



Research Article

A STUDY ON THE ETHICAL PERCEPTIONS ON THE USE OF ARTIFICIAL INTELLIGENCE IN DENTISTRY

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ABSTRACT

Artificial Intelligence (AI) is a scope of technology that mimics human behaviour and portrays high level intelligence. AI has recently been incorporated into various fields ranging from arts, industry, food and technology itself. But there are numerous ethical barriers to cross when we consider using AI in medical practices. The objective of this study is to understand the ethical perceptions of dentists on the integration of the use of AI in dental treatment. A survey-based cross-sectional study was carried out among the interns, clinicians and academicians from dental institutes to assess their current perspectives and promptness to integrate AI into their practices. The use of AI has been highly receptive among the respondents though there is a sizable fear of the indiscriminate use of AI. It is suggested that it be used responsibly under human authentication so as to enhance and optimize the use of technology in dental services.

Keywords: Medical ethics, Machine Intelligence, Dentistry, Disruptive technologies, Responsible AI.

INTRODUCTION

On observing the boom of AI in various industries, it is not surprising to find the applications of AI in dentistry. Integrating AI into healthcare has significantly enhanced diagnostic accuracy, treatment planning, and overall patient management. Using AI technologies, such as machine learning and deep learning, has increased the efficiency of large data processing, ultimately leading to quicker and precise clinical decision-making. These advancements have now made their way into dentistry and have significantly improved patient care and increased efficient workflow in hospitals (Fernando *et al.*, 2025). The applications of AI in dentistry have featured a wide range of functions especially in its aid for diagnostic assessments. AI technologies have been used to accurately analyze X-rays and scans to detect dental conditions. They assist dental professionals to create personalized treatments plans and design specific procedure protocols that would be best for a particular patient. Additionally, AI-driven automations like

robotic surgeries enhances the precision and the efficiency of a dental procedure. This increases clinical outcomes and, at the same time, contributes to cost reduction, giving easy access to dental care (Fernando *et al.*, 2025; Chen *et al.*, 2020). Though there is a growing scope for AI in dentistry, ethical unease remains a big challenge. Issues regarding the privacy and security of patient data arise since AI relies on a big input of a patient's medical history which requires strict protocols to censor sensitive information (Beauchamp & Childress, 2019). Use of AI also brings its own problems like algorithm bias as machine learning models may not be trained on certain rare case datasets and there is also the issue of accountability should there arise any errors in the treatment or when there is found to be a misdiagnosis leading to wrong clinical decision making. It is critical to understand that AI use is a supplement and not a replacement in clinical treatment. Human supervision is a must to declare human involvement in dental procedures, maintaining the integrity of patient-centered care (Gerke *et*

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al., 2020). While the role of ethics in the use of AI in healthcare has been discussed there is a significant gap when it come to the same in dentistry. As dental care involves both clinical and aesthetic considerations, exploring for what and how dental professionals incorporate the use of AI models in a procedure is crucial. Addressing this gap can help in establishing ethical guidelines specific to the dental field ensuring a moral use of AI (Kostov & Yordanova, 2025). The objective of this study is to explore the ethical perceptions of AI in dentistry, predominantly focusing on privacy, bias, accountability, and human oversight when it comes to patient care. The study will evaluate how dentists and dental interns view the ethical concerns of AI applications and recognize the factors triggering the trust and acceptance of AI-driven solution. AI has significantly transformed dentistry by improving how dentists diagnose conditions, plan treatments, and manage hospital operations more efficiently. Various studies feature AI's ability to increase accuracy in identifying dental caries, periodontal disease, and oral cancers through machine learning models which have been trained on broad datasets. Additionally, AI tools assist in creating patient-centered treatment plans and ensuring precise prosthetic outcomes. Programmed administrative protocols like scheduling appointments and recording patient history has been seen to further enhance efficiency in dental practices (Cozmescu *et al.*,2025).

The basic principles of healthcare ethics autonomy, beneficence, non-maleficence, and justice are foremost while reviewing the use of AI in dentistry. Autonomy concerns arise during patient misinterpretations regarding consent and the role of AI in their care. Beneficence and non-maleficence focus on the reliability of AI, ensuring that it is an addition and not a replacement to any dental treatment. Justice addresses potential biases that may lead to inconsistencies in the accessibility for the biased population (Vani *et al.*, 2024). Existing studies on ethical concerns while using AI in healthcare all emphasize on the potential privacy breaches, bias due to inadequate algorithm training and accountability for AI aided decisions in the clinical setting (Harishbhai *et al.*, 2024). Studies show that these systems are trained on non-represented datasets which risk making differences in treatment outcomes. Moreover, the legal responsibility at the occurrence of errors in AI aided decisions remains uncertain. Patient data security has posed another issue thus requiring strict regulations to prevent the abuse of data and security breaches (Ma *et al.*,2025).

Studies on establishing the use of AI among healthcare professionals has received mixed ideas. While some acknowledge the potential of AI to increase precision and efficiency in clinical procedures, others voice concerns over the typical reliance and the loss of clinical management. Previous research states that trust in AI corresponds with a straightforward use of machine learning models to determine treatment plans with human supervision. Addressing these factors can increase the capacity to incorporate the use of AI in dental practice

(Pringle *et al.*,2024). Despite the numerous debates on AI ethics in medicine, the literature specific to dentistry is pointedly limited. There appears to be only a few studies that explore how dental experts and patients view ethical unease while using AI, leaving a gap in recognizing the factors that influence trust and approval of AI in dentistry (Kostov & Yordanova, 2025; Cozmescu *et al.*,2025). This study seeks to fill this void by studying ethical considerations of AI that are unique dentistry to promote responsible AI implementation. By tackling privacy, bias, accountability, and human oversight, this research aims to contribute to the ethical incorporation of AI in dental practice. This study aims to understand the attitudes of different dental professionals regarding the ethical perceptions on the use of artificial intelligence in dental practices.

MATERIALS AND METHODS

For the purpose of the study, AI in medicine was defined as the use of AI to diagnose, analyze, and to plan treatments without seeking a doctor. The survey questions are divided into five sections. The first section consisted of the basic demographic information of the respondents such as sex and professional designation. The second section contained questions that geared towards understanding the attitude of different dental professionals in different stages of their career on the use of AI in dentistry. The third section aimed to understand the ethical issues surrounding the use of AI and whether the respondents regarded the significance of its use in dentistry. The questions under this section provided situations in which the use of AI could be exploited (Char *et al.*,2018). The fourth section focused on the issue of responsibility should the technology be detrimental to the patient either during diagnosis or in the middle of treatment (Daungsupawong & Wiwanitkit, 2024). The fifth and final section consisted of questions that would bring to light the impending concern of cybersecurity and privacy control of patient information (Farhud & Zokaei, 2021). The measurement tool is a Likert Scale (Likert, 1932) spread across the second and fifth sections with responses strongly agree, agree, agree to some extent, disagree to some extent, disagree and strongly disagree. The third section included the responses not significant and significant. The fourth section contained the responses based on the matter of responsibility ranging from the Doctor, Ministry of Health, Health Institution, and the AI developer.

RESULTS AND DISCUSSION

The survey collected responses from 73 dental professionals and students, providing insights into AI perceptions across different experience levels and demographics. The sample composition reflects a diverse representation of the dental community. The participant demographics show a predominantly young cohort with 46.6% under 25 years of age, followed by 39.7% in the 25-44 age group, and 13.7% in the 45-59 range. Gender distribution favoured female participants at 63.0% compared to 35.6% male respondents. Professional

experience was skewed toward newer practitioners, with 54.8% having less than 4 years of experience, while those with 5-9 years comprised 17.8%, 10-14 years represented

9.6%, and those with over 14 years of experience constituted 17.8% of the sample (Table 1).

Table 1. Demographic Characteristics of the participants.

	Characteristic	Participants, Number (%)
Age Groups (Years)	18-24	34 (47%)
	25-44	29 (40%)
	45-59	10 (14%)
Gender	Male	26 (36%)
	Female	46 (63%)
	Not willing to disclose	1 (1%)
Designation	Undergraduates	5 (7%)
	Interns	5 (7%)
	Postgraduate	13 (18%)
	Clinician	4 (5%)
	Academician	17 (23%)
Professional Experience	Both clinician and academician	18 (25%)
	< 4 years	40 (55%)
	5 - 9 years	13 (18%)
	10 - 14 years	7 (10%)
	>14 years	13 (18%)

Table 2. Attributes towards the use of AI in dentistry.

Attitudes toward AI use in Dentistry	YES	MAYBE	NO
Are you familiar with AI applications in healthcare?	32 (43.8%)	32 (43.8%)	9 (12.3%)
Are you familiar with AI-based dental software?	11 (15.1%)	33 (45.2%)	29 (39.7%)
Do you think AI could replace dentists?	8 (11.0%)	29 (39.7%)	36 (49.3%)
Do you think AI could improve quality of dental work?	32 (43.8%)	29 (39.7%)	12 (16.4%)
Do you think AI could improve efficacy of dentists?	31 (42.5%)	30 (41.1%)	12 (16.4%)
Do you think AI should be used in dental practice?	28 (38.4%)	36 (49.3%)	9 (12.3%)
Should AI be in undergraduate curricula?	32 (43.8%)	33 (45.2%)	8 (11.0%)
Should AI be in postgraduate curricula?	39 (53.4%)	27 (37.0%)	7 (9.6%)

The results reveal a moderate level of AI awareness among dental professionals. When asked about familiarity with AI applications in healthcare, 43.8% expressed positive familiarity, 43.8% showed neutral or mixed responses, and only 12.3% indicated negative familiarity. However, specific knowledge of AI-based dental software was considerably lower, with only 15.1% showing positive familiarity, 45.2% neutral responses, and 39.7% negative familiarity (Table 2). Regarding AI's role in dental practice, respondents showed cautious optimism about AI's potential benefits while expressing strong resistance to replacement scenarios. 43.8% positively believed AI could improve the quality of dental work, while 42.5% believed it could improve dentist efficacy. Conversely, 49.3% negatively viewed the possibility of AI replacing dentists, with only 11.0% supporting this notion. When asked whether AI should be used in dental practice, 38.4% responded positively, 49.3% were neutral or mixed, and 12.3% were negative. This suggests cautious acceptance rather than enthusiastic adoption. Support for AI education showed

progressive acceptance across academic levels. For undergraduate curricula, 43.8% supported inclusion, 45.2% were neutral, and 11.0% opposed. Postgraduate curricula received stronger support with 53.4% positive responses, 37.0% neutral, and only 9.6% negative, indicating recognition that advanced practitioners may be better positioned to understand AI complexities. Ethical issues emerged as major barriers to AI adoption (Rigby, 2019). The lack of regulatory policy was identified as the most significant concern by 76.7% of respondents, surpassing even the reference study's findings. Data protection and privacy issues were considered significant by 74.0%, while 68.5% were concerned about the lack of transparent and representative data for AI development. The lack of assigned responsibility for AI decisions was significant to 65.8% of participants (Table 3).

Consistent with the reference study, gender differences emerged in ethical issue perception (Obermeyer *et al.*, 2019). Male respondents showed higher concern for

regulatory policy (88.5% vs 69.6% for females) and responsibility issues (80.8% vs 58.7% for females). However, both genders showed substantial concern across all ethical domains, indicating widespread awareness of AI implementation challenges (Shaw & Donia, 2021) (Table 4). The survey revealed complex perceptions of accountability across different AI failure scenarios. For patient harm due to AI errors, 64.4% believed doctors should be accountable, while 56.2% pointed to AI developers. This dual responsibility model suggests recognition that both clinical judgment and technological reliability are crucial (Ifdil *et al.*, 2025). Algorithmic bias responsibility was more clearly attributed to AI developers (mentioned by 74.0%), while doctors were seen as accountable by 31.5%. This distinction indicates understanding that bias originates in the development phase but may require clinical oversight to detect and mitigate. Software monitoring responsibilities were distributed among multiple stakeholders: AI developers (57.5%), Ministry of Health (34.2%), health institutions (32.9%),

and doctors (30.1%). This multi-stakeholder approach reflects recognition that AI oversight requires collaborative responsibility (Wirtz *et al.*, 2019). Data protection from cybercriminals was primarily assigned to AI developers (47.9%) and Ministry of Health (35.6%), with lesser roles for doctors (9.6%) and health institutions (6.8%). Regarding data ownership, 58.9% agreed (strongly or moderately) that AI-collected data should belong to health institutions or medical workers, while 21.9% disagreed. Informed consent received overwhelming support, with 82.2% requiring it for AI data collection, analysis, and sharing, demonstrating strong commitment to patient autonomy and data ethics (Figure 1). Compared to the Serbian reference study (n=193), our findings show similar patterns with some notable differences (Kostov & Yordanova, 2025; Cozmescu *et al.*, 2025). AI acceptance levels were comparable (38.4% vs ~48% in reference study), but regulatory concerns were higher in our sample (76.7% vs ~70%) (Table 5).

Table 3. Ethical concerns in the use of AI in dentistry.

Ethical Issues	Significant	Not significant
Lack of assigned responsibility for AI decisions	48 (65.8%)	25 (34.2%)
Lack of transparent/representative data for AI development	50 (68.5%)	23 (31.5%)
Lack of regulatory policy governing AI use	56 (76.7%)	17 (23.3%)
Data protection and privacy issues not specified	54 (74.0%)	19 (26.0%)

Table 4. Gender differences in ethical perceptions.

Parameters	Male respondents	Female respondents	95% CI	p-value
AI Familiarity - Positive	13 (50.0%)	18 (39.1%)	-12.93% to 34.73%	0.369
AI Familiarity - Neutral/Mixed	10 (38.5%)	22 (47.8%)	-32.93% to 14.33%	0.445
AI Familiarity - Negative	3 (11.5%)	6 (13.0%)	-17.12% to 14.12%	0.852
AI Should Use - Positive	11 (42.3%)	16 (34.8%)	-15.96% to 30.96%	0.527
AI Should Use - Neutral/Mixed	12 (46.2%)	24 (52.2%)	-30% to 18%	0.624
AI Should Use - Negative	3 (11.5%)	6 (13.0%)	-17.12% to 14.12%	0.852
Ethics: Responsibility - Significant	21 (80.8%)	27 (58.7%)	1.32% to 42.88%	0.056
Ethics: Regulatory Policy - Significant	23 (88.5%)	32 (69.6%)	0.81% to 36.99%	0.069

Table 5. Comparative analysis of the present study with similar reference studies.

Measure	Reference Study	Our Study	Notes
Sample size	193	73	Smaller but adequate sample
AI familiarity (positive)	~27% (estimated)	43.8% (healthcare), 15.1% (dental software)	Higher general AI awareness
AI should be used (positive)	~48%	38.40%	Similar acceptance level
Regulatory policy concern	~70%	76.70%	Higher regulatory concern
Female representation	71.50%	63.00%	Similar female predominance

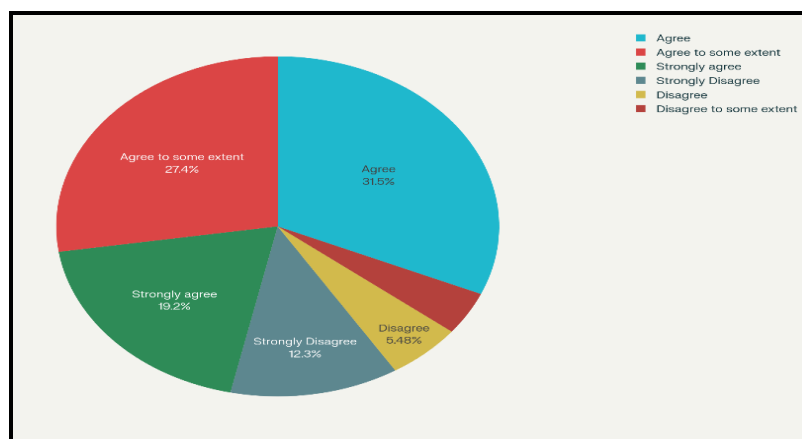


Figure 1. Data ownership survey results.

Female representation was similar (63.0% vs 71.5%), and gender differences in ethical perceptions were consistent across both studies. However, our sample showed higher general AI awareness (43.8% for healthcare applications) compared to the reference study's more specific metrics. Both studies found experience-related differences in AI attitudes, with less experienced practitioners showing greater skepticism and higher regulatory concerns (Kostov & Yordanova, 2025; Cozmescu *et al.*, 2025). The high proportion of participants with less than 4 years of experience (54.8%) in our sample may explain the elevated concern levels compared to the reference study. The findings suggest urgent need for comprehensive AI education in dental curricula, particularly at the postgraduate level where support was strongest (53.4%). The knowledge gap between general AI awareness (43.8%) and specific dental software familiarity (15.1%) indicates need for specialized training programs. The overwhelming concern about regulatory policy (76.7%) indicates that clear guidelines and standards are prerequisites for AI adoption. Regulatory frameworks should address multi-stakeholder responsibilities, accountability mechanisms, and performance monitoring requirements. The high significance placed on ethical issues across all domains suggests need for comprehensive ethical guidelines covering data protection (74.0% concern), transparency requirements (68.5% concern), and responsibility assignment (65.8% concern) (Fernando *et al.*, 2025; Tschandl *et al.*, 2020). The strong support for informed consent (82.2%) should be incorporated into all AI implementation protocols.

CONCLUSION

The integration of Artificial Intelligence (AI) in dentistry offers transformative potential for enhancing diagnostic precision, treatment planning, and operational efficiency. However, this study underscores that technical advancement must be matched by robust ethical frameworks. While there is a cautious optimism among dental professionals regarding the clinical benefits of AI

(Mohammad-Rahimi *et al.*, 2022), significant barriers remain, particularly concerning the lack of regulatory policies and data privacy.

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CONFLICT OF INTERESTS

The authors declare no conflict of interest

ETHICS APPROVAL

Not applicable

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AI TOOL DECLARATION

The authors declares that no AI and related tools are used to write the scientific content of this manuscript.

DATA AVAILABILITY

Data will be available on request

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