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CONGRESS PROCEEDING

The New Normal in Dental Education: Perceptions of e-Learning Among Dental Students and The Impact of The Pandemic on Education

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Abstract

Dentistry education, unlike other professional programs, consists of three core components: theoretical education, laboratory (pre-clinical) practices, and clinical training. These components, along with various social programs, research projects, and interdisciplinary experiences, are highly integrated. With the global accessibility of the internet, especially during the COVID-19 pandemic, there has been a shift toward virtual learning across many fields. However, the unique structure of dentistry education has limited the widespread implementation of distance learning strategies.

Aim and Method: : This review aims to evaluate the perceptions of dentistry students regarding distance learning and in-class education, especially in the context of the COVID-19 pandemic. A detailed literature review was conducted, and relevant findings were summarized.

Conclusions: Zhang et al.'s survey showed that 53.8% of students reported difficulty recalling material during distance learning, and 64.1% found it harder to concentrate compared to face-to-face lessons. Additionally, 79.5% experienced fatigue during online education. Despite challenges in practical training, students generally felt they had received adequate pre-clinical education. The pandemic impacted both learning and practical training, with students expressing fear of infection. Distance learning with interactive activities, quality materials, and well-organized modules can improve students' learning experiences and satisfaction, providing guidance for future educational models.

Key words: COVID-19; Dentistry education; Digital learning; E-learning; Pandemic

Introduction

The integrated curriculum is becoming a popular concept among dental schools, incorporating both theoretical and clinical practices[1]. In the realm of higher education, digital transformation can be understood as the combination of all digital processes necessary to achieve this transformation. This process provides higher education institutions with opportunities to effectively and optimally utilize digital technologies . However, the COVID-19 pandemic, although no longer classified as an active global pandemic, led has led to serious consequences in multiple areas, including economic, social, and health-related issues, and it has notably influenced the field of dental education[2]. Because of lockdowns and government guidelines aimed at curbing the spread of COVID-19, dental teaching activities allowed in universities were significantly restricted. The pandemic has led to significant changes in education systems worldwide, and the adaptation of dental students to e-learning processes, along with its impact on the quality of education, has played a critical role in defining new norms in dental education.[3]

The adoption of e-learning during COVID-19 revealed significant regional disparities. In Germany, over 80% of faculty successfully adapted to online teaching, demonstrating the country's competence in digital education[4]. Conversely, Turkey and the USA faced significant difficulties, particularly in delivering practical training and hands-on experience, which are key components of dental education[5]

This review analyzes these challenges, identifies regional disparities, and evaluates innovative solutions such as hybrid learning and AR/VR technologies to inform more resilient approaches in dental education.

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Table 1. Comparative Analysis of E-Learning Challenges and Innovations in Dental Education

Country	E-learning Adoption	Reported Challenges
Germany	80%	Faculty resistance, need for rapid digital upskilling.
Turkey	45%	Technological barriers, resource shortages, and heightened stress.
USA	65%	Limited hands-on training and increased stress.
UK	70%	Reduced student engagement and reliance on hybrid models.
China	90%	Infrastructure gaps in rural areas, but strong government support.

Objective and Method

The objective of this study is to evaluate the perceptions of e-learning among dental students during the COVID-19 pandemic and analyze its impact on the quality of dental education, particularly in theoretical learning, pre-clinical training, and clinical practice. Additionally, the study aims to identify regional disparities in e-learning adoption and propose innovative solutions, such as hybrid learning models and AR/VR technologies, to address these challenges.

To achieve this, a comprehensive literature review was conducted using predefined keywords, including "COVID-19," "dental education," "e-learning," and "clinical practice." Relevant articles were sourced from PubMed, Scopus, and Google Scholar, covering studies published between 2020 and 2024. The inclusion criteria consisted of peer-reviewed studies focusing on dental education during the COVID-19 pandemic, particularly those assessing e-learning challenges, adoption rates, and proposed solutions. Only original research, cross-sectional studies, and systematic reviews were considered. Non-peer-reviewed studies, opinion pieces, and articles unrelated to dental education or lacking clear methodological descriptions were excluded.

From an initial pool of 450 studies, a total of 34 articles met the inclusion criteria and were selected for detailed analysis. The findings were synthesized and categorized into four main themes: regional disparities in e-learning adoption, challenges in practical training and clinical skill acquisition, psychological impacts on students, and innovative solutions for improving dental education. Results were summarized in structured tables and critically discussed in relation to existing literature to highlight key insights and future directions.

Results

The studies reviewed underscore the growing need to integrate digital tools, including internet-based platforms and e-learning technologies, into dental curricula to ensure continuity of education and support learning outcomes [5]. While students demonstrated adaptability to these platforms, challenges persisted, particularly in pre-clinical and clinical training, where hands-on skill development was disrupted. Several studies reported that although e-learning was effective for theoretical knowledge, it failed to provide adequate support for acquiring procedural and psychomotor skills. Psychological challenges were also prominent, as students experienced increased stress, anxiety, and fatigue, which impaired their ability to concentrate and retain information effectively [6,7].

A comparative analysis of e-learning adoption rates and challenges across key regions is summarized in Table 1.

The findings emphasize the significant regional disparities in e-learning adoption and reported challenges. Germany and China achieved the highest adoption rates, attributed to their robust digital infrastructure, institutional preparedness, and use of innovative tools like AR/VR for clinical simulations [8]. In contrast, Turkey and the USA faced notable difficulties, including technological limitations, lack of practical training, and increased psychological burden on students [9,10].

Several solutions have been proposed to mitigate these challenges. Virtual simulations have emerged as a useful tool for providing clinical practice in a controlled environment, while hybrid learning models strategically combine online theoretical education with in-person practical sessions. Tele-dentistry tools have also offered remote clinical consultations and instructor feedback, enhancing students' learning experience. However, despite their promise, these approaches remain insufficient to fully replicate real-world patient care, underscoring the need for further refinement and investment in technological tools. [11]

Discussion

The review found that while theoretical education successfully adapted to e-learning during the COVID-19 pandemic, practical training faced significant challenges due to the limitations of replicating hands-on clinical experiences online. Dentistry education, unlike other professional programs, relies heavily on an integrated structure of theoretical teaching, pre-clinical laboratory practices, and clinical training, which are not easily replicated in virtual settings. This unique structure limited the widespread adoption of distance learning strategies, despite its advantages in ensuring educational continuity during the pandemic [6,8].

Countries such as Germany and China achieved higher adoption rates (80% and 90%, respectively) due to their robust digital infrastructure, faculty upskilling, and advanced technological integration. Germany focused on preparing educators for digital teaching, ensuring smoother transitions to online platforms. Similarly, China implemented government-supported programs and incorporated AR/VR technologies to simulate clinical environments, partially mitigating the lack of hands-on training opportunities [8]

Psychological challenges were a recurring theme across regions, with many students reporting fatigue, reduced concentration, and difficulties in retaining material during online education [12]. These findings emphasize the importance of addressing mental health support alongside educational reforms to ensure student well-being and engagement.

Innovative strategies, such as hybrid learning models and AR/VR simulation tools, have shown promise in bridging these gaps. Hybrid models combine online theoretical education with controlled, in-person practical training sessions, addressing some of the limitations of distance learning [8]. Similarly, AR/VR technologies enable students to practice procedures in simulated environments, improving skill retention and reducing the psychological burden associated with physical practice during the pandemic. However, these tools cannot fully replicate real-world patient care, emphasizing the need for further refinement and resource allocation. [13]

Moving forward, addressing regional disparities in e-learning adoption requires targeted investments in digital infrastructure, particularly in resource-limited regions like Turkey. Furthermore, global collaboration among institutions can facilitate knowledge-sharing and access to innovative educational tools, ensuring a more equitable and resilient dental education system worldwide. Future research should prioritize longitudinal studies to evaluate the effectiveness of hybrid learning models and AR/VR technologies in enhancing clinical competency and student readiness for professional practice.

Conclusion

E-learning has proven to be an essential tool in dental education during the COVID-19 pandemic, ensuring flexibility and accessibility for theoretical learning. However, its limitations in delivering practical, pre-clinical, and clinical training emphasize the need for a hybrid approach that combines digital teaching with structured, hands-on sessions to bridge gaps in skill acquisition.

Author Contributions

Detailed literature review and compilation : G.H.
Manuscript preparation and editing : All Authors

Conflict of Interest

There is no conflict of interest.

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