

Knowledge and Awareness Regarding the Use of Artificial Intelligence in dentistry and Pediatric Dentistry Among Dental Students at some Private Syrian Universities

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Abstract:

Introduction: In recent years, artificial intelligence (AI) applications have developed significantly across various fields, including dentistry, making it necessary to evaluate dental students' readiness to engage with this advanced technology.

Objective: This study aims to assess the knowledge of dental students in Syria, specifically at Cordoba Private University and Al-Shahba Private University in Aleppo, regarding AI concepts, as well as to evaluate their attitudes and perceptions towards its uses in the medical field.

Materials and Methods: A cross-sectional survey was conducted using an electronic questionnaire consisting of 18 questions, distributed among 960 undergraduate dental students. The data were analyzed statistically using appropriate analytical tools.

Results: 49% of participants showed a basic understanding of AI principles, while 48% were aware of its uses in pediatric dentistry. Social media was the most common source of information. Most students believed in the importance of AI in the advancement of dentistry, while less than half expressed concerns about AI potentially replacing doctors. Furthermore, 49% of students supported integrating AI into undergraduate and 52% postgraduate curricula .

Conclusion: Dental students in private Syrian universities are aware of AI developments and hold positive attitudes towards incorporating AI into clinical practice and education. It is recommended to include comprehensive AI training within dental curricula.

Key Words: Artificial Intelligence, Dental Students, Knowledge and Attitudes, Medical Applications.

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المعرفة والوعي حول استخدام الذكاء الاصطناعي في طب الأسنان وطب أسنان الأطفال لدى طلاب طب الأسنان في بعض الجامعات السورية الخاصة

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الملخص:

المقدمة: شهدت تطبيقات الذكاء الاصطناعي (AI) تطورًا كبيرًا في مختلف المجالات، بما في ذلك طب الأسنان، ما يجعل من الضروري تقييم مدى استعداد طلاب طب الأسنان للتعامل مع هذه التكنولوجيا الحديثة.

الهدف: تهدف هذه الدراسة إلى تحليل مدى معرفة طلاب طب الأسنان في سوريا، وتحديدًا في جامعة قرطبة الخاصة و جامعة الشهباء الخاصة في مدينة حلب، بمفاهيم الذكاء الاصطناعي، بالإضافة إلى تقييم مواقفهم وتصوراتهم تجاه استخداماته في المجال الطبي.

المواد والطرائق: أُجري مسح مقطعي باستخدام استبيان إلكتروني مكون من 18 سؤالاً، وُرِع على 960 طالبًا وطالبة في المرحلة الجامعية الأولى. تم تحليل البيانات إحصائيًا باستخدام أدوات التحليل المناسبة.

النتائج: أظهر 49% من المشاركين فهمًا أساسيًا لمبادئ الذكاء الاصطناعي، في حين كان 48% على دراية باستخداماته في طب أسنان الاطفال. كانت وسائل التواصل الاجتماعي هي المصدر الأكثر شيوعًا للمعلومات. أعربت الأغلبية عن اعتقادهم بأهمية الذكاء الاصطناعي في تطوير طب الأسنان، بينما أبدى أقل من النصف تخوفهم من إمكانية استبدال الأطباء بهذه التقنية. كما أيد 49% من المشاركين دمج الذكاء الاصطناعي ضمن البرامج الدراسية الجامعية للمرحلة الجامعية الأولى و 52% من المشاركين أيدو دمج الذكاء الاصطناعي ضمن البرامج الدراسية لطلاب الدراسات العليا.

الاستنتاج: طلاب طب الأسنان في الجامعات الخاصة في سوريا على دراية بتطورات الذكاء الاصطناعي ويبدون مواقف إيجابية تجاه دمجها في الممارسات الطبية والتعليمية. ويُوصى بإدراج تعليم الذكاء الاصطناعي بشكل موسع ضمن مناهج كليات طب الأسنان.

الكلمات المفتاحية: الذكاء الاصطناعي، طلاب طب الأسنان، المعرفة والمواقف، تطبيقات طبية.

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Introduction:

In recent years, there has been a remarkable increase in interest in artificial intelligence technologies, which have become a key pillar in developing medical practices. The role of AI is no longer limited to statistical models but has become an active component in diagnosis and treatment through analyzing complex medical data using machine learning and deep learning algorithms. These advancements have led to the use of AI in various clinical procedures in dentistry, such as enhancing radiographic image quality and automatic diagnosis of oral diseases.

(Rahim et al., 2024, Ghaffari et al., 2024)

The concept of artificial intelligence emerged with John McCarthy, who introduced the term during the Dartmouth Conference in 1956, defining it as “the science and engineering of making intelligent machines.” In recent years, this computer science field has garnered widespread interest and development. (Garcia et al., 2024)

AI in dentistry has flourished in recent years. From a dental perspective, AI applications can be categorized into diagnosis, decision-making, treatment planning, and outcome prediction. (Ding et al., 2023)

There have been increasing calls to integrate AI technologies into medical education curricula, including dentistry, to ensure that future healthcare professionals are prepared for this rapid digital transformation. With the growing importance of these technologies, it is vital to understand dental students' awareness and attitudes towards AI concepts and applications and their views on its integration into dental care and academic training. (Zarei et al., 2024)

Substantial funding for AI research, especially in the medical field, has come from high-income countries. There are limited intentions to apply AI in low-income countries like Syria, and research on this topic is scarce.

The use of AI in dentistry has recently expanded, benefiting new dental graduates, particularly in diagnosis. In pediatric dentistry, AI can be applied for clinical procedures such as tooth numbering and arrangement, caries detection and evaluation, managing anxious or fearful children's behavior, and robotic-assisted surgical treatment. (Ranjana et al., 2021)

Given the lack of similar studies in Syria, this study aims to assess the knowledge and attitudes of dental students at Cordoba Private University and Al-Shahba Private University in Aleppo Governorate towards the use of AI in dentistry and pediatric dentistry.

Materials and Methods:**Study Design:**

A cross-sectional study was conducted using an electronic questionnaire designed via Google Forms to collect the opinions of a sample of 960 undergraduate students (third to fifth year). The study adhered to the scientific transparency principles recommended in the STROBE guidelines for observational studies.

Ethical Considerations:

Ethical approval was obtained from the Research Ethics Committees of the Higher Commission for Scientific Research in Damascus (No . DN-210122-391- Date 21/01/2025). All participants were informed about the study objectives, confidentiality, and privacy protection, and written consent was obtained before completing the questionnaire.

Sample Size:

The initial sample size was calculated using the standard formula for cross-sectional studies, based on the prevalence reported by (Yüzbaşıoğlu, 2021), which indicated that 48.4% of students had knowledge of AI principles, with a 95% confidence level and a $\pm 5\%$ margin of error. According to this calculation, the estimated sample size was approximately 384 students.

However, field studies commonly encounter the issue of non-response, which can compromise the representativeness of the results. To ensure a representative sample of the target population and to maintain adequate statistical power despite potential non-response, the final sample size was increased to 960 students. This adjustment helps improve the reliability of the findings and their generalizability to the entire study population

Inclusion and Exclusion Criteria:

Inclusion: Syrian dental students of both genders in their third to fifth years.

Exclusion: Students who refused to participate, did not complete the questionnaire .

Results:

This survey aimed to assess the knowledge, attitudes, and perceptions of Syrian dental students at private universities towards artificial intelligence.

The data collection tool was an approved English-language questionnaire based on (Yüzbaşıoğlu, 2021), Translated into Arabic and presented in Arabic , Evaluated by two pediatric dentists, one of whom is a professor., pretested on a group of dental students, demonstrating internal consistency with a Cronbach's alpha of 0.83. The questionnaire was used without any modifications, The questionnaire can be generalized to other studies if they are similar to the mechanism of our current study. The Google Forms-based electronic survey was distributed to eligible dental students at Cordoba and Al-Shahba Private Universities. The survey began with a consent section explaining the study's purpose, nature of the questionnaire, and voluntary participation. Informed consent was obtained before respondents proceeded by answering a yes/no question. The questionnaire comprised three sections with 22 questions: the first section (4 questions) collected sociodemographic characteristics such as age, gender, university, and level of dental education; the second section included 3 questions about basic knowledge of AI principles, awareness of its use in dentistry, and sources of AI information; the third section asked

participants to indicate their level of agreement with 15 statements.

Data Analysis:

SPSS software (version 22) was used for statistical analysis. The Kolmogorov–Smirnov test was used to test normal distribution, while the independent samples t-test and ANOVA were used for quantitative data, and the chi-square test for categorical data. Statistical significance was set at $P < 0.05$.

Statistical Results:

A total of 960 students participated: Cordoba Private University ($n=610$; 63.5%) and Al-Shahba Private University ($n=350$; 36.5%). The average age was 19 ± 1.5 years, with 42% males ($n=403$) and 58% females ($n=557$). By academic year, 21% were in the third year ($n=201$), 26% in the fourth year ($n=247$), and 53% in the fifth year ($n=512$). First- and second-year students were not included. There were no significant differences in the survey results due to gender or years of study. Regarding basic AI knowledge, 49% ($n=470$) acknowledged understanding AI principles, while 51% ($n=490$) did not. As for awareness of AI use in dentistry, 48% ($n=460$) were aware, while 52% ($n=500$) were not. Social media was the most common source of AI information (76%, $n=730$), followed by university lectures (10%, $n=95$), friends and family (9%, $n=87$), and newspapers and magazines (5%, $n=48$). No significant statistical differences were found between knowledge or awareness and gender, university, or academic year ($P > 0.05$).

Regarding perceptions, 53% believed in AI's role in advancing dentistry, while 44% did not believe AI could replace doctors. 57% expressed enthusiasm about using AI for disease diagnosis, and 33% agreed with its role in predicting disease conditions. The majority supported its use in diagnosing caries, periodontal diseases, soft tissue diseases, and maxillary lesions (49%-58%).

54% viewed AI as important in dental implantology, and 58% agreed on its value in treatment planning and general diagnosis, with

only 1% disagreeing. In forensic dentistry, 44% supported AI's use, while 40% lacked sufficient knowledge. 62% acknowledged AI's importance as a quality control tool for evaluating treatment

success. Lastly, 49% supported including AI education in undergraduate curricula, and 52% supported adding it to postgraduate programs.

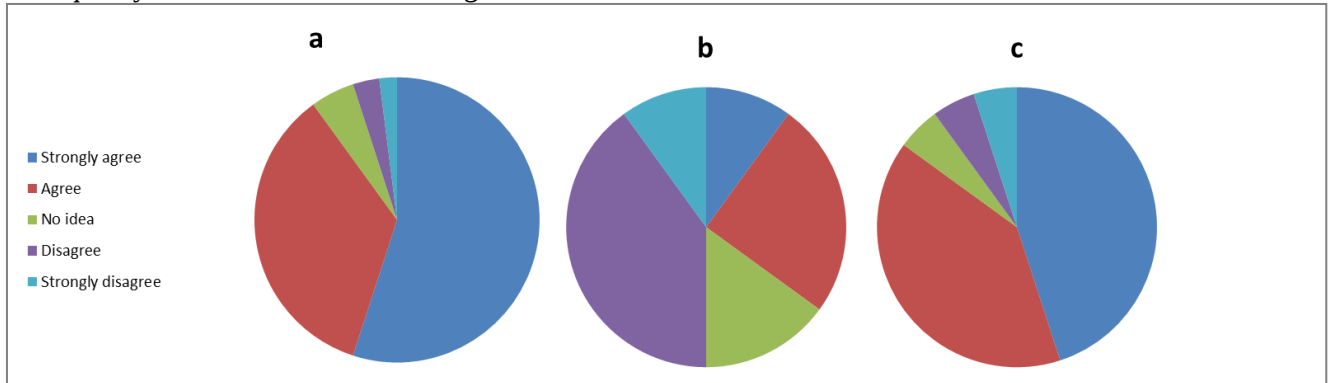


Figure (1): (a): I believe that artificial intelligence will lead to major contracts in dentistry and medicine. (b): Artificial intelligence could replace dentists/doctors of the future. (c): Explore the exciting uses of artificial intelligence in dentistry and medicine.

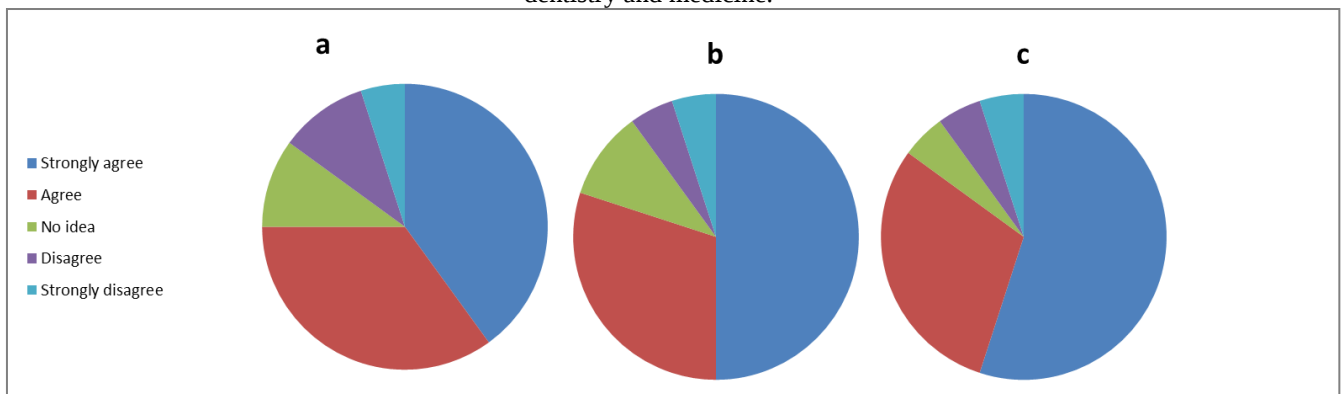


Figure (2): (a): Artificial intelligence can be used as a "decisive diagnostic tool" in diagnosing diseases. (b): Artificial intelligence can be used as a "predictive tool" to predict the course of the disease and determine its course. (c): Artificial intelligence can be used in the radiological diagnosis of dental caries.

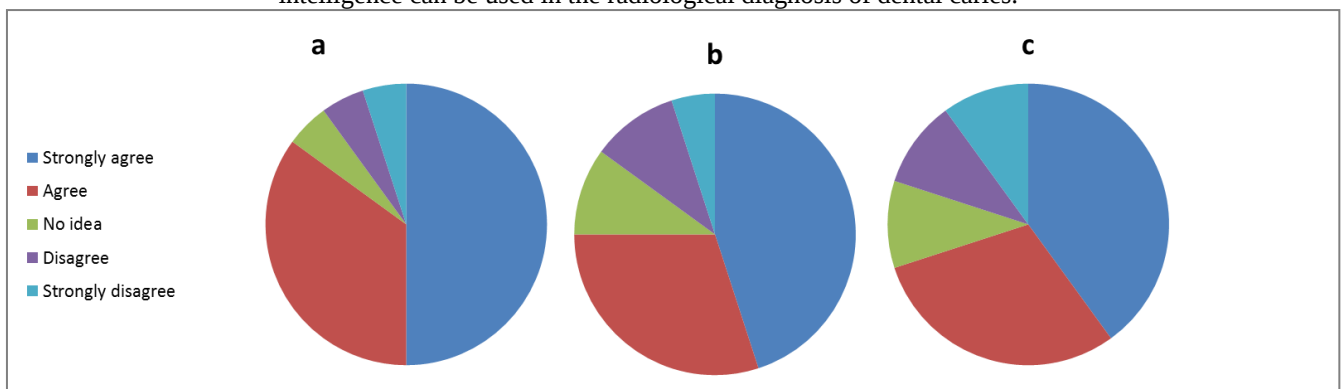


Figure (3): (a): Artificial intelligence can be used in the radiological diagnosis of gum diseases. (b): Artificial intelligence can be used in the diagnosis of soft tissue lesions in the mouth. (c): Artificial intelligence can be used in determining the position and planting of three-dimensional implants and planning them.

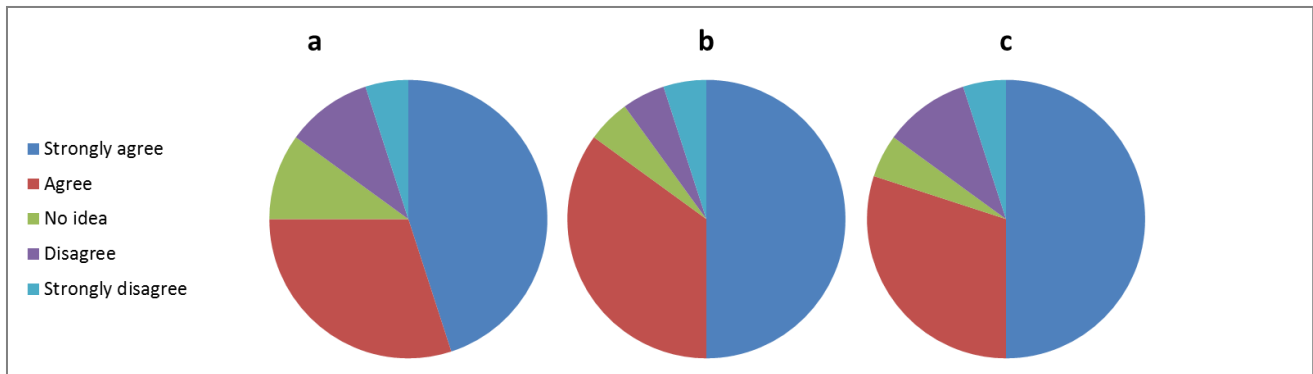


Figure (4): (a): Artificial intelligence can be used as a “treatment planning tool” in diagnosing and planning treatment in dentistry. (b): Artificial intelligence can be used as a “quality control tool” to evaluate the success of treatments. (c): Artificial intelligence can be used in radiological diagnosis of jaw diseases .

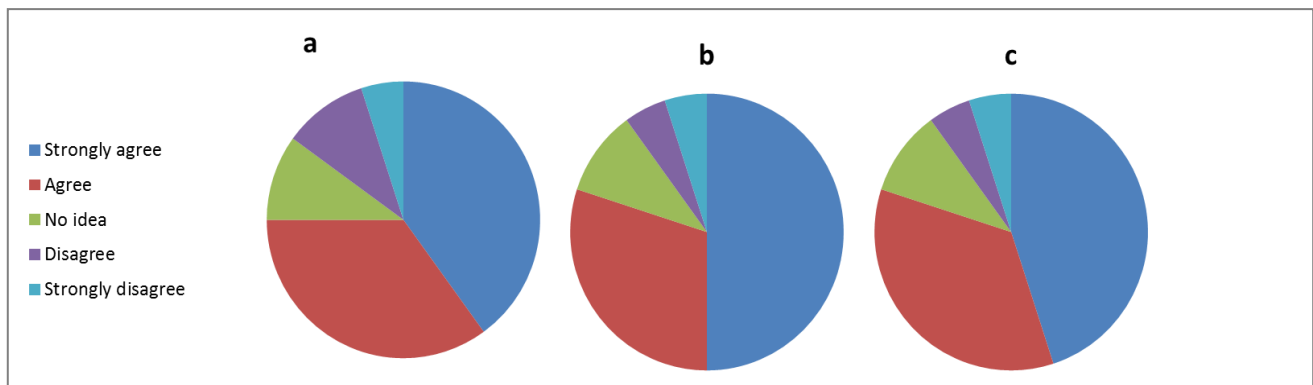


Figure (5): (a): Artificial intelligence can be used in forensic dentistry. (b): Artificial intelligence applications should be part of undergraduate dental training. (c): Artificial intelligence applications should be part of postgraduate dental training

Discussion:

AI has proven to be an effective tool in various aspects of healthcare, with the potential to improve patient care, increase healthcare system efficiency, and enhance overall health outcomes. As a result, integrating AI into medical and dental education is essential to prepare future doctors and dentists for the evolving healthcare landscape. (Lee et al., 2021). This study's results indicate that dental students at private Syrian universities, specifically Cordoba and Al-Shahba Private Universities, possess moderate awareness and initial knowledge of AI concepts and applications in the medical field. Although about half demonstrated familiarity with AI fundamentals, this proportion needs to be

strengthened through more comprehensive training and educational programs.

These findings align with studies conducted in other countries like Turkey (Yüzbaşıoğlu, 2021) , Morocco (Elhijazi and Benyahya, 2023) , and Saudi Arabia (Khanagar et al., 2021a) , which revealed varying levels of knowledge with a clear preference for unofficial sources such as social media to learn about AI. This suggests a clear lack of organized academic content explaining these concepts to students within the university environment.

In this study, the majority of students were in their fifth year of dental school (53%), followed by fourth-year (26%) and third-year students (21%). In (Yüzbaşıoğlu, 2021) , second-year dental students represented the largest group (36.9%), while fifth-year students were the least represented (8.8%). In (Murali et al., 2023), most participants (20.7%) were postgraduates, with the fewest being third-year students and interns (19.3%).

Regarding basic understanding, 49% were aware of AI, and 48% knew of its dental applications, aligning with WHO recommendations that healthcare workers should understand AI fundamentals to fully and appropriately benefit from its broad scope.(Elhijazi and Benyahya, 2023)

In this study, social media was the most common source of AI information (76%), while newspapers and magazines were the least common (5%). In most studies, participants learned about AI through social media (Yüzbaşıoğlu, 2021, Khanagar et al., 2021b), This can be explained by the fact that most people today use social media and own smartphones, and AI-related posts are common online.

When asked whether using AI in the medical field is exciting, 57% found AI use in diagnosis exciting, similar to Turkish students (Yüzbaşıoğlu, 2021) and Saudi students (Khanagar et al., 2021a) . Notably, most students considered AI an aid in diagnosis and treatment planning rather than a threat to the dental profession. This positive attitude reflects a mental readiness to embrace modern technologies in clinical practice, especially given students' desire to learn more about AI through official curricula.

A significant proportion of students supported AI's application in various diagnostic fields such as periodontology, caries detection, and implantology, indicating an initial understanding of its clinical potential. Similar to the results of the study of (Khanagar et al., 2021b)

Regarding forensic dentistry, students showed some hesitation, likely due to limited exposure to this specialty or lack of awareness of AI's capabilities in legal applications, which aligns with findings from other study (Yüzbaşıoğlu, 2021). Despite these positive indicators, there remains an urgent need to introduce systematic content that educates students about the basic principles, clinical applications, and ethical aspects of AI, along with practical training to develop the technical skills necessary for its safe and effective use.

Conclusion

This study showed that dental students in private Syrian universities have a moderate level of knowledge about AI. Students believe that AI can be used to diagnose oral diseases and caries and facilitate dental implant placement, although they have not yet used it during the study or actual treatment phases. . Social media was the main source of knowledge, highlighting the lack of structured academic sources in this field. Students expressed strong interest in including AI in curricula at both undergraduate and postgraduate levels. Despite this positive outlook, a deeper understanding of some advanced uses, such as forensic dentistry, is still lacking , it is important to provide training programs, workshops and other resources that are specifically designed to assist users in feeling more comfortable and confident when utilizing AI tools.

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