent pandemic has led to the suspension of offline training and the exploration of distant learning methods. **Objective:** This paper aims to identify and compare the overall level of preparedness of dental graduates for their cognitive, communication, and professional skills in terms of offline and online educational methods from students' perspectives. **Material and methods:** A web-based non-randomized longitudinal trial was conducted amongst 182 students pursuing their final year in a dental college in Bangalore City, India for the academic years 2020-21 Study Group (Exposure to only online teaching) and 2021-22 Control Group (Exposure to both online and Classroom-based teaching). A Pre-tested online questionnaire was used to evaluate the change in the assessment of educational experience and the level of preparedness of dental graduates for cognitive, communication, and professional skills for the academic batch 2020-21 and then for 2021-22. **Results:** The study group missed educational experiences more as a result of the lockdown than the control group ($p<0.05$) but considered online assessment as a good evaluation method ($p<0.05$). Clinical Training is perceived as most affected by distant

learning methodology. Moreover, the study group felt a greater need to be mentored or indirectly supervised following graduation ($p<0.05$) despite reporting almost similar self-perceived preparedness levels. **Conclusion:** Online Education has shown similar preparedness levels among dental graduates for cognitive, communication, and professional skills making it a promising alternative methodology for offline education. However, there are a few uncertainties regarding clinical practice so; a "Smart Hybrid Model" of educational approach for dental education should be promulgated.

Introduction

The recent covid-19 pandemic has led governments and institutions to take draconian measures concerning ongoing classroom-based education. In an attempt to balance the safety of students, faculty, and patients, while keeping track of the changing national and international policies, universities/ institutions were forced to take different measures to ensure the continuity of education [8].

This is untrue despite the widespread belief that covid-19 was a "once in a lifetime" epidemic. The worry of a revival of the more recent iterations of omicron, such as BF.7, XBB.1.5, etc., continues to plague the world. There is a 22-28% chance that another outbreak on the magnitude of covid-19 will occur within the next 10 years and a 47-57% chance that it will occur within the next 25 years [4]. These newer covid-19-like variants can become the biggest challenge in the future directly impacting patient care and clinical skills of graduating dentists, which is an essential component of the dental curriculum.

Although the online-teaching has become an important instrument for delivering education during the pandemic and offered numerous advantages such as ease of accessibility (anytime and anywhere), distance learning, and overcoming many traditional educational problems (lack of classrooms and a shortage of faculty) [10]. When compared to traditional didactic methods, scientific materials can be easily updated and rapidly accessed. It can easily foster self-learning skills. Some studies have indicated that this self-regulated learning has significantly affected academic achievement and learning performance [8]. Online education has also been found to satisfy different learning styles, which is considered a major success factor in teaching and learning [10]. Many universities across the world are now promoting it as an alternative teaching methodology [1].

While online learning has multiple facades that can undoubtedly improve education. One cannot deny that didactic and clinical skills are two different outcomes of education and no virtual sessions can duplicate the close experience with patients [8].

Hence, this paper tries to analyze this sudden shift from four-walled classroom-based teaching (Offline) to distant learning (online) methodology in terms of the efficacy and limitations from students' perspectives and the overall level of preparedness of dental graduates for their cognitive, communication, and professional skills.

Material and methods

Study design and participants

A web-based non-randomized longitudinal trial was conducted on a cohort of 182 dental students belonging to Final year batches of academic years 2020-21 and 2021-22 in a dental college in Bangalore, Karnataka, India. Particularly, we decided to include all the final-year students of the institution as this would provide the study sample with sufficient statistical power (0.80) to detect small-sized correlation coefficients (0.20) (https://www.samplesize.net/correlation-sample-size/).

The list of the Final year students was obtained from the institutional office for the academic batch 2020-21 and then, subsequently for the academic batch 2021-22 which served as a sampling frame. In India, the Nationwide lockdown was implemented on 24th March 2020. Since then, almost all dental colleges and universities have switched to online modes of teaching for their students. The Study Group was taken as final-year students in the academic batch of 2020-21 as they had only been exposed to online teaching due to covid-related implications. The Final year students belonging to the academic batch 2021-22 were taken as the Control Group as they had been exposed to both classroom-based teaching and online teaching for almost 2-3 months.

Ethical committee clearance

Institutional ethical approval (IEC/MRADC&H/EC-071/2022) was obtained. The purpose, nature, and implications of the study were intimated to all the study participants through mail along with a survey questionnaire developed through Google Forms with a consent form appended to it. Informed consent was obtained from the study participants before the commencement of the study.

Eligibility criteria

Students studying in the final year for the academic batch 2020-21 and 2021-22 were eligible to participate in this study.

Study instrument

A pre-tested structured online questionnaire was prepared on Google Forms referenced from an earlier study [8]. The first section comprised students' perceptions of the impact on their dental education due to online teaching. On a four-point Likert scale (strongly agree, agree, disagree, strongly disagree), the responses to this part were reported. The second section dealt with investigating the students' self-perceived preparedness related to cognition, communication, and professional skills. The responses to this section were arranged in descending order on a three-point scale (No experience, Mostly, and Always). The third section evaluates their General practice readiness and grades on a three-point scale (No, Unsure, Yes).

Data collection

The questionnaire was floated on Google Classroom as well as mailed to Final-year students first in July 2021 for the Study Group and then, after almost a year in September 2022 for the Control Group. All the students belonging to the Study Group (N = 90) and Control Group (N = 92) were asked to fill out the questionnaire after giving their due informed consent. No personal identifiers were used but the questionnaire maintained anonymity and included a brief section on demographic information (year of study, gender, and place of residence). Answering all questionnaire items was mandatory to submit to eliminate the chance of incomplete responses. The response form per student was limited to one to prevent multiple submissions by a single participant. The respective group class representatives were contacted by the investigators (PM, GS) to explain the study objectives and implications. They were then requested to convey the same to the students to encourage maximum participation. Data reported in this study were collected in two phases: First from 25 July 2021 to 31 July 2021 and then, from 1 September 2022 to 15 September 2022. Only investigators had access to analyze the responses which ensured the confidentiality of the data.

Data management & statistical analysis

Data were analyzed using SPSS software version 23.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were generated and the Chi-square test was used to examine differences between groups. The significance level was stated as $p \leq 0.05$.

Result

A total of 179 responses were received. 51.3% (92) of students were from the Control Group and 48.6% (87) were from the Study Group resulting in a response rate of 98%. 27% (49) of males and 72% (130) of females participated in the study. The mean age of the participants was 22 ± 0.5 years. 24% (43) of the study population were attending online teaching from rural parts of India.

The perception of the impact on their dental education during the covid-19 pandemic is shown in table I. Both the groups agreed that they missed educational experiences as a result of the lockdown but this impact was perceived more amongst the study group than the control group and this difference was statistically significant ($p<0.05$). Almost half of the participants felt that online assessment is not a good evaluation method but 55% of the study group felt online assessment is a good method and this difference was also statistically significant ($p<0.05$).

Table I – Perception of the impact on dental education

Perception of the impact on dental education	Study population	Strongly disagree (%)	Disagree (%)	Agree (%)	Strongly agree (%)	p-value*
Do you feel that you missed educational experiences as a result of the lockdown?	Study Group	3.7	9.3	58.9	28.0	**0.038**
	Control Group	2.0	16.1	47.5	34.4	
Do you think the online assessment is a good method for evaluation?	Study Group	11.8	42.1	31.6	14.5	**0.002**
	Control Group	17.0	50.7	29.3	3.1	
Do you think group discussions posted on E-learning such as clinical cases and scenarios had a positive value on your education?	Study Group	9.2	22.4	36.8	31.8	0.057
	Control Group	7.9	10.5	41.5	40.2	
Did the recent quarantine increase your collaboration with your colleagues?	Study Group	6.1	14.0	51.5	28.4	**0.001**
	Control Group	6.6.	35.5	36.8	21.1	
Did you feel more engaged and motivated in following up with distant e-learning?	Study Group	23.4	46.7	23.4	6.5	0.556
	Control Group	28.3	48.5	17.2	6.1	
Do you prefer online lectures compared to face-to-face theatre lectures?	Study Group	38.3	35.5	15.9	10.3	0.563
	Control Group	41.4	39.4	12.1	7.1	
Do you feel comfortable with all this technology-based education?	Study Group	15.9	46.7	25.2	12.1	**0.033**
	Control Group	17.2	37.4	39.4	6.1	

* p-value of Chi-Square Test

Similarly, both the groups agreed that group discussions posted on E-learning such as clinical cases and scenarios had added a positive value to their education. A higher percentage of the students in both groups especially the study group (80%) thought that the quarantine had increased their collaboration with their colleagues and this difference was statistically significant ($p<0.05$). Both the groups neither felt engaged nor motivated in following up with distance e-learning and did not prefer online lectures compared to face-to-face teaching. More than 60% of the participants in the study group were not more comfortable with all this technology-based education than the control group and this difference was statistically significant ($p<0.05$). The major reasons stated were – Issues with internet connectivity (45%), Lack of concentration (37%), and home distractions (18%). Majorly 89% of the participants stated that Clinical Training is most affected by e-learning methodology (figure 1) and Conservative dentistry is the most affected dental specialty (figure 2).

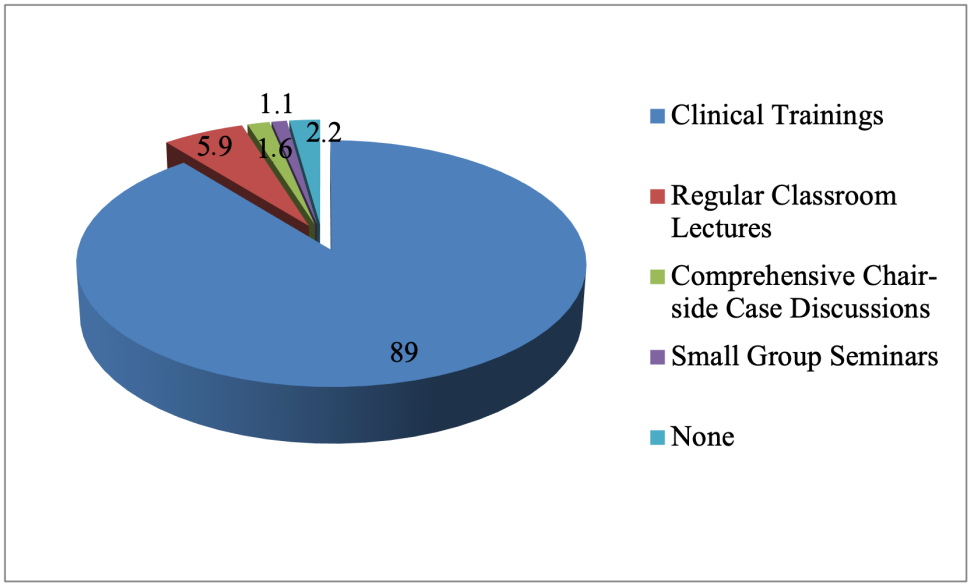

Figure 1 – Experience most affected due to e-learning methodology

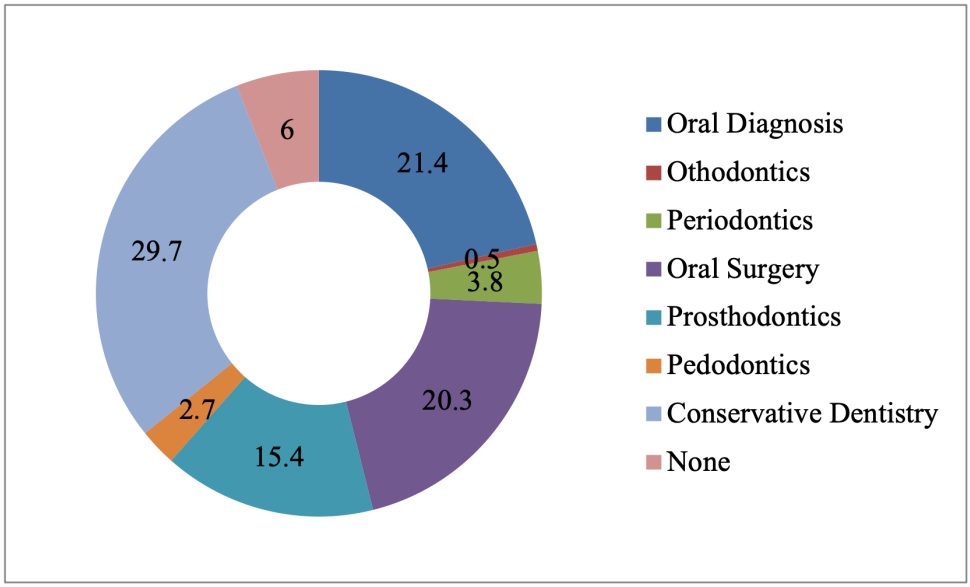

Figure 2 – Dental Clinical Specialty most negatively affected under e-learning methodology

Table II depicts the preparedness of the students related to cognition, communication, and professional skills. The competency skills of both the study group and control group showed a total or most of the time preparedness related to the majority of attributes and professional skills. The mean total self-perceived preparedness score (TPS) for the control group was 20.59 ± 11.4 and for the study group was 19.28 ± 10.81 and was not significant ($p > 0.05$). Although the study group reported almost similar competencies skills the majority of participants in the study group stated a lack of clinical confidence in carrying out to treat patients with complex treatment needs and in communicating with teachers or explaining the potential procedural risks to patients. These differences were statistically significant ($p<0.05$).

Table II – Self-perceived preparedness related to Cognition, Communication, and Professional Skills of dental students

Skill evaluation questions	Study population	No experience (%)	Mostly (%)	Always (%)	p-value*
I can evaluate new dental materials/products using an evidence-based approach.	Study Group	48.6	41.1	10.3	0.750
	Control Group	47.5	44.4	8.1	
I have sufficient evidence-based knowledge of scientific principles to support my practice.	Study Group	1.9	52.3	45.8	0.116
	Control Group	7.1	45.5	47.5	
I can reflect on my clinical practice in order to address my learning needs.	Study Group	23.4	57.0	19.6	0.303
	Control Group	19.2	53.5	27.3	
I can manage patients' expectations for their treatment.	Study Group	24.3	64.5	11.2	0.579
	Control Group	19.2	68.7	12.1	
I am able to treat patients with complex treatment needs.	Study Group	45.8	44.9	9.3	**0.011**
	Control Group	37.4	39.4	23.2	
I feel comfortable asking for help from Teachers/ colleagues if needed.	Study Group	12.1	50.5	37.4	**0.041**
	Control Group	9.1	38.4	52.5	
I can maintain accurate records of my clinical notes.	Study Group	14	55.1	30.8	0.739
	Control Group	15.2	50.5	34.3	
I can restrict my relations with my patients to a professional level.	Study Group	11.2	46.7	42.1	0.064
	Control Group	12.1	33.3	54.5	
I take responsibility for continuing my professional development.	Study Group	12.1	42.1	45.8	0.425
	Control Group	11.1	35.4	50.8	
I can take appropriate measures to protect patient confidentiality.	Study Group	6.5	38.3	55.1	0.113
	Control Group	10.1	27.3	62.6	
I can communicate potential procedural risks to my patients.	Study Group	13.1	57.9	29.0	0.001
	Control Group	19.2	36.4	44.4	

To be continued...

Continuation of table II

Skill evaluation questions	Study population	No experience (%)	Mostly (%)	Always (%)	p-value*
I can obtain informed consent from my patients.	Study Group	15.0	47.7	37.4	0.215
	Control Group	14.1	38.4	47.5	
I can motivate patients to maintain good oral/ general health.	Study Group	6.5	47.7	45.8	0.344
	Control Group	9.1	46.5	44.4	
I am aware of my legal responsibilities as a dental professional.	Study Group	11.2	41.1	47.7	0.205
	Control Group	15.2	31.3	53.5	
I recognize my personal limitations in clinical practice.	Study Group	12.1	53.3	34.6	0.176
	Control Group	11.1	43.4	45.5	
I can communicate appropriately with my colleagues.	Study Group	8.4	50.5	41.1	0.375
	Control Group	7.1	43.4	49.5	
I can communicate effectively with my patients.	Study Group	6.5	47.7	45.8	0.741
	Control Group	9.1	46.5	44.4	

* p-value of Chi-Square Test

Nearly 60% of the participants in the study group felt the need to be mentored or indirectly supervised following graduation and this difference was statistically significant ($p<0.05$) despite reporting an almost similar level of confidence in starting an independent practice after graduation. The study group preferred to have a well-structured academic year with proper training after graduation (table III).

Table III – Practice readiness of Dental students

Questions	Study population	No (%)	Unsure (%)	Yes (%)	p-value*
Do you have confidence in the skills you have acquired?	Study Group	23.4	43.9	32.7	0.205
	Control Group	15.2	48.5	36.4	
Do you prefer to be mentored or indirectly supervised following graduation?	Study Group	38.2	26.3	35.5	**0.000**
	Control Group	38.0	45.9	16.2	
Do you have confidence in starting an independent practice?	Study Group	44.9	32.7	22.4	0.085
	Control Group	34.3	45.5	20.2	
Do you have a preference for a well-structured academic year with proper clinical training?	Study Group	16.2	22.2	61.6	0.279
	Control Group	18.7	29.0	52.3	

* p-value of Chi-Square Test

Discussion

The initiative for online teaching-learning mode commenced through the instructions received from the University Grants Commission (UGC) and Ministry of Human Resource Development (MHRD) under the Government of India to continue higher education during the lockdown due to covid pandemic. The students intended to use Google Classroom, Meet, Zoom, and WhatsApp for teaching. But gradually, as the lockdown period went on being extended from time to time, they started missing conventional education.

This study was the first of its kind in the developing world to evaluate the effectiveness of ongoing educational teaching and the preparedness of dental graduates during the covid-19 crisis. The current study assessed the readiness, skill evaluation, and preparedness of a cohort of final-year dental students who were exposed only to online learning in comparison to conventional dental education in India. The authors have specifically selected the final year students as this could be the best study population for carrying out a non-randomized trial. The control group had exposure to both online and face-to-face teaching, while the study group was only exposed to online learning.

The results of the present study showed that both the groups missed the conventional educational experiences and this was more prominent amongst the study group as because of covid restrictions, students were not allowed to attend dental colleges/ institutions physically despite reopening in India. Clinical training was most understated during online teaching. These results were in line with the previous studies [1, 3, 5, 7-10, 12-14]. However, the online method of assessment was considered better than the offline by more than half of the study group. This is in contrast to the study done by Hattar *et al.* [8]. The probable reason may be the final year students are exam-going batch with eight dental sub-specialties to pass in India so there might be a natural fear of giving an examination. Hence, they perceived offline mode as a better evaluation method. The study group also noticed that the quarantine increased their interactions and collaboration, especially with their classmates. This is in contrast to the previous studies [5, 8].

The self-perceived preparedness was satisfactory for both groups for the majority of attributes and professional skills and confidence levels which is in line with the previous studies [2, 6, 8, 9, 11]. However, the study group stated a lack of clinical confidence in carrying out treatment for patients with complex treatment needs and in communicating with teachers or explaining the potential procedural risks to patients. The probable reason may be due to the absence of clinical exposure and patient interactions. Moreover, the open and free communication that is witnessed between students and staff is missing on the online platform. The study group felt the need to be mentored or indirectly supervised following graduation. This was in line with findings from the previous studies [1, 7, 5, 8, 12, 13].

There may be limitations to generalizing these results: There might be a respondent's bias as the results were investigated only through subjective outcomes. The sample population has been drawn from a single, private dental college. Students in different institutions with different online experiences might have responded differently. Therefore, more trials are needed to investigate the success of online learning concerning the overall preparedness of graduating dental students.

Hence, the present study concluded that the e-learning methodology is effective and has the potential to increase knowledge and skills among dental students. But it is also recommended that new solutions such as clinical case discussions, simulation, and virtual reality systems might be promising alternatives to strengthen the clinical confidence level amongst students during these hard times [8]. Therefore, the need of the hour is to better develop a "New Normal" and more flexible curricula based on the "Hybrid Model" comprising greater online learning and little emphasis on "face-to-face" contact.

References

1. Abbasi S, Ayoob T, Malik A, Memon SI. Perceptions of students regarding E-learning during Covid-19 at a private medical college. Pak J Med Sci. 2020;36:S57-S61.

2. Al Shorbaji N, Atun R, Car J, Majeed A, Wheeler EE. Learning for Undergraduate Health Professional Education. A systematic review informing a radical transformation of health workforce development. World Health Organization; 2015.

3. Amir LR, Tanti I, Maharani DA, Wimardhani YS, Julia V, Benso Sulijaya B et al. Student perspective of classroom and distance learning during covid-19 pandemic in the undergraduate dental study program Universitas Indonesia. BMC Med Educ. 2020;20.

4. Agyarko R, Jamison D, Oppenheim B, Stefan C, Stephenson N. What's next? Predicting the future and scale of future pandemics. Centre for Global Development [Cited 2022 July 20]. Available from: URL:https://www.cgdev.org/event/.

5. Chang TY, Hsu ML, Kwon JS, Kusdhany MFLS, Hong G. Effect of online learning for dental education in Asia during the pandemic of covid-19. J Dent Sci. 2021;16(4):1095-101.

6. Frehywot S, Vovides Y, Talib Z, Mikhail N, Ross H, Wohltjen H et al. E-learning in medical education in resource constrained low and middleincome countries. BMC Hum Res Health. 2013;11(4):1-5.

7. Gupta A, Shrestha RM, Shrestha S, Acharya A, Pandey N. Perception of BDS students of Kathmandu University on online learning during covid-19 pandemic. Orthod J Nepal. 2020;10(2):20-8.

8. Hattar S, Al Hadidi, Sawair FA, Alraheam IA, El-Ma'aita A, Wahab FK. Impact of covid-19 pandemic on dental education: online experience and practice expectations among dental students at the University of Jordan. BMC Medical Education. 2021;21.

9. Kumar PM, Gottumukkala SN, Ramesh KS, Bharath TS, Penmetsa GS, Kumar CN. Effect of e-learning methods on Dental education: an observational study. J Edu Health Promot. 2020;9:235.

10. Linjawi AI, Alfadda LS. Students' perception, attitudes, and readiness toward online learning in dental education in Saudi Arabia: a cohort study. Adv Medical Educ Pract. 2018;9:855-63.

11. Nicoll P, MacRury S, Van Woerden HC, Smyth K. Evaluation of technology enhanced learning programs for health care professionals: systematic review. J Med Internet Res. 2018;20:1-9.

12. Schlenz MA, Schmidt A, Wöstmann B, Krämer N, Schulz-Weidner N. Students' and lecturers' perspective on the implementation of online learning in dental education due to SARS-CoV-2 (covid-19): a cross-sectional study. BMC Medical Education. 2020;20.

13. Shrivastava KJ, Nahar R, Parlani S, Murthy VJ. A cross-sectional virtual survey to evaluate the outcome of online dental education system among undergraduate dental students across India amid covid-19 pandemic. Eur J Dent Educ. 2022;26(1):123-30.

14. Van Doren EJ, Lee JE, Breitman LS, Chutinan S, Ohyama H. Students' perceptions on dental education in the wake of the covid-19 pandemic. J Dent Educ. 2021;(Suppl. 1):1187-9.