

Original Article

Knowledge of Artificial Intelligence in Dentistry among Dental Students: A Cross -Sectional Study in 2025-2026.

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Received: 30/6/2026

Accepted: 25/7/2026

Abstract:

Background: Artificial Intelligence (AI) is increasingly influencing various aspects of dentistry, including diagnosis, treatment planning, and clinical decision-making. However, the level of understanding, awareness, and attitudes toward AI among dental students in Sudan 2026 remains insufficiently explored. **Materials and Methods:** This cross-sectional Study aimed to assess the knowledge, awareness, and attitudes of semi-final and final-year dental students toward AI in dentistry at Napata College, Khartoum Bahri, Sudan, during the 2025–2026 academic years. Data were collected using online questionnaires and analyzed using SPSS software. **Results:** Of the 66 dental students who participated in the study, 47% reported only partial knowledge of AI, while 31.8% confirmed having prior knowledge. More than half of the respondents (54.5%) rated their knowledge as poor. The majority (59.1%) relied on the internet and social media as their primary source of information, compared to formal university education. Most students recognized the importance of AI and its potential applications; clinical decision support systems were the most preferred AI technology (53%). Key perceived benefits included time-saving and improved diagnostic accuracy, while major concerns involved lack of human judgment (59.1%) and technical errors. Additionally, 57.6% of participants believed that AI applications will enhance their clinical practice. **Conclusion:** Although dental students at Napata College demonstrated positive attitudes toward AI and recognize its clinical value, there is a significant gap in formal knowledge. Integrating AI-focused education and training into dental curricula is essential to prepare future dentists for the evolving digital landscape.

Keywords: Artificial Intelligence (AI), Dental Students, Knowledge.

Introduction:

Over the past decade, the massive development in AI technologies has led to radical changes in our lifestyles. These technologies have become indispensable partners in managing our daily tasks, from handling simple individual queries and assisting with email writing to analyzing complex datasets in scientific research [1]. Artificial intelligence and machine learning are defined as the ability to teach a computer to perform tasks without the intervention of a human being using a specific algorithm[2]. AI is distinguished by its capability to mimic human reasoning and thinking [3].

AI has revolutionized dentistry, just as it has in many other scientific fields. Its applications are particularly transformative in dental radiology, where AI systems enable automatic segmentation of the inferior alveolar nerve, precise tracing of cephalometric landmarks, detection of caries, and alveolar bone loss with high accuracy [4]. In operative dentistry, AI assists in cavity diagnosis and root morphology analysis, determining working length and detecting root fractures. For prosthodontics, AI enhances denture shade selection for natural-looking results, as well as automated denture design, which leads to better fit and aesthetics [4- 6].

Beyond clinical applications, AI also enables remote diagnosis, making dental care more accessible for patients in underserved areas.

Additionally, researchers and practitioners can leverage machine learning to analyse large datasets, accelerating advancements in dental science [7, 8]. In Sudan, artificial intelligence is a brand-new technology, and it is not fully established yet in the health care systems in general, including dentistry. In order to find solutions for the increasing difficulties of delivering excellent medical care in an era of large information, there is growing competition to develop AI applications [9, 10]. The application of AI in the field of health will raise the quality of care in terms of effectiveness, efficiency, patient management, and accuracy. Thus, decreasing the risk of mistakes due to the stress of healthcare professionals [11].

Therefore, understanding dental students' knowledge and awareness regarding AI technology is vital for advancing effective integration and ensuring that future dentists are well-prepared to use AI in their professional practices [1]. However, there is only one study in Sudan on this particular area among dental students; thus, this study aims to assess the knowledge and awareness of dental students at Napata College about the application of artificial intelligence and to figure out their perceptions and thoughts. This information will be the basis for the beginning of the integration of AI with dental practice in Sudan. As a result, this cross-sectional study was conducted.

Methods:

A descriptive, faculty-based, cross-sectional study was conducted at Napata College, a prominent private higher education institution in Khartoum, Sudan, established in 2005.

The College is recognized for its commitment to medical and technological sciences, providing a clinical and academic environment that integrates modern dental education within the Sudanese healthcare context. Napata College is located in the Khartoum North locality (Bahri), within the Greater Khartoum State, Sudan. The college is situated in the Kafouri area, known for its accessibility and central location within the city. The study was carried out over a six-month period from September 2025 to February 2026. Data collection specifically took place between October 1, 2025, and January 1, 2026.

The target population comprised all fourth- and fifth-year dental students enrolled in the Bachelor of Dental Surgery (BDS) program at Napata College. The total number of eligible students was estimated at 66. A census method was applied, meaning all eligible students were invited to participate. This approach was chosen to eliminate sampling error and provide a comprehensive representation of the target group.

Data were collected using a structured, pre-tested questionnaire developed following a thorough review of relevant literature. The questionnaire was designed and distributed using Google Forms, facilitating efficient data collection and

management. It covered three main areas: demographic information, including the academic year; knowledge of AI applications across various dental specialties such as diagnostics, radiology, treatment planning, and prosthodontics; and attitudes toward AI, exploring students' perceptions, concerns, and views regarding the integration of AI in dental practice and education. Responses were automatically compiled into a spreadsheet from Google Forms. The data were then cleaned, coded, and analyzed using the Statistical Package for the Social Sciences (SPSS) version 24. Ethical approval was obtained from the Institutional Review Board (IRB) of Napata College prior to the start of the study. The first page of the online survey contained a detailed informed consent statement, and completion of the questionnaire was considered implied consent. Participation was entirely voluntary, and participants were assured of their right to withdraw at any time without penalty. All data were handled in strict accordance with the principles of the Declaration of Helsinki.

Results:

A total of 66 dental students completed the questionnaire. Tables 1–9 summarize their responses regarding awareness, knowledge, perceived importance, applications, benefits, concerns, information sources, expected impact on clinical practice, and preferred artificial intelligence technologies.

Awareness of artificial intelligence was uncertain among participants. Of the 66 respondents, 31.8% reported being aware of AI, 21.2% were not aware, and 47% answered “maybe” (Table 1).

Table 1: Awareness of artificial intelligence (AI) applications in dentistry is present

Items	Frequency	Percent
Yes	21	31.8 %
No	14	21.2%
Maybe	31	47%
Total	66	100 %

More than half of the dental students (54.5%) described their level of knowledge as "basic," while 37.9% considered their knowledge to be excellent (Table 2).

Table 2: The level of knowledge regarding artificial intelligence in dentistry is adequate:

Items	Frequency	Percent
Excellent	25	37.9%
Basic	36	54.5%
None	5	7.6%
Total	66	100 %

Additionally 89.4% of the participants recognized the importance of artificial intelligence in modern dentistry (Table 3).

Table 3: The importance of artificial intelligence in modern dentistry is recognized.

Items	Frequency	Percent
Very important	17	25.8%
Important	42	63.6%
Neutral	6	9.1%
Not important	1	1.5%
Total	66	100 %

One-third of participants (33.3%) believed that artificial intelligence can be comprehensively applied in diagnosis, orthodontics, prosthodontics, and oral surgery, while surgery came in as the single specialty with the most expected role for artificial intelligence by (27.3%) (Table 4).

Table 4: Artificial intelligence can be applied across various dental specialties.

Items	Frequency	Percent
Filing	12	18.2%
Prosthesis	6	9.1%
Prosthodontics	8	12.1%
Surgery	18	27.3%
Diagnosis, ortho, prosthodontics, and oral surgery	22	33.3%
Total	66	100 %

Regarding perceived benefits, the use of artificial intelligence in dentistry provides remarkable benefits mainly in the increased accuracy in diagnosis by (66.7%) (Table 5).

Table 5: The use of artificial intelligence in dentistry provides remarkable benefits in.

Items	Frequency	Percent
Increased accuracy in Diagnosis	44	66.7%
Time saving	19	28.8%
Better patient outcomes	3	4.5 %
Total	66	100 %

The greatest concerns among students were about “lack of human judgment” (59.1%), followed by concerns about technical errors at 28.8% (Table 6).

Table 6: The use of artificial intelligence in dentistry has potential drawbacks.

Items	Frequency	Percent
Lack of human judgment	39	59.1%
Data privacy concerns	5	7.6%
Technical errors	19	28.8%
Ethical issues	3	4.5%
Total	66	100 %

Most participants (59.1%) relied on the internet and social media as their primary source of information, surpassing university lectures, which accounted for only 19.7% (Table 7).

Table 7: The main sources of information about artificial intelligence in dentistry are reliable.

Item	Frequency	Percent
University lectures	13	19.7%
Internet and social media	39	59.1%
Conferences or workshops	7	10.6%
Friends/colleagues	2	3%
None	5	7.6%
Total	66	100 %

Additionally, 57.6% of participants believed that AI applications will enhance their clinical practice (Table 8).

Table 8: The application of artificial intelligence enhances clinical practice.

Item	Frequency	Percent
Yes	38	57.6%
No	8	12.1%
I don't know	20	30.3%
Total	66	100 %

More than half of the dental students (53%) preferred using Clinical Decision Support systems, followed by surgical robots at 31.8% (Table 9).

Table 9: Certain types of artificial intelligence technologies are considered more beneficial in dentistry:

Item	Frequency	Percent
Image-based Diagnosis	1	1.5%
3D Printing	9	13.6%
Surgical Robots	21	31.8%
Clinical Decision Support	35	53%
Total	66	100 %

Discussion:

The present study assesses the knowledge, awareness, and perceptions of dental students at Napata College, Sudan, regarding the application of artificial intelligence (AI) in dentistry. The findings reveal a consistent pattern of high interest and positive attitudes toward AI, despite a noticeable deficiency in formal knowledge, highlighting a critical gap in contemporary dental education.

AI is increasingly recognized as a transformative tool in dentistry, influencing both clinical practice and education. Its rapid development necessitates the integration of modern technologies into dental curricula to ensure that future practitioners are adequately prepared for the evolving digital landscape [5, 12, 13].

A key finding of this study is that more than half of the participants (54.5%) rated their knowledge of AI as poor, while 47% expressed uncertainty regarding their awareness. This reflects limited depth of understanding and lack of confidence among students. Similar findings have been reported in previous studies, where students demonstrated general awareness but insufficient foundational knowledge of AI concepts [1, 14,15]. In contrast, studies reporting higher knowledge levels often attribute this to early exposure and structured educational programs [4, 10, 16].

The heavy reliance on informal sources, particularly the internet and social media

(59.1%), further explains this knowledge gap. While these platforms increase accessibility, they may lack scientific accuracy and

reliability, potentially leading to fragmented understanding. This observation aligns with previous research highlighting the growing dependence on non-academic sources among students [6, 11], emphasizing the need for structured, evidence-based learning approaches [13, 16].

Despite these limitations, students demonstrated strong positive attitudes toward AI. The majority acknowledged its role in enhancing diagnostic accuracy, improving treatment planning, and increasing clinical efficiency. This is consistent with findings from studies conducted in Saudi Arabia, Turkey, and Sudan [6, 14, 17]. The preference for clinical decision support systems suggests that students perceive AI as an assistive tool rather than a replacement for clinical judgment.

However, concerns regarding AI were also evident, particularly related to the lack of human judgment and the risk of technical errors. These concerns are well documented in the literature and reflect the limitations of AI in complex clinical scenarios that require critical thinking, ethical considerations, and patient interaction [13, 15, 18]. Dentistry remains a patient-centered profession that

relies heavily on human skills such as communication and empathy, which cannot be fully replicated by AI. Artificial Intelligence is considered mainly as supportive in clinical decision support rather than a substitutive technology [12, 18].

The overall findings of this study are consistent with both regional and international research, highlighting the urgent need to integrate AI into dental education through curriculum reform, faculty training, and infrastructure development. Addressing these gaps is essential to ensure that future dentists are equipped with the necessary knowledge and skills to effectively utilize AI technologies in clinical practice.

Conclusions:

The study of 66 dental students showed limited knowledge of artificial intelligence (AI), with most reporting poor or only partial understanding. The majority relied on the internet rather than university education, highlighting a gap in formal teaching. Despite this, students had positive attitudes toward AI and recognized its benefits, especially in improving diagnosis and saving time. Concerns included a lack of human judgment and technical errors, and most of the students thought that clinical decision support is the artificial intelligence technology which is considered more beneficial in dentistry.

Recommendations:

1. Integrating specialized courses in "Artificial Intelligence in Dentistry" into the academic curriculum, to reduce reliance on informal sources such as social media.
2. Investing in AI-based diagnostic tools, as most participants (66.7%) agreed on their role in increasing the accuracy of results, thus improving patient treatment outcomes.
3. Medical software developers should focus on making AI tools "augmented intelligence" rather than replacements, to reassure clinicians who fear losing "human judgment".

Acknowledgments:

The authors thank the administration of Napata College Programme of Dentistry for facilitating data collection. Gratitude is also extended to all final and semi-final year dental students at Napata College who voluntarily participated in this study.

Authors' Contributions:

All authors reviewed and approved the final manuscript.

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