Effect of Post-COVID Face-to-Face learning Mode on Endodontic Students' Satisfaction and Exam Performance Compared to Hybrid Learning Mode during the pandemic; a Single-centre Retrospective Study

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Abstract

Aim

This study compared the perceptions and exam performance of third-year undergraduates in endodontic courses. The study analyzed hybrid training during COVID-19 and Face-to-Face teaching post-COVID-19 to identify the most effective teaching methods.

Materials and Methods

This study was a single-centre retrospectively analyzed endodontic courses delivered to third-year dental students in 2021 and 2022 at the Gulf Medical University, College of Dentistry. Student perceptions of the hybrid and F2F courses were obtained through a satisfaction questionnaire administered by the University's Quality Assurance Office at the end of each course. Student performance was measured by analyzing exam grades for both teaching modes.

Results

Total of 75 students took the hybrid course while 77 received the F2F course. The number of respondents to the questionnaire was significantly higher for the F2F group (81% vs. 31.5%, $p \leq 0.05$). The hybrid course received a satisfaction score of 100% compared to 94.54% for F2F. Student performance in the hybrid group was comparable to the F2F group, with mid- and end-of-year course marks ranging from 64.67% to 71.46% and 63.93% to 65.79%, respectively ($p \leq 0.05$). These findings suggest that the hybrid model did not negatively affect student performance.

Conclusion.

In conclusion, the hybrid learning approach was well-received and produced similar endodontic exam marks to F2F teaching. This suggests that combining e-learning with F2F teaching can maintain the quality of education. The absence of differences between the groups dismisses concerns that endodontic education suffered due to the pandemic.

Key words: Endodontics; hybrid teaching; Face-to-face teaching; COVID-19; e-learning.

Declarations

'The authors declare that there is no conflict of interest'.

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Main Text File

Introduction

In December 2019, SARS-COV-2 (COVID-19) was declared a global health issue by the World Health Organization (WHO). The pandemic brought disruption to dental education forcing the advent of new teaching approaches to maintain student education in the face of social distancing(Linjawi and Agou, 2020, Martinez-Melo et al., 2022). Most dental education courses consist of lectures, simulated learning, and practical skills that require significant repetition (Escobar et al., 2022). During the COVID-19 pandemic, most dental schools suspended practical courses and shifted to e-learning, introducing alternative performance assessments. Other adaptations included the design of virtual curricula, lab simulations,and mannequin models for preclinical teaching(Tabatabaei et al., 2022, Takenouchi et al., 2020, Taramarcaz et al., 2022). This was supplemented with online courses, lectures, and virtual training. Since the removal of COVID-19 restrictions, endodontic training continued to implement these virtual learning applications to complementtraditional teaching methods(Kumar et al., 2020, Hassan et al., 2021).

Endodontic procedures require appropriate expertise and practice to obtain acceptable quality and accuracy. Error rates tend to increase with more complex practical procedures (Balasubramaniam et al., 2018, Barakat et al., 2022, Bastos et al., 2022, Bock et al., 2021). Since University education provides only theoretical and practical skills, major innovationssuch as the introduction of endodontic tooth models like, 3-d printed plastic acrylic modelsand the incorporation of media into teaching have advanced dental education(Connolly, 2022, Dyrek et al., 2022, Escobar et al., 2022, Goh et al., 2022, Grundgeiger et al., 2022, Hulke et al., 2022). Studies assessing these teaching styles suggest many benefits, but e-learning in isolation has limitations compared to F2F and/or hybrid teaching methods (Maqbool et al., 2022, Martinez-Melo et al., 2022, Mladenovic et al., 2022). Flipped classrooms that provide students with content prior to attendance at lectures or seminars represent further innovations that are advantageous over traditional teaching methods(Schlenz et al., 2020). The effectiveness of these procedures ishowever limited by equipment availability which can be influenced by the social-economic conditions of the country and the budget of the dental school(O'Doherty et al., 2018).

Online learning is defined as teaching using information and communication technologies. This has been utilized as an additional learning method for dental teaching for over 20 years(Taramarcaz et al., 2022, Vaona et al., 2018, Walsh, 2018, Wang et al., 2022). In blended/hybrid learning, course content is prepared using media e-learning platforms to replace F2F instructions. Given the persistence of the pandemic, long-term strategies have now been designed to sustain endodontic education thatutilise both F2F and virtual approaches(Abbasi et al., 2020, Aggarwal et al., 2022, Aldosari et al., 2022, Alsaywid et al., 2021, Alshammari et al., 2022, Ansar et al., 2020, Bahanan et al., 2022, Bastos et al., 2022, Connolly, 2022, Goh et al., 2022, Hulke et al., 2022).

Student evaluation is an important measure of student's perception of the quality of course delivery. This can inform on course strengths and provides inputs for areas that need improvement. The Quality &Assurance unite in College of dentistry (GMU)conducts student evaluation of each semester's courses once per-semester. The objective is to assess studentsatisfaction with the quality of course delivery and further identify areas of improvement.

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In this study, we measured the effectiveness of traditional F2F teaching in the post-COVID-19 era compared to hybrid teaching approaches implemented during the COVID-19 pandemic. We used student evaluation to investigate whether hybrid learning had a positive impact on student performance compared to F2F teaching and if the differences in learning led to improved or impaired student course performance.

Materials and Methods

Sample selection

This cross-sectional study was performed on students registered under the course Endodontics II under BDS program during the fall semesters 2021/2022and 2022/2023. Participants were voluntarily invited to participate. During the pandemic (Fall 2021/2022) the course was administered in a hybrid format, with online lectures and on-site practical training. Following the pandemic, the same course was provided withon-site with lectures and F2F practical classes. A total of 75 students took the hybrid course and 77 took the F2F course.

Hybrid teaching and F2F methods

In the hybrid approach, lectures were recorded on a weekly basis and made available through college's learning and management platform. Every two weeks, students were required to attend an in-person session to review, summarize, and discuss the content covered in the previous two recorded lectures using an individual Readiness Assurance Test (IRAT) and in groups using the group IRAT. Throughout the course, students were granted full access to recorded lecture videos, as well as supplementary materials and learning resources. Following the COVID-19 pandemic, the frequency of in-person sessions was adjusted, with face-to-face lectures held on a weekly basis.

Survey methodology

The online survey on course evaluation was conducted using the survey application platform named "Blue"https://blueapp.gmu.ac.ae/. The survey was designed by the Quality Assurance and Institutional Effectiveness Unit (QA&IEU) and administered in coordination with the colleges of the GMU. Students were allowed to access the survey via two methods. [1]: Using the Blue survey link received in their official email address; [2]: Through access to their individual Blue platform through login credentials.

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Study questionnaire

Ethical approval for the survey-based study was granted by the local ethical committee.The study questionnaire is outlined in Table 1. The survey consisted of five responses: Rating Scale: Strongly Disagree, Disagree, Agree, Strongly Agree, and Neutral. The evaluation date was the end of semester 2020/2021 for the hybrid teaching group and was the end of semester 2022/2023 for the F2F group. Visual indicators of the teaching learning success approach were used to present current strengths and areas for Improvement. The agreement/satisfaction rate calculated the percentage of students who responded,"Strongly Agree" and the percentage ofstudents who responded "Agree". Disagreement was deemed from the percentage of students who responded,"Strongly Disagree" or "Disagree". Neutral responses were excluded from the calculation of Satisfaction rate.Nonparametric tests were used to compare categorical variables within the same sample population.

Exam performance

Theoretical tests were performed on campususing ExamSoft software for testing in the testing center. Student performance was assessed using exam scores from the Fall 2021 and 2022. Exam scores were collated from mid-semester theory tests and end-of-year theoretical exams. For the 2021 hybrid teaching students, both exams consisted of 30 questions. For the 2022 F2F students, the mid-semester exam contained 20 questions and the end-of-year exam consisted of 30 questions. Marks are presented as the percentage of correctly answered questions.

Statistical analyses

Data werecollated into MS Office Excel 2013 files. Statistical analyses were performed using GraphPad Prism 6 Software. Nominal exam results were compared using the chi-squared test. Alpha of <0.05 was considered statistically significant.

Results

Participant evaluations

A total of 75 students took the hybrid course compared to 77 that received the F2F course (Table 2). A total of 31.5% of students answered the questionnaire from the hybrid group compared to 81% in the F2F teaching group. Higher response rates in the F2F group were likely due to the ease of completion of the survey in this format and the students' obligation to compete the form presented in the F2F format. How participants of both groups evaluated the study programme are shown in Figure 1. There were no remarkable differences in the two groups' ratings of the teaching program with high satisfaction scores observed throughout. Both groups confirmed that the course was well organised (100% hybrid vs 92.6% F2F) with achievable learning outcomes (100% hybrid vs 93.2 F2F), the lab sessions were useful in developing and acquiring skills (100% hybrid vs 92.6% F2F), the assessments measured learning accurately (100% hybrid vs 92.6% F2F), the interactive sessions stimulated learning (100% hybrid vs 92.9% F2F), the learning resources were useful (100% hybrid vs 93.6% F2F), the course instructor(s) gave feedback on assessments within 1-week of the exam/assignment deadline (100% hybrid vs 93.2% F2F), and that the practice questions (formative assessments) were helpful in improving performance in the course (100% hybrid vs 95.3% F2F).

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Theoretical tests

Theoretical tests were performed on campus. The results of both mid- and end- semester assessments are shown in Figure 2. All nominal data were compared using the chi-squared test. Alpha of <0.05 was considered statistically significant.No statistically significant differences between the results of the hybrid/e-learning group nor the F2F group were observed at either mid- or end of semester stages ($p \geq 0.05$).

Discussion

All dental colleges and institutions must ensure that their students can diagnose and treat oral disease and meet the dental needs and demands of the public. Dental education consists of non-clinical teaching and clinical-based training, involving face-to-face (F2F) components for honing the technical skills. The COVID-19 pandemic impacted global dental education through restricting this training to virtual approaches. In the post-COVID-19 era, attention has been paid to the transition back to face-to-face (F2F) teaching and its implications for dental studies(Abi-Rafeh and Azzi, 2020, Chan et al., 2021, Collins et al., 2021). This study aimed to explore the students' perceptions of online education, specifically examining their preferences in terms of learning, teaching, and interaction with peers and instructors. The research compared the efficacy of hybrid and traditional face-to-face (F2F) learning environments in endodontic training.

The study evaluated the students 'theoretical proficiency, and satisfaction to determine if the hybrid teaching method used during the COVID-19 pandemic resulted in any adverse effects. It was found that those taught through hybrid teaching showed comparable results in teststhat assessing theoretical knowledge at mid- and end of-semester stages, compared to those taught through traditional F2F methods. This was consistent with previous studies suggesting that hybrid learning is comparable to F2F learning for knowledge acquisition(Nijakowski et al., 2021). We similarly observed a high acceptance of the hybrid learning approach with good levels of student satisfaction. These data relieved any concerns that the COVID-19 pandemic negatively impacted student exam performance or their perception of thelearning experience(Masterton et al., 2021, Mortazavi et al., 2021, Padley and Di Pace, 2021, Patel and Taggar, 2021).

The transfer of dental lectures and practical activities to an online environment required reassessment of the teaching strategy and reconceptualization of assessment activities. Prior to the pandemic, lecturers had minimal experience of online teaching (Sleiwah et al., 2020). Whilst the COVID-19 pandemic had an unprecedented impact on higher education, our study highlights several positive aspects emerging from the educational experience in endodontics. These include that the hybrid courses were well-organised, produced achievable learning outcomes, had useful lab sessions to develop and acquire skills, produced assessments that measured learning accurately, had interactive sessions that stimulated learning, provided access to relevant learning resources and provideduseful feedback for course instructors and formative exams. In the online environment, this knowledge can be used to improve F2F activities and can lead to more effective and sustainable education.

A major advantage of hybrid/e-learning is the possibility of self-directed learning where students take the initiative in determining their end-goals(Alsaywid et al., 2021, Bahanan et al., 2022, Baig et al., 2019, Balasubramaniam et al., 2018, Barakat et al., 2022, Bock et al., 2021). E-learning also offersease of access to

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information with wider variety and greater quantity, optimising the learning process. Studies have shown that e-learning modalities are used widely by students outside of their formal curricula and by health professionals for continuing professional education, indicating that they appreciate this mode of learning(Dyrek et al., 2022, Escobar et al., 2022, Goh et al., 2022, Grundgeiger et al., 2022, Hulke et al., 2022). E-learning is also designed to accommodate student needs with reduced costs of labour, fast delivery, scalability, and consistency of teaching in the face of limited availability of instructors. (Martinez-Melo et al., 2022, Mladenovic et al., 2022, Puskulluoglu et al., 2022, Tabatabaei et al., 2022, Takenouchi et al., 2020, Taramarcaz et al., 2022, Vaona et al., 2018, Walsh, 2018).

In previous studies, e-learning has led to student displeasure in maintaining course schedules and deadlines during the COVID-19 lockdown. This is likely due to social isolation imposed in the pandemic, resulting in low motivation and psychological stress (Abbasi et al., 2020). There are documented limitations to clinical training using e-learning, as students lack confidence when faced with real-patientscenarios. A blended learning approach incorporating F2F approaches can avoid issues of self-isolation and a lack of self-discipline, maintaining an environment favourable for learning(Mladenovic et al., 2022, Puskulluoglu et al., 2022). This is particularly true in endodontics in which students have shown a preference for integration of e-learning into traditional classroom lectures, maintaining both independent learning and interactivity with the instructors (Bahanan et al., 2022).

Some limitations of this study should be noted. It was limited to a single academic centre and one study year where hybrid learning was introduced as a necessity due to the COVID-19 pandemic. To fully validate our findings and make confident recommendations for the widespread adoption of this format at other universities, further multi-centre studies that encompass a diverse range of assessments are necessary.

In conclusion, our findings demonstrate that the hybrid learning approach was well-received by dental students at our institution and produced endodontic education outcomes that were comparable to those obtained through traditional face-to-face instruction. These results suggest that high-quality education can be sustained through blended learning, and that dental student education was unlikely to be negatively impacted by the pandemic.

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