Knowledge and Perceptions of Artificial Intelligence among Dental Students in Tunisia

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ABSTRACT

Background: Artificial intelligence (AI) is rapidly transforming dental practice and education worldwide. Despite growing international interest, there is limited research assessing the awareness and perceptions of AI among dental students in Tunisia.

Objectives: To evaluate the knowledge and perceptions of Tunisian dental students regarding AI and its applications in dentistry and to identify potential gaps that support future curriculum development.

Materials and methods: A cross-sectional survey was conducted among 502 dental students at the Faculty of Dentistry in Tunisia. The questionnaire gathered sociodemographic data, assessed knowledge of AI principles and applications, and explored students' perceptions of AI in clinical practice and its integration into dental education.

Results: Among the 502 participants, 49% reported having basic knowledge of AI, and 48% were familiar with its applications in dentistry. The most frequently reported source of information was social media, cited by 76% of the respondents. While 53% believed AI would significantly advance dentistry, and 44% disagreed with the idea that AI could replace dentists. AI was considered valuable for diagnosis (58% for dental caries), treatment planning (58%), implantology (54%), and forensic dentistry (44%). Nearly half of the students supported integrating AI into both undergraduate and postgraduate dental education.

Conclusion: This study highlights moderate knowledge and generally positive perceptions of AI among Tunisian dental students. Integrating AI-related content into dental curricula is essential to better prepare future practitioners for the evolving technological landscape. Further studies are recommended to explore the continued influence of this educational approach.

Keywords: Artificial Intelligence; Dental Students; Artificial intelligence applications; Dental Education; Knowledge and Perceptions

INTRODUCTION

Artificial intelligence (AI) is rapidly transforming the healthcare landscape, and dentistry is no exception. From its early beginnings in the mid-20th century as a statistical aid, AI has evolved into a vital tool within modern clinical practice. Through machine learning and deep learning, AI systems now can analyse vast and complex datasets, offering support in image-based diagnostics, treatment planning, and clinical decision-making. In the dental field, these technologies have proven useful in identifying oral lesions, diagnosing periodontal conditions, and enhancing the clarity and interpretation of clinical images [1, 2]. Beyond clinical applications, AI is also gaining ground in dental education. It provides students with access to personalised learning environments, collaborative digital platforms, and sophisticated diagnostic simulations. These

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advances underscore the necessity for dental curricula to include critical engagement with AI tools, ensuring that future practitioners are well-prepared for a profession increasingly shaped by technology [3].

Several international studies have investigated how dental students perceive and understand AI, with data emerging from countries such as Brazil, India, Morocco, South Korea, Egypt, and Saudi Arabia [3–8]. While students often report only a moderate level of knowledge, their attitudes tend to be optimistic, acknowledging AI's potential to improve patient care. Nevertheless, data on Tunisian dental students' views remain scarce, highlighting the importance of further exploration in this context [4, 5, 9]. Therefore, the objectives of this study are to assess the knowledge and perceptions of Tunisian dental students regarding AI and its applications in dentistry, identify educational gaps, and to inform future curriculum development.

MATERIALS AND METHODS

This study received approval from the Scientific Research Ethical Committee of Farhat Hached Hospital in Sousse, Tunisia (Reference number: 010692-023520, dated September 2022). All procedures adhered to the principles outlined in the Declaration of Helsinki, originally adopted in 1964 and modified in October 2024. Participants were informed about the study's purpose and their rights, including the voluntary nature of their involvement. Informed consent was obtained at the start of the online survey, with assurances of anonymity and confidentiality.

An observational cross-sectional study was conducted over six months, from February 1 to July 31, 2023.

The target population comprised undergraduate dental students enrolled in the 3rd, 4th, 5th, and 6th years at the Faculty of Dental Medicine of Monastir, the only public dental institution in Tunisia. While the total number of students enrolled across all six academic years was 1460, only those in the last four years (980 students) were eligible for inclusion. This selection was based on the structure of the six-year dental curriculum, which includes both preclinical and clinical education in the final four years (each lasting 6 months).

First- and second-year students were excluded as they had not yet been exposed to clinical training or AI-related content, making their input less relevant to the study objectives. The required sample size was calculated using the Epi Info™ software (Centers for Disease Control and Prevention), with a 95% confidence level, a margin of error of 5%, and a population size of 980. The minimum required sample was 450 students. However, this study included 502 participants during the study period, which enhances the statistical power and validity of the findings.

Inclusion Criteria
- Undergraduate dental students in their 3rd to 6th year.
- Enrolled at the Faculty of Dental Medicine of Monastir.
- Voluntary consent to participate.

Exclusion Criteria
- First- and second-year students.
- Graduate or postgraduate students.
- Incomplete or missing responses.
- Students who declined to provide informed consent.

Data were obtained using a predesigned and pretested questionnaire, originally developed by Yüzbaşıoğlu (2020) [10] and adapted for the Tunisian context. The instrument was evaluated and validated by a group of three experts in dentistry and public health. The Cronbach's alpha coefficient was 0.83, indicating high internal consistency.

The questionnaire consisted of 22 multiple-choice questions, divided into three sections:

1. **Demographic data (4 items):** Age, sex, academic year, and university affiliation.
2. **Perceptions of AI (8 items):** Assessed attitudes toward AI using a 5-point Likert scale. These items included questions about AI's contribution to advancing dentistry, its potential to replace dentists, its role in diagnostic support, its usefulness in disease prediction, its application in diagnosing soft tissue lesions, periodontal diseases, dental caries and jaw pathologies, its use in treatment assessment and quality control, and participants' support for integrating AI into undergraduate and postgraduate dental education.
3. **Knowledge of AI applications (10 items):** Evaluated students' awareness of AI technologies in dentistry. This section explored participants' basic knowledge of artificial intelligence concepts and their awareness of how artificial intelligence is applied in dental practice, with response options being Yes or No. The sources from which they obtained information about AI (social media, friends/family, university lectures, newspapers/magazines), and the application of AI in diagnosing dental caries, periodontal diseases, soft tissue lesions, and jaw pathologies, as well as its use in implantology and forensic dentistry.

The questionnaire was administered online via Google Forms. It was distributed to eligible students using institutional email lists and WhatsApp academic groups. A brief introduction on the first page outlined the study aims and ethical principles. Consent was obtained through a "Yes/No" question before accessing the questionnaire. The form remained accessible throughout the six-month data collection period, ensuring sufficient response time.

To minimise selection bias, all eligible students were invited to participate. The anonymous format and wide dissemination via multiple platforms ensured inclusivity. Information bias was reduced by using a clearly worded and validated questionnaire, as well as a consistent explanation of study objectives.

The analysis was performed using statistical software (IBM SPSS Statistics, version 26; IBM Corp., Armonk, NY, USA). Descriptive measures such as means, percentages, frequencies, and standard deviations were used to summarise the data. The Kolmogorov–Smirnov test assessed the normality of continuous variables. Associations between categorical variables were examined using the Chi-square test, while differences between groups for continuous variables were evaluated using independent samples t-tests and one-way ANOVA. Statistical significance was defined as a P-value less than 0.05.

RESULTS

The survey included 502 dental students, yielding a participation rate of 56%. Participants had a mean age of 22 ± 1.5 years. The sample included a higher proportion of female students (56%). In terms of academic year distribution, the largest group consisted of fifth-year students (35.9%). These demographic and characteristics are summarized in Table 1).

Regarding knowledge of basic AI principles, 49.2% of students demonstrated understanding based on "Yes/No" responses. Similarly, 48% of participants were aware of AI ap-

Table 1. Sociodemographic details of the 502 participants.

Variable	Frequency(n)	Percentage%
Sex		
Male	221	44.0
Female	281	56.0
Academic Year		
3rd Year	98	19.5
4th Year	82	16.3
5th Year	180	35.9
6th Year	142	28.3

Table 2. Knowledge and awareness of artificial intelligence (AI) among 502 participants.

Variable	Frequency(n)	Percentage%
Knowledge of AI principles		
Yes	247	49.2
No	255	50.8
Awareness of AI in dentistry		
Yes	241	48.0
No	261	52.0
Source of AI information		
Social media	381	75.9
Friends/Family	45	9.0
University Lectures	50	10.0
Newspapers/Magazines	26	5.2

plications in dentistry. The primary source of AI information was social media, cited by 76% of participants (Table 2).

No significant associations were observed between sex, year of study, or type of university and knowledge about AI principles (P-values: 0.934, 0.452, and 0.115, respectively) or awareness of AI usage in dentistry (P-values: 0.968, 0.449, and 0.711, respectively).

A significant portion of participants acknowledged the transformative role of AI in dentistry, with 53% agreeing that it contributes significantly to advancing the field. However, skepticism regarding AI's ability to replace dentists persisted, as 44% disagreed with this notion.

AI was widely acknowledged by students as a valuable tool for diagnosing dental conditions. There was strong agreement regarding its usefulness in identifying common issues such as caries, periodontal diseases, and jaw pathologies. In contrast, perceptions were more divided when it came to diagnosing soft tissue lesions, reflecting some uncertainty about AI's reliability in this area (Figure 1).

AI's application in implantology was well-appreciated, with 54% of participants finding it beneficial. In forensic dentistry, the opinions were more varied: 44% acknowledged AI's usefulness, 40% were uncertain, and 16% disagreed (Figure 2).

A significant majority (62%) of participants recognized AI's potential in treatment assessment and quality control. This result underscores its perceived value in enhancing the precision and consistency of dental care. AI's ability to provide detailed evaluations and maintain high standards of clinical outcomes is gaining traction among dental students (Figure 3).

The integration of AI into dental education received strong
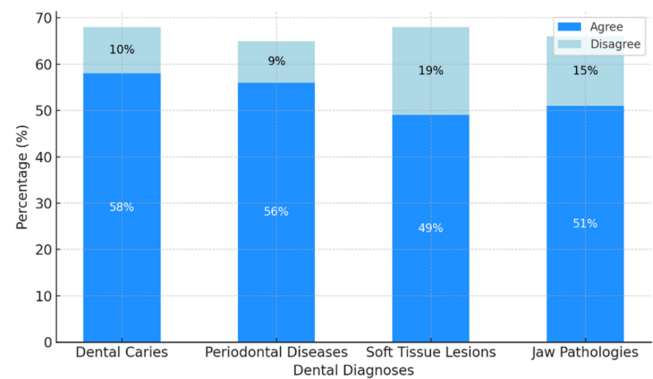
Figure 1. Perception of artificial intelligence in dental diagnosis.
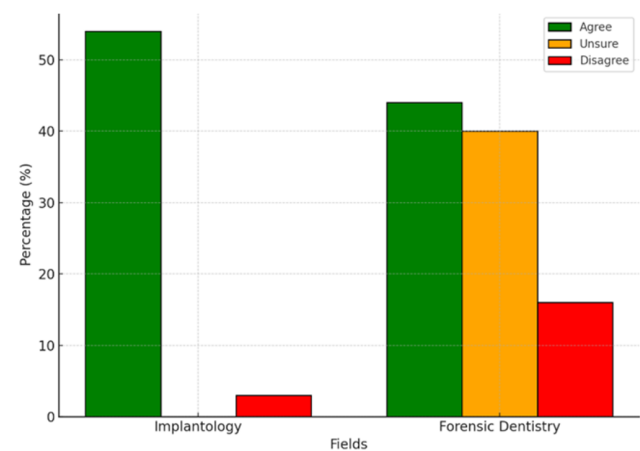
Figure 2. Dental Students' Perceptions of artificial intelligence Applications in implantology and forensic dentistry.
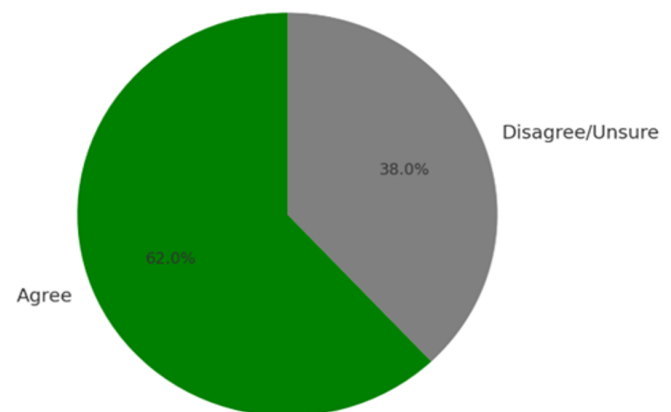
Figure 3. Artificial intelligence as a quality control tool.

support from participants. Nearly half (49%) expressed interest in incorporating AI applications into undergraduate dental training. Furthermore, 52% supported the inclusion of AI in postgraduate programs (Figure 4).
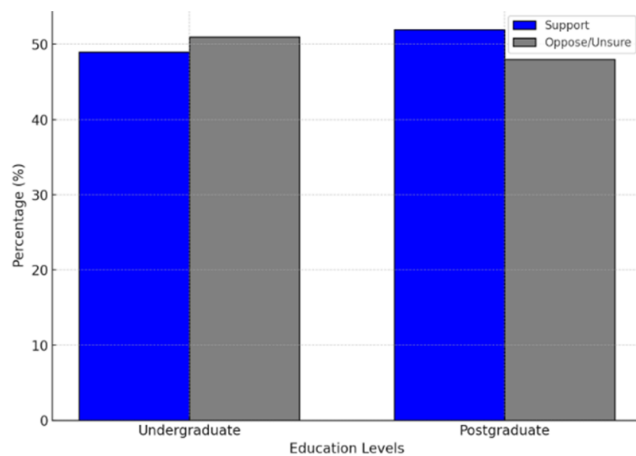
Figure 4. Support for artificial intelligence integration in dental education.

DISCUSSION

The application of AI in dentistry is a rapidly evolving field with significant implications for clinical practice and education. This change in thinking necessitates the integration of AI-related content into dental curricula to ensure that future dentists are well-equipped to utilize its potential [11, 12]. The results of this survey contribute to the growing body of literature on dental students' knowledge and perceptions of AI, offering valuable insights specific to Tunisia, where such studies have been limited [9]. A notable strength of this study lies in its large and diverse sample, which includes students from various academic years. This diversity reinforces the validity and broad applicability of the findings. The survey results indicate that although dental students generally view AI positively, particularly in areas like diagnostics and quality control, there remains a significant gap in formal training and awareness. This highlights the urgent need to incorporate AI-related education into undergraduate dental curricula.

The sex distribution in our sample showed a male-to-female ratio of 1:1.38, which aligns with demographic patterns reported in similar studies conducted in Turkey and Morocco [11, 12]. This trend reflects the growing predominance of women in dental education worldwide. In terms of academic level, 21% of participants were third-year students, 26% were in their fourth year, and the majority (53%) were in their final year. This distribution suggests a greater interest or availability among students nearing the end of their studies. Interestingly, these results differ from reports in Turkey and India, where younger students or postgraduates were more highly represented, a variation that may stem from differences in curricular design or institutional emphasis [4, 5, 13].

Regarding AI literacy, nearly half of the respondents (49%) reported a basic understanding of AI concepts, and 48% were familiar with its applications in dental practice. These figures are comparable to findings from Turkey and Morocco [11, 12], but remain lower than those observed in India and Saudi Arabia, where certain dental schools have already introduced AI education into their programs [4, 8]. This variation underscores the importance of curriculum design in fostering foundational knowledge. Social media emerged as the predominant source of information about AI (76%), which aligns with global trends reflecting the pervasive role of digital plat-

forms in information dissemination.

A significant proportion of students (53%) perceived AI as a key driver for progress in dentistry, mirroring positive perceptions reported in other countries. However, 44% disagreed with the notion that AI could replace dentists, citing the irreplaceable human elements of trust, empathy, and nuanced clinical judgment. Similar sentiments have been echoed in Turkey and Saudi Arabia, where students expressed scepticism about AI's ability to fully replicate the dentist-patient relationship [8, 10].

Students widely acknowledged AI's potential in diagnostic applications, with high agreement rates for its role in identifying dental caries (58%), periodontal diseases (56%), and radiographic pathologies (51%). These results are consistent with findings from Turkey, Saudi Arabia, and India [4, 8, 13]. Moreover, 58% of participants recognized AI's utility in treatment planning, reinforcing its value as a clinical decision-support tool. AI's role in forensic dentistry was recognized by 44% of students, reflecting its acknowledged importance in victim identification and medico-legal investigations, as highlighted by international studies [10, 14]. Additionally, 62% of participants valued AI as a quality control tool, recognizing its potential to improve treatment outcomes and maintain consistency in clinical practice.

Nearly half of the respondents (49%) expressed support for integrating AI into undergraduate dental education, while 52% favoured its inclusion at the postgraduate level. These findings reflect a broader global trend, where dental students are increasingly aware of the transformative role AI is playing in clinical practice. In fact, studies conducted in several country report even higher levels of enthusiasm for AI-related instruction, highlighting the growing demand for curriculum reform in dental schools worldwide [4, 5, 12, 15].

This study represents an important initial effort to explore Tunisian dental students' knowledge and attitudes toward AI, offering a foundation for future investigations. Nevertheless, one notable limitation is the sample's restriction to students from only one academic institutions, which may not fully represent the diversity of perspectives across Tunisia [16]. Expanding future research to include students from multiple universities, along with longitudinal designs, would help capture the evolving nature of AI-related knowledge and attitudes over time. Moreover, investigating the specific obstacles students encounter when engaging with AI technologies could inform the development of tailored educational strategies [17, 18].

While the current findings offer valuable preliminary insights, several methodological limitations should be acknowledged. First, the cross-sectional design precludes any assessment of causality or temporal changes, limiting our understanding of how students' views might evolve with increased exposure to AI in educational or clinical contexts. Second, the absence of a structured educational intervention, such as a pre- and post-test, introduces a risk of bias, as students' knowledge was largely self-acquired, often through unregulated sources like social media or online videos. Finally, reliance on self-reported data presents the possibility of social desirability bias, which may lead to overestimation of actual knowledge or confidence levels.

To enhance the validity of future investigations, we recommend the implementation of a multi-phase study design that includes focus groups, followed by structured educational sessions led by faculty members using standardized and evidence-based materials (e.g., slides, videos, and AI modules). The

impact of these sessions should be assessed through pre- and post-intervention surveys, allowing for objective evaluation of knowledge acquisition and attitude shifts. Such an approach would provide a more rigorous foundation for curriculum development and ensure that AI literacy among dental students is evidence-driven [18–20].

CONCLUSION

While Tunisian dental students' knowledge and perceptions generally align with global trends, there are notable gaps, particularly in their understanding of AI principles and practical applications. Bridging these gaps through updated curricula and focused training programs is essential to preparing future dentists to leverage AI's full potential. By integrating human expertise with cutting-edge technology, the dental profession can move toward a future of enhanced precision, efficiency, and superior patient care.

ETHICAL DECLARATIONS

Acknowledgments

Ethics Approval and Consent to Participate

This study received approval from the Scientific Research Ethical Committee of Farhat Hached Hospital in Sousse, Tunisia (Reference Number: 010692-023520). All procedures complied with the principles outlined in the Declaration of Helsinki. Participants were informed about the study's purpose and their rights, including the voluntary nature of their involvement. Informed consent was obtained at the start of the online survey, with assurances of anonymity and confidentiality.

Consent for Publication

Not applicable. This manuscript does not contain any person's data in any form (including individual details, images, or videos).

Availability of Data and Material

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Competing Interests

The authors declare that there is no conflict of interest.

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Authors' Contributions

All listed authors made significant, direct, and intellectual contributions to the work. They have read and approved the final version of the manuscript.

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