GRADUATION PROJECT

Degree in Dentistry

Insights into the use of Artificial Intelligence by Dentists and Dental Students – a pilot study

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RESUMEN

Introducción: La Inteligencia Artificial (IA) está cada vez más presente en odontología, donde se aplica al diagnóstico, la planificación del tratamiento y la educación. Se sabe poco sobre cómo la perciben y utilizan en la práctica. **Objetivo:** Identificar la prevalencia y los patrones de uso de la IA entre estudiantes de odontología y dentistas en ejercicio, y evaluar su nivel de conocimiento, confianza y actitudes. **Material y Métodos:** Se realizó una encuesta transversal en línea (Microsoft Forms) entre estudiantes de la Universidad Europea de Madrid y dentistas en España y Francia. La muestra incluyó 94 participantes (70 estudiantes, 24 dentistas). Se aplicaron estadísticos descriptivos, chi-cuadrado y U de Mann-Whitney. **Resultados:** La mayoría de los participantes calificó su conocimiento sobre IA como bajo o moderado (85,1%), mientras que el 79,8% había oído hablar de la IA en odontología. Casi la mitad (50,0%) afirmó utilizar actualmente la IA, principalmente con fines educativos (78,7% de los usuarios). La confianza en la IA fue moderada (mediana 3/5), sin diferencias significativas entre grupos ($p = 0,792$). Las principales preocupaciones fueron el riesgo de errores diagnósticos (66,3%) y la responsabilidad legal (43,9%). Una amplia mayoría (93,6%) apoyó la inclusión de formación en IA en la educación dental. **Conclusiones:** La conciencia sobre la IA crece en la comunidad odontológica, aunque el conocimiento y el uso clínico siguen siendo limitados. El uso predominantemente educativo es coherente con la composición estudiantil de la muestra. Se constata una clara demanda de formación estructurada en IA.

PALABRAS CLAVE

odontología, inteligencia artificial, estudiantes de odontología, dentistas, encuesta,

ABSTRACT

Introduction: Artificial Intelligence (AI) is increasingly present in healthcare, including dentistry, where it is being applied to diagnosis, treatment planning, and education. Despite growing technical capabilities, little is known about how dental professionals and students perceive and use these tools in practice. **Objective:** This study aimed to identify the prevalence and patterns of AI use among dental students and practising dentists, describe the main fields of application, and assess their level of awareness, trust, and attitudes towards AI. **Material and Methods:** A cross-sectional online survey was conducted using Microsoft Forms and distributed via social media among dental students at Universidad Europea de Madrid and practising dentists in Spain and France. The final sample included 94 participants (70 students, 24 dentists). Descriptive statistics, chi-square tests, and Mann-Whitney U tests were used to analyse the data. **Results:** Most participants rated their AI knowledge as low or moderate (85.1%), while 79.8% had heard of AI in dentistry. Half (50.0%) reported currently using AI, predominantly for educational purposes (78.7% of users). Trust in AI was moderate (median score 3/5) with no significant difference between groups ($p = 0.792$). The main concerns were risk of diagnostic errors (69.1%) and legal responsibility (45.7%). A large majority (93.6%) supported formal AI training in dental education. **Conclusions:** AI awareness is growing in the dental community but knowledge and clinical use remain limited. Educational use predominated, consistent with the student-majority composition of the sample. These findings highlight the need for structured AI training within dental education.

KEYWORDS

dentistry, artificial intelligence, dental students, dentists, survey,

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1. INTRODUCTION

1.1 Background and context

Artificial Intelligence (AI) has emerged as one of the most significant technological developments in modern healthcare. This technology can analyse large amounts of data, recognise complex patterns and assist clinicians in making decisions.

AI can already support the analysis of medical images, detecting early diseases, predicting complications and even planning treatment (1).

Recent digital transformations such as cone-beam computed tomography (CBCT), intraoral scanners and computer-aided design and manufacturing systems (CAD/CAM) have made possible the introduction of AI in dentistry. These systems rely on machine learning and deep learning models, which can analyse radiographic, photographic, or clinical data to provide more specific diagnostic or predictive information.

Recent findings suggest that AI may detect dental caries, apical lesions, bone loss, and other oral pathologies with comparable or better performance than human expertise. Beyond diagnosis, AI could also reduce human errors, optimize working time and raise quality of patient care (2).

Despite these technological advances, AI is still poorly implemented in daily dental practice. Most practitioners acknowledge the potential of AI but report feeling undertrained or uncertain about its complexity and ethical implications (3, 4).

1.2 Applications and benefits of AI in dentistry

In recent years, Artificial Intelligence has moved from theoretical research to real clinical applications in dentistry, where it is now being used across multiple specialties to assist diagnosis, treatment planning, and education. In dental radiology, deep learning algorithms can analyze panoramic and CBCT images to detect caries, periapical lesions, or impacted teeth precisely.

A systematic review of deep learning for caries detection reported high sensitivity rates for AI models across multiple radiographic modalities (5,6).

In implantology, AI is applied to analyze CBCT scans to define bone density and optimal implant sites (7). In a 2024 study, peri-implant bone mineral density estimated by an AI model was significantly related to the implant's primary stability (8). Artificial intelligence in prosthodontics and aesthetic dentistry enables digital smile design, automatic shade selection, and prediction of aesthetic outcomes after rehabilitation (9, 10).

Software such as Alisone, a European dental AI platform based on convolutional neural networks, can detect carious lesions, periodontal bone loss, apical infections and impacted teeth on radiographs, while generating structured diagnostic reports. Studies have shown that such systems can achieve diagnostic performance comparable to expert radiologists (11, 12). AI can also support patient communication by generating annotated images that visually explain findings. In orthodontics, tools such as Dental Monitoring and CephX use deep learning for automated cephalometric analysis and tooth-movement tracking (13).

Finally, AI has entered dental education, where universities have implemented training platforms capable of evaluating students' preparations, identifying technical errors, and giving personalized feedback (14). These tools promote self-learning and prepare students for the integration of digital workflows into modern dental practice.

1.3 Challenges, perception and gaps in research

AI has great potential but is underused and inconsistent in dentistry. Most dentists and dental students know about AI in South Korea, India and Turkey but very few use it in practice. A survey of more than 1,000 dentists for example found only 37% had used an AI tool previously but more than 60% acknowledged its value in clinical work (15). Their main barrier is lack of formal education. In most dental schools AI is not taught yet. One Turkish survey found over 80%

students wanted specific AI training but only 12% were confident enough to use it in real life (16).

Also, problems of ethics and law arise. Issues such as data protection, algorithm transparency, and legal responsibility when an AI-based diagnosis is wrong are topics frequently raised by dental professionals. Some experts suggest using explainable AI so dentists can understand how it makes decisions and feel more confident using it. The literature is also geographically uneven. AI-related dental studies mainly report data from high income countries (17).

One systematic review suggests that multicentric research should investigate whether cultural and educational differences influence AI perceptions and acceptances among dental students and practitioners, and highlights how AI research in dentistry remains largely concentrated in high-income countries (18).

Overall, although the technical performance of AI systems is documented, relatively little work has been done on human, educational and ethical aspects of AI integration in dentistry.

1.4 Relevance and Justification of the Study

AI has moved from being a research concept to a practical tool in healthcare. In dentistry, this shift has brought new diagnostic and planning systems that improve accuracy and efficiency. While many studies have looked at the technical performance of these systems, fewer have examined how dental professionals actually perceive, understand and trust them (15, 16).

Implementing AI in clinical and educational settings requires more than technical validation. It also calls for training, institutional support, and awareness of the ethical dimensions involved. Dentists and dental students will be key actors in this digital transition but surveys indicate that knowledge and preparedness are uneven across countries and institutions. That divergence suggests a need to explore how current and future practitioners perceive AI in terms of utility, reliability and impact on patient care.

Understanding these perceptions is important for several reasons. It allows educators to identify gaps in digital literacy and AI knowledge within dental curricula, and to design training accordingly. It also supports policymakers and professional organisations in defining standards for responsible AI use. Finally, by capturing the concerns and expectations of students and practitioners, this type of research contributes to a more human-centred approach to technological change in dentistry.

This study therefore aims to provide new insights into how AI is perceived and used within the dental community, focusing on two key groups: dental students and practising dentists. The findings will inform future educational strategies and promote responsible and effective AI integration in dental practice.

2. OBJECTIVE

The purpose of this study is to assess the prevalence, patterns, and perceptions of Artificial Intelligence (AI) use among dental students and practising dentists in their professional and academic environments.

This study specifically seeks to:

1. Identify the proportion of dentists and dental students who use AI in their clinical or educational practice.

2. Describe the main clinical and educational fields of application of AI among current users.

3. Evaluate the level of awareness, trust, and attitudes of participants towards AI in dentistry, including their perceived barriers and training needs. This study follows a PICO framework. Population: dental students at Universidad Europea de Madrid and practising dentists in Spain and France. Intervention: current use of AI tools. Comparison: dental students versus practising dentists. Outcomes: prevalence of AI use, fields of application, and self-rated awareness, trust, and attitudes towards AI.

3. MATERIAL AND METHODS

3.1 Study Design

An online questionnaire served as the basis for this cross-sectional descriptive study. In dentistry research, cross-sectional designs are commonly used to assess knowledge, attitudes, and behaviours related to emerging technologies such as AI (15, 16, 19). Similar observational survey-based approaches have been successfully employed in earlier research assessing dentists' and dental students' impressions of AI (15, 16, 19). This study adopts the same approach to gather data on AI knowledge and use within the dental community.

The study covers: (1) how many dental students and dentists actively use AI, (2) the fields they use it in, and (3) their views on its limitations, ethical concerns, and usefulness. The design is appropriate for a pilot study that aims to evaluate current trends and investigate associations between demographic factors and AI-related behaviours.

3.2 Population and Sampling

The target population comprised two main groups:

1. Dental students who study at Universidad Europea de Madrid (UEM)
2. Dentists working in Spain or France, in private clinics or public healthcare centers.

Due to its suitability for exploratory pilot research and compatibility with online data collection, a convenience sampling strategy was employed. The university's dental clinic's professional network of dentists as well as online resources commonly utilized by dental students were used to attract participants. In order to quickly and easily distribute the survey, invitations to complete it were sent out via social media sites like Instagram and WhatsApp groups that belonged to UEM dental students.

The target sample size was at least 100 participants, divided between 50 dentists and 50 dental students, to guarantee adequate representation of both groups. Similar sample sizes were sufficient to extract significant descriptive trends in perception-based research examining AI in dentistry (15,16).

Inclusion criteria

- Being at least 18 years old
- Being either a registered dentist or a dental student
- Ability to understand English or Spanish

Exclusion criteria

- Responses with more than half of the questions left unanswered
- Duplicate responses
- Participants from non-dental healthcare fields

3.3 Data Collection Tool

A structured online survey created with Microsoft Forms was used to gather data. The survey was distributed during February 2026. Data were collected and stored exclusively within the Microsoft Forms platform, in compliance with the data protection policy of Universidad Europea de Madrid. No personal identifiers were collected. This study was approved by the Comisión de Investigación of Universidad Europea de Madrid (Approval code: CI 2026-442; Department code: OD.069/2526; Date of approval: 20 February 2026). All procedures adhered to the principles of the Declaration of Helsinki. An online format was chosen for its accessibility and ability to reach participants across different locations. Online self-administered questionnaires were used in earlier AI-related dental research to assess knowledge and attitudes, demonstrating their feasibility for this type of research (15, 16).

After examining validated survey structures from AI-related dental literature, particularly those from Jeong et al. (15), Yilmaz et al. (16), and Roganović et al. (20), the questionnaire was created. Their work provided a methodological basis for developing questions about dental students' and practitioners' awareness, use, and opinions of AI.

The survey introduction page explained the study's purpose, voluntary participation, anonymity, estimated completion time (approximately five minutes), and that no personal data would be collected. Completion and submission of the survey was taken as evidence of informed consent.

3.4 Variables and Structure of the Questionnaire

The final questionnaire consisted of four sections and included both categorical and ordinal variables.

1. Demographic Variables

Collected demographic information included:

- Age (continuous variable)
- Gender (categorical)
- Professional category (student or dentist)

- Academic year (for students) or years of experience (for dentists)
- Country of initial dental training

These variables were selected to explore potential differences in AI perception and use across demographic groups, comparable to approaches used in previous AI perception studies (15,16).

2. Knowledge of Artificial Intelligence

This section assessed:

- Awareness of AI as a concept
- Self-rated level of AI knowledge (5-point Likert scale)
- Familiarity with AI dental systems such as Alisone, Dental Monitoring, CephX, or AI-driven radiographic tools

Awareness and familiarity questions were inspired by similar variables used by Jeong et al. (15) to evaluate AI readiness among dental students and dentists.

3. AI Use and Areas of Application

The central part of the questionnaire addressed the core objective of the study:

- Whether participants currently use AI (Yes/No)
- Frequency of use
- Clinical fields of application (radiology, orthodontics, implant planning, caries detection, digital smile design, education, etc.)

The list of applications was derived from published data detailing actual AI applications in dentistry (4–12). AI-assisted caries detection (5,6), radiographic interpretation using Alisone (11,12), orthodontic AI capabilities (13), implant stability predictions (8), and aesthetic dentistry applications including shade matching and digital smile design (9,10) are a few examples.

4. Attitudes, Perceptions, and Ethical Considerations

This section included variables evaluating:

- Perceived usefulness of AI
- Level of trust in AI systems (measured on a 5-point Likert scale: 1 = Strongly disagree to 5 = Strongly agree)
- Concerns regarding errors, bias, or misuse
- Expectations for future integration into dental practice
- Ethical considerations such as patient data protection and transparency of algorithms

3.5 Data Analysis

Data analysis was performed using Microsoft Excel and IBM SPSS Statistics**.** Only complete questionnaires were included in the final dataset.

Descriptive Analysis

Descriptive statistics were used to summarize:

- Frequencies and percentages for categorical variables
- Means and standard deviations for numerical variables
- Distribution of AI use between dentists and dental students
- The most common fields of AI application in dentistry

Group Comparisons

Comparisons between dental students and dentists were conducted using:

- Chi-square tests for categorical variables (e.g., use vs. non-use of AI)
- Mann-Whitney U tests for ordinal variables (e.g., Likert-scale perceptions) These statistical tests follow the same analytical strategy applied in similar surveys investigating AI perceptions (15,16). Given the pilot nature of the study, effect sizes were not calculated; statistical significance was set at $p < 0.05$. Given the pilot and exploratory nature of this study, all statistical analyses should be interpreted as preliminary and hypothesis-generating rather than confirmatory.

Data Presentation

Results are presented using:

- Bar charts
- Frequency tables
- Cross-tabulations comparing AI use by group

4. RESULTS

4.1 Sample Characteristics

The survey was distributed via social media and WhatsApp groups, reaching an estimated audience of several hundred dental students and practising dentists within the target networks. In total, 101 responses were received. Of these, 3 participants (2.9%) did not accept the informed consent and were excluded. The final analytical sample comprised 94 participants: 70 dental students (74.5%) and 24 practising dentists (25.5%). Four participants did not specify their professional category and were therefore excluded from group comparisons, resulting in a final

analytical sample of 94 participants for between-group analyses. The majority of participants were female (60.2%, n = 59), and the mean age was 27.4 years (SD = 8.3), ranging from 18 to 56. The survey was distributed in two languages: 78 responses were collected in English and 20 in Spanish.

Most participants had received their dental education in Spain (83.7%), which reflects the main target population of the study. Among students, the majority were in their 4th or 5th year. Dentists varied widely in terms of clinical experience, from recent graduates to professionals with over 20 years of practice.

Table 1. Demographic Characteristics of the Study Sample (N = 94)

Characteristic	Total (N = 94)	Students (n = 70)	Dentists (n = 24)
Female	59 (60.2%)	44 (62.9%)	13 (54.2%)
Male	35 (37.2%)	23 (32.9%)	10 (41.7%)
Mean age, years (SD)	27.4 (8.3)	≈24.5	≈38.1
Age range (years)	18–56	18–42	25–56
English survey	78 (79.6%)	61 (87.1%)	14 (58.3%)
Spanish survey	20 (20.4%)	9 (12.9%)	10 (41.7%)

4.2 Self-Rated AI Knowledge and Awareness

Most participants rated their AI knowledge as moderate (47.9%) or low (37.2%). Very few considered themselves highly knowledgeable: only 2 rated their level as “high” and 2 as “very high”, which together represent just 4.3% of the total sample. On the other end, 10.6% rated their knowledge as very low, and these were all students; none of the practising dentists gave themselves the lowest rating.

Despite this limited self-rated knowledge, awareness of AI in dentistry was fairly widespread: 75 participants (79.8%) said they had already heard about AI applications in dentistry before taking the survey. This was slightly more common among students (80.0%) than dentists (70.8%).

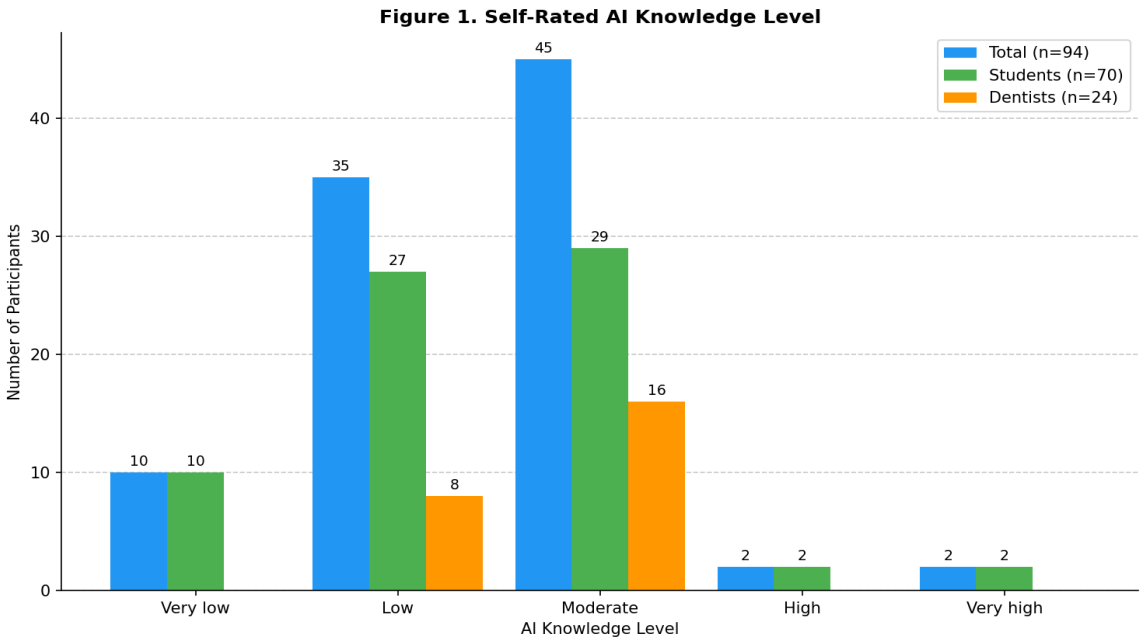


Figure 1. Self-rated AI knowledge level among total sample, students and dentists (N = 94).

Table 2. Self-Rated AI Knowledge Level by Professional Group

Knowledge Level	Total n (%)	Students n (%)	Dentists n (%)
Very low	10 (10.6%)	10 (14.3%)	0 (0.0%)
Low	35 (37.2%)	27 (38.6%)	8 (33.3%)
Moderate	45 (47.9%)	29 (41.4%)	16 (66.7%)
High	2 (2.1%)	2 (2.9%)	0 (0.0%)
Very high	2 (2.1%)	2 (2.9%)	0 (0.0%)
Heard of AI in dentistry	75 (79.8%)	56 (80.0%)	17 (70.8%)

4.3 Current Use of Artificial Intelligence

Of the 94 participants, 47 (50.0%) reported currently using some form of AI in their studies or clinical practice. The remaining 47 participants (50.0% of the 94 respondents) did not. Among students, slightly more than half reported using AI (52.9%), compared to 41.7% of dentists. A chi-square test showed no statistically significant difference between the two groups ($\chi^2 = 0.504$, $p = 0.478$),

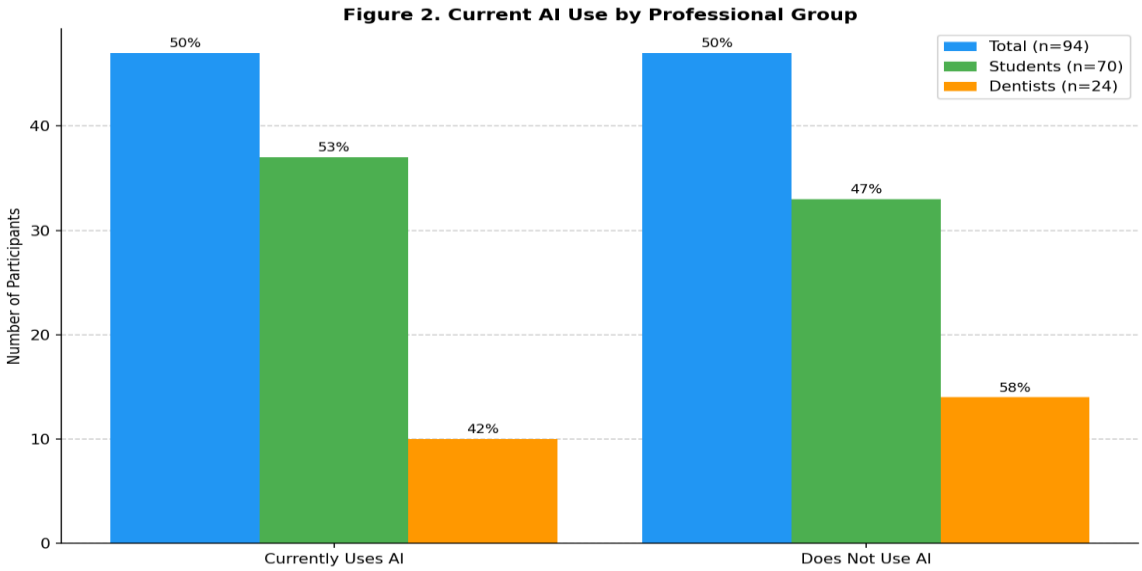


Figure 2. Current AI use by professional group (N = 94).

Among those who do use AI, the most common frequency was weekly (36.2%), followed by occasional use (27.7%) and daily use (21.3%). Only 2 people (4.3%) said they use it rarely.

Table 3. Current AI Use by Professional Group: Contingency Table

Professional Group	Uses AI: Yes n (%)	Uses AI: No n (%)	Total
Dental students	37 (52.9%)	33 (47.1%)	70
Practising dentists	10 (41.7%)	14 (58.3%)	24
Total	47 (50.0%)	47 (50.0%)	94

4.4 Areas and Purposes of AI Use

When asked in which areas they use AI, dental education and training came out on top by a large margin, with 78.7% of current users selecting it. After that, prosthodontics and aesthetic dentistry came second (17.0%), then dental radiology (12.8%), orthodontics (8.5%), and lastly implantology, mentioned by just one participant.

The same pattern appeared when looking at purposes: the most common reason for using AI was academic learning or training (76.6%), followed by workflow efficiency (29.8%), diagnostic

support (23.4%), and treatment planning (19.1%). Patient communication and monitoring were mentioned less often.

Table 4. Areas and Purposes of AI Use Among Current Users (n = 47)

Category	n	% of current users
AREAS OF USE		
Dental education / training	37	78.7%
Prosthodontics / Aesthetic dentistry (smile design)	8	17.0%
Dental radiology (caries, apical lesions)	6	12.8%
Orthodontics (cephalometric analysis, tracking)	4	8.5%
Implantology (bone density, implant planning)	1	2.1%
PURPOSES OF USE		
Academic learning or training	36	76.6%
Time optimization / workflow efficiency	14	29.8%
Diagnostic support	11	23.4%
Treatment planning	9	19.1%
Monitoring and follow-up	5	10.6%
Patient communication and education	4	8.5%

4.5 Familiarity with AI-Based Dental Tools

Participants were shown a list of specific AI dental tools and asked which ones they recognised. AI for implant planning was the most familiar (37.2%), followed by AI-assisted caries detection (28.7%), Alisone (18.1%), Dental Monitoring (17.0%), and CephX (8.5%). However, 42.6% of participants reported not recognising any of the tools listed.

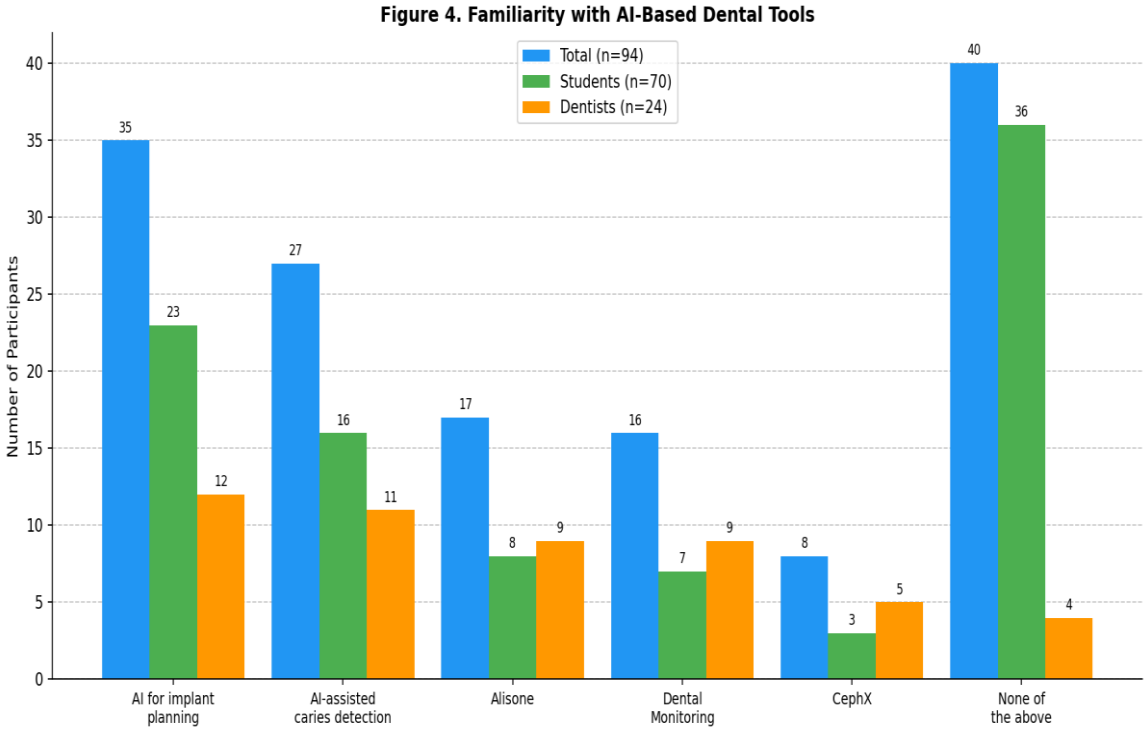


Figure 4. Familiarity with specific AI-based dental tools (N = 94).

4.6 Level of Trust in AI Systems

Trust in AI was measured on a five-point scale. The most frequent answer was “Neutral” (44.7%), followed by “Agree” (38.8%). Only 10 participants (10.6%) expressed some level of distrust. Taken together, 44.7% agreed or strongly agreed that AI can be trusted in a dental context, while the majority remained undecided. No significant difference was found between students and dentists ($U = 868.5$, $p = 0.792$), with both groups having a median score of 3 (Neutral).

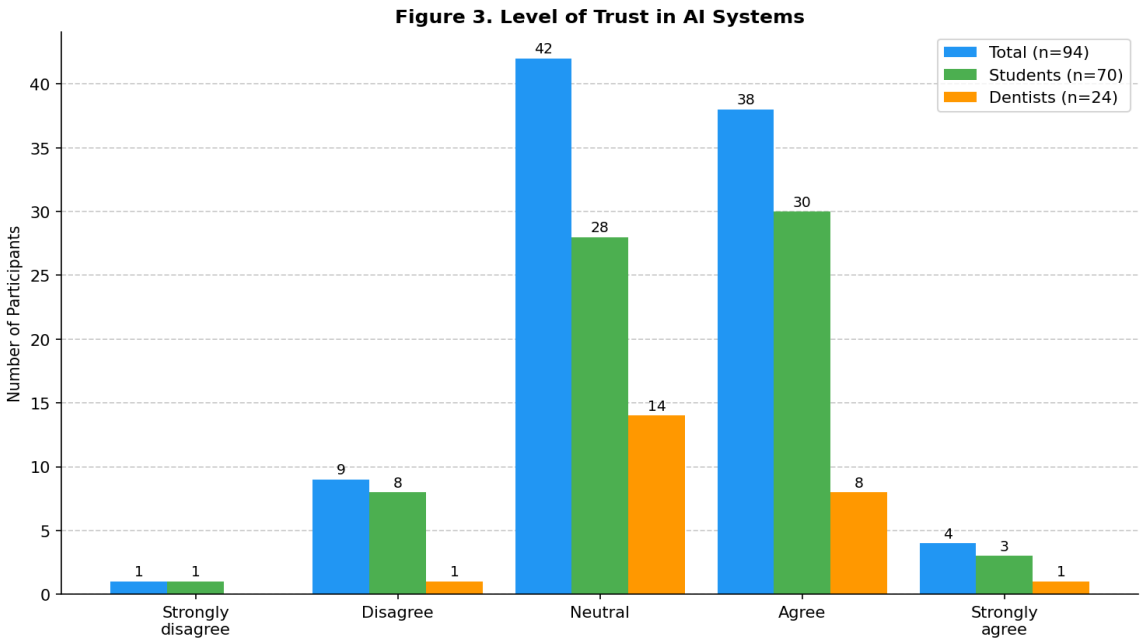


Figure 3. Level of trust in AI systems (measured on a 5-point Likert scale: 1 = Strongly disagree to 5 = Strongly agree) by professional group (N = 94).

4.7 Main Concerns About AI in Dentistry

The concern mentioned most often was the risk of diagnostic errors, raised by 65 participants (69.1%). This was followed by legal responsibility (45.7%), data protection and patient privacy (39.4%), and the possibility of AI replacing human clinicians (31.9%). Lack of transparency in how AI algorithms make decisions was mentioned by 9 people (9.6%). A small minority, 7 participants (7.4%), said they had no concerns at all.

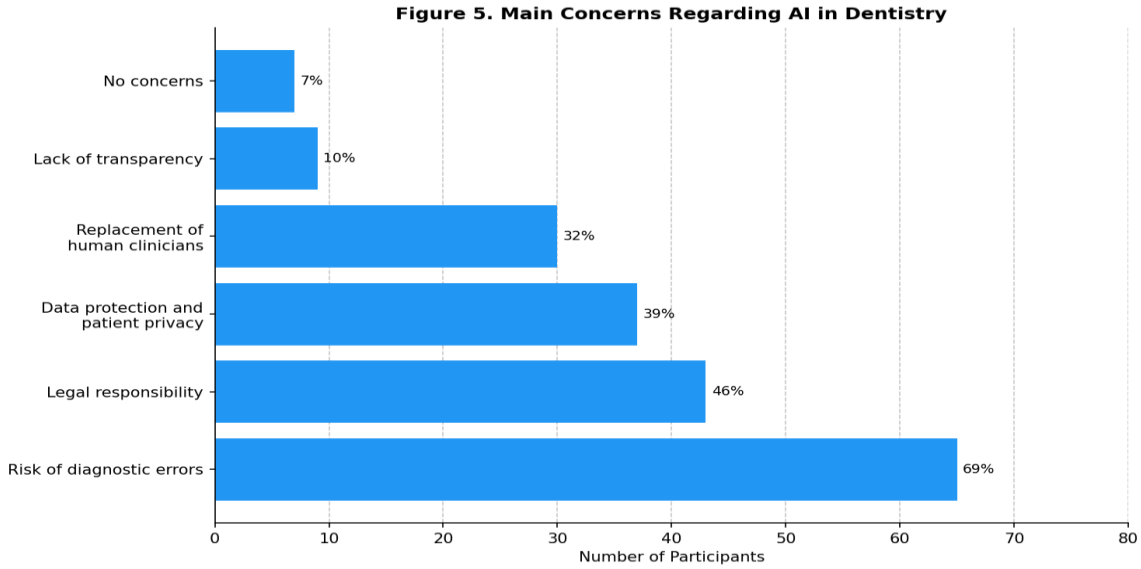


Figure 5. Main concerns about AI in dentistry (% of total sample, N = 94).

4.8 Attitudes Towards Training and the Future of AI

Participants showed a positive orientation towards AI training and future use. 93.6% said they thought formal AI training should be included in dental education, including all 24 practising dentists who participated. At the same time, 95.7% believed AI will have an important role in the future of dentistry, and the same proportion (95.7%) said they would be interested in using AI tools themselves in the future.

Table 5. Attitudes Towards AI Training and Future Use (N = 94)

Question	Total Yes n (%)	Students n (%)	Dentists n (%)
Formal AI training should be provided	88 (93.6%)	64 (91.4%)	24 (100.0%)
AI important in future of dentistry	90 (95.7%)	67 (95.7%)	23 (95.8%)
Interested in future AI use	90 (95.7%)	66 (94.3%)	24 (100.0%)

5. DISCUSSION

This pilot study set out to explore how dental students and practising dentists perceive, know about, and use Artificial Intelligence in their professional or academic contexts. The results are discussed below in relation to each objective, and compared with existing literature on the subject (1, 2, 15, 16, 17).

5.1 AI Knowledge and Awareness

The overall level of AI knowledge reported by participants was low to moderate. Nearly half of the sample rated their knowledge as low (37.2%) and only 4.3% considered it high or very high. This is consistent with what has been found in other countries, and aligns with the findings of a systematic review by Dashti et al. (19) which reported that, across 13 cross-sectional studies, basic AI knowledge among dental students averaged 58.6%. Jeong et al. (15) also reported similar patterns in South Korea, where awareness of AI was high but actual knowledge and confidence in using it remained limited among both dental students and practising dentists. Yilmaz et al. (16) found the same in Turkey, noting that despite positive attitudes towards AI,

most students lacked the practical knowledge to use it confidently. These findings together suggest that the gap between awareness and actual competence is a common issue across different educational systems and countries.

An interesting observation in our sample is that no practising dentist rated their knowledge as "very low", while 14.3% of students did. This might be explained by the fact that dentists in active practice are more regularly exposed to digital tools and technology-related discussions within their professional environment (2). Students, on the other hand, may be more aware of the extent of what they do not yet know, particularly as AI in dentistry is still not formally taught in most dental schools (14).

In terms of general awareness, 79.8% of participants had already heard of AI applications in dentistry before completing the survey. This is encouraging and reflects the growing presence of AI as a topic of discussion in the dental community, even if formal training programmes are still largely absent (14, 17). Xie et al. (17) confirmed that AI research in dentistry has expanded rapidly, which likely contributes to greater exposure through academic literature, conferences, and social media.

5.2 Current Use of AI

Half of the participants (50.0%) reported currently using some form of AI in their studies or clinical practice. This is higher than the 37% reported by Jeong et al. (15) in their South Korean survey, and higher than figures reported in several other perception studies published before 2023 (1, 2). This increase could reflect a genuine acceleration in AI adoption within the dental community over the past few years, driven by the increasing availability and accessibility of AI-powered tools (1). A recent multinational survey by Kavadella et al. (21) similarly found that while dental students across multiple countries were generally familiar with AI concepts, their knowledge of specific dental applications remained limited.

Dental students used AI slightly more than practising dentists (52.9% vs 41.7%), although the difference was not statistically significant ($\chi^2 = 0.504$, $p = 0.478$). This finding should be interpreted cautiously, as the dentist subgroup was relatively small ($n = 24$), which limits the statistical power of the comparison. A similar pattern of higher AI use among students was described by Yilmaz et al. (16), who suggested that younger professionals may be more naturally inclined to adopt digital tools as part of their learning habits.

Among AI users, weekly use was the most frequent pattern (36.2%), and daily use was reported by 21.3%. Ghaffari et al. (1) noted that AI is progressively transitioning from an experimental technology to a practical one in healthcare.

5.3 Areas and Purposes of AI Use

The dominant area of AI use was dental education and training (78.7% of current users). This is consistent with the growing integration of AI-based learning platforms in dental schools, as documented by Claman and Sezgin (14), who described tools capable of evaluating student preparations, detecting technical errors, and providing individualised feedback. The predominance of educational use in our sample may also simply reflect the composition of the sample, which was predominantly made up of dental students.

Beyond education, clinical applications were less frequent but consistent with documented AI capabilities. Prosthodontics and aesthetic dentistry came second (17.0%), consistent with the growing evidence on AI in shade matching, restoration design, and prosthetic treatment planning (9, 10). Dental radiology was reported by 12.8% of users, which is coherent with the extensive evidence showing that deep learning algorithms can detect caries, periapical lesions, and bone loss with high diagnostic accuracy across multiple radiographic modalities, as demonstrated by systematic reviews of deep learning for caries detection (5, 6). Convolutional neural network-based tools such as Alisone have demonstrated strong radiographic diagnostic performance, consistent with the broader evidence on deep learning for dental image analysis (11, 12). Orthodontics was cited by 8.5% of users, consistent with systematic evidence on AI applications for automated cephalometric analysis, treatment planning, and remote monitoring in orthodontics (13). Only one participant mentioned implantology, despite the documented potential of AI for bone density analysis and implant stability prediction (8, 7).

The purposes for which AI was used also followed a primarily educational pattern: academic learning dominated (76.6%), followed by workflow efficiency (29.8%), diagnostic support (23.4%), and treatment planning (19.1%). This is consistent with findings across the literature (2, 3): despite the technical readiness of AI systems, a significant gap remains between what AI can do and what practitioners actually use it for in daily practice. Thurzo et al. (22) argued that this gap highlights the urgent need for dental curricula to be updated to include practical AI training modules.

5.4 Familiarity with Specific AI Tools

When asked about specific tools, AI for implant planning was the most recognised (37.2%), followed by AI-assisted caries detection (28.7%), Alisone (18.1%), Dental Monitoring (17.0%), and CephX (8.5%). The relatively lower recognition of Alisone is somewhat surprising, given the published evidence on convolutional neural network-based systems for dental image diagnostics and their demonstrated clinical-level performance (11, 12). The lower recognition of CephX may be related to its specific use in orthodontics (13).

What stands out more is that 40.8% of participants said they were not familiar with any of the tools listed. This confirms the findings of Yilmaz et al. (16), who observed that positive attitudes towards AI often coexist with a near-total lack of practical exposure to actual AI software. A similar pattern was documented by Aldowah et al. (23), who found that undergraduate dental students showed enthusiasm for AI but lacked specific knowledge about available dental software. As Claman and Sezgin (14) argued, hands-on training with real tools is essential to bridge the gap between theoretical awareness and clinical competence. The lack of familiarity with commercially available dental AI tools is therefore not just a knowledge problem, it is a structural gap in dental education (14, 17).

5.5 Trust and Ethical Concerns

The level of trust in AI among participants was moderate. The most common response on the Likert scale was “Neutral” (44.7%), and no significant difference was found between students and dentists ($U = 868.5$, $p = 0.792$). This finding suggests that trust in AI is not something that increases with clinical experience, which in itself is noteworthy. Both students and practising dentists seem equally uncertain about how much AI can be relied upon in a clinical context. Jeong et al. (15) reported a similar pattern in their sample, where trust in AI was generally cautious regardless of professional background.

The most frequently raised concern was the risk of diagnostic errors (69.1%), which directly relates to patient safety. This is a legitimate concern given that even well-validated AI systems can produce false positives or false negatives, and the consequences in a clinical setting can be significant (3, 5, 6). Mörch et al. (3) emphasised that responsible AI deployment in dentistry requires not only technical accuracy but also transparency about how and when errors occur,

so that clinicians can make informed decisions about when to trust or override an AI recommendation.

Legal responsibility was the second most cited concern (45.7%), followed by data protection and patient privacy (39.4%). These concerns are consistent with what has been reported across the literature (3, 15, 16, 20). Roganović et al. (20) found that dentists identified legal liability as a primary concern, noting that in cases of AI-caused harm, the dentist would bear primary responsibility. The need for a clear ethical and legal framework was also highlighted by Rokhshad et al. (24), who proposed a structured checklist for the responsible deployment of AI in clinical dental settings. As AI becomes more integrated into clinical workflows, questions about liability when an AI-assisted diagnosis leads to harm remain largely unresolved at the regulatory level. Similarly, the use of patient data to train or improve AI models raises important ethical and legal questions regarding consent and confidentiality (3).

The fear of being replaced by AI was mentioned by 31.9% of participants. While this concern is understandable, most of the available literature agrees that AI should be viewed as a decision-support tool rather than a substitute for clinical judgement (1, 2, 3). Khanagar et al. (2) argued that AI is designed to complement the dentist's role by reducing errors and improving efficiency, not to replace human expertise. Communicating this message more clearly during training could help alleviate this concern.

5.6 Attitudes Towards Training and the Future

Despite relatively low AI knowledge and moderate trust, participants showed very positive attitudes when it came to training and the future of AI in dentistry. Over 93% of the sample agreed that formal AI training should be part of dental education, including every single practising dentist who participated. This is one of the most striking findings of the study, and it echoes the 80% of Turkish students who expressed the same need in the study by Yilmaz et al. (16). It also aligns with Halat et al. (25), who found that dental students in Qatar, despite moderate AI readiness scores, expressed a strong desire for dedicated AI education modules. Schwendicke et al. (4) similarly argued that building the digital literacy of the dental workforce requires not only technical training but also education in the ethical and legal dimensions of AI use. It also strongly supports the position of Claman and Sezgin (14), who argued that dental schools must proactively incorporate AI into their curricula to prepare future professionals for the realities of modern clinical practice.

Over 95% of participants believed that AI will play an important role in the future of dentistry, and the same proportion (95.7%) expressed personal interest in using AI tools themselves. These findings are coherent with the broader consensus in the literature that AI is not a passing trend but a fundamental shift in how healthcare, and dentistry in particular, will be practised (1, 2, 3). The review by Ghaffari et al. (1) described AI as already transforming diagnostic and treatment workflows, and Xie et al. (17) showed that AI research in dentistry has grown rapidly across all specialties.

The contrast between the limited knowledge levels and the high enthusiasm for training and future use is perhaps the most important takeaway from this study. Participants are not resistant to AI, they simply have not had the structured opportunity to learn about it (14, 16). This gap between motivation and access to training represents a real opportunity for dental schools, professional bodies, and policymakers to invest in AI literacy programmes for the dental workforce.

5.7 Limitations of the Study

Several limitations of this study must be acknowledged. First, convenience sampling was used to recruit participants, mainly through social media channels and WhatsApp groups within the university network. This introduces a selection bias, as individuals who chose to respond to a survey about AI may already have been more interested or informed about the topic than the average dental student or professional. This is a recognised limitation in survey-based AI perception research more broadly (15, 16).

Second, the dentist subgroup was small (n = 24), which limited the statistical power of group comparisons. The lack of significant differences between students and dentists on most variables may partly be a consequence of this imbalance rather than a true reflection of the population. A larger and more balanced sample would allow for more robust and generalisable conclusions, particularly given the documented geographic concentration of AI research in high-income countries (17). Furthermore, the geographic concentration of this study in Spain and France means findings may not reflect the situation in other regions. Umer et al. (18) demonstrated that AI adoption and research in dentistry remain significantly skewed toward high-income countries, suggesting that perceptions in lower-resource settings may differ substantially.

Third, all data was self-reported, which means that AI knowledge and use may have been over- or underestimated by respondents. There was no objective test of AI competence included in the questionnaire. This is a common limitation in this type of study (15, 16), and future research could benefit from combining self-report measures with practical assessments. Finally, the questionnaire was adapted from validated instruments (15, 16) but was not independently validated in this specific population, which may affect the reliability of some measures.

6. CONCLUSIONS

This pilot study set out to explore how dental students and practising dentists perceive and use Artificial Intelligence in their academic and clinical environments. Based on the data collected from 98 participants, the following conclusions can be drawn.

1. AI knowledge remains limited across both groups. The majority of participants rated their level as low or moderate, and very few felt genuinely confident about their understanding of AI in dentistry. This is not specific to our sample; it reflects a broader pattern seen in other countries as well, and points to a clear gap in formal AI education within dental training programmes.

2. Despite this limited knowledge, nearly half of the participants already use AI in some form. This was higher than expected for a pilot study, and suggests that adoption is accelerating even in the absence of structured training. Use was predominantly educational rather than clinical. Given that 74.5% of respondents were dental students, this is consistent with using AI mainly as a learning tool rather than for direct patient care. However, even among practising dentists, a significant proportion reported using AI tools, mainly for workflow efficiency and diagnostic support.

3. Trust in AI was moderate and cautious across the board, with no significant difference between students and dentists. The most common concerns raised were the risk of diagnostic errors, legal responsibility, and data privacy, all of which are legitimate issues that the dental

community and regulatory bodies will need to address as AI becomes more integrated into clinical practice.

4. The vast majority of participants (nearly 90%) expressed a clear need for formal AI training as part of dental education. Every single practising dentist in the sample agreed with this. At the same time, over 91% believed AI will play a significant role in the future of dentistry and said they would be interested in using it themselves. This combination of high motivation and limited access to training is the most actionable finding of this study.

5. Despite limited AI knowledge, participants showed strongly positive attitudes towards the future of AI and training. Over 91% considered AI important for the future of dentistry and expressed personal interest in using AI tools themselves. Overall, these results suggest that the dental community is aware of AI and open to its use, but is not yet equipped to integrate it confidently or critically into practice. The primary gap is not one of attitude, but of education. Dental schools and professional organisations should respond by incorporating AI literacy into curricula and continuing professional development programmes.

A larger, more balanced, and geographically diverse sample would be needed to draw firmer conclusions. This work provides a starting point for future research into the human dimensions of AI adoption in dentistry.

7. SUSTAINABILITY

Artificial intelligence in dentistry is one of the drivers for sustainable development in healthcare. SDG (Sustainable Development Goals) refers to a set of 17 global goals established by the United Nations to promote social, economic, and environmental sustainability. Its incorporation in diagnostic and clinical processes optimizes resources, reduces human error, and promotes responsible material use. AI supports SDG 3 - Good Health and well-being by improving diagnostic accuracy and treatment planning.

From a didactic standpoint, including AI-based tools in dental curricula increases students' digital literacy and prepares future professionals for a technology-driven healthcare system. This is in line with SDG 4 - Quality Education for continuous learning and competence acquisition in modern dentistry.

Artificial Intelligence also supports SDG 9 - Industry, innovation, and infrastructure by promoting collaboration between universities, dental companies, and technology developers for research and innovation in oral health. Such platforms as Alisone show that intelligent systems may enhance diagnostic workflows while maintaining ethical and clinical standards.

Thirdly, AI indirectly contributes to SDG 12 - Responsible Consumption and Production by reducing repetitive procedures and unnecessary radiographs for an environmentally sustainable oral healthcare model.

Ultimately, this project illustrates how Artificial Intelligence could help make dental practice more effective, equitable and sustainable - improving patient outcomes while also ensuring long-term resilience of health systems.

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Annex 1 — Survey Questionnaire (English version)

Title: Insights into the Use of Artificial Intelligence by Dentists and Dental Students
Platform: Microsoft Forms. Language: English. Data collection period: February 2026.

You are invited to participate in a research study conducted as part of a Final Degree Project (TFG) at Universidad Europea de Madrid. Participation is voluntary and anonymous. No personal or identifiable data will be collected. The questionnaire takes approximately 5 minutes to complete.

Section 1 — Informed Consent

This survey is part of the Graduation Project in Dentistry at Universidad Europea de Madrid titled Insights into the Use of Artificial Intelligence by Dentists and Dental Students, The purpose of this work is to analyse the use and perception of artificial intelligence among dentists and dental students. Participation is voluntary. You may withdraw from the study at any time without justification or prejudice. The information collected will be kept confidential and will not be used for any purpose outside this research. All data are completely anonymous. No personal identifying information will be requested. Data will be processed in accordance with Organic Law 3/2018 of 5 December on the Protection of Personal Data. To exercise your rights of access, rectification, cancellation or opposition, contact the academic supervisor via the university's official channels.

1. Do you give your consent to participate in this survey as a volunteer, and agree that the results may be used in the Final Degree Project?
(Single choice, required)

□ Yes

□ No

2. I confirm that I am at least 18 years old and that I agree to participate in this study.

(Single choice, required)

□ Yes

□ No

Section 2 — Demographic Information

3. Age

(Open text field, required)

4. Gender

(Single choice, required)

□ Male

□ Female

□ Non-binary

□ Prefer not to say

5. Professional status

(Single choice, required)

□ Dental student

□ Practising dentist

6. Current year of dental studies

(Single choice, required — for students only)

□ 1st year

□ 2nd year

□ 3rd year

□ 4th year

□ 5th year

7. Years of clinical experience

(Open text field, required — for dentists only)

8. Country where you received your dental education

(Single choice, required)

- □ Spain
- □ France
- □ Other

9. If the country is "other", please specify

(Open text field)

Section 3 — Knowledge of Artificial Intelligence

10. How would you rate your level of knowledge about AI in dentistry?

(5-point Likert scale, required)

□ Very low □ Low □ Moderate □ High □ Very high

11. Have you heard of AI applications in dentistry before this survey?

(Single choice, required)

- □ Yes
- □ No

12. Which of the following AI-based dental tools are you familiar with?

(Multiple choice, required)

- □ Alisone
- □ Dental Monitoring
- □ CephX
- □ AI-assisted caries detection software
- □ AI for implant planning
- □ None of the above

Section 4 — Use of Artificial Intelligence

13. Do you currently use any form of Artificial Intelligence in your dental practice or studies?

(Single choice, required)

- □ Yes

□ No

14. How often do you use AI-based tools?

(Single choice, required)

□ Daily

□ Weekly

□ Occasionally

□ Rarely

15. In which areas do you use AI?

(Multiple choice, required)

□ Dental radiology (e.g. caries detection, apical lesions)

□ Orthodontics (tooth movement tracking, cephalometric analysis)

□ Implantology (bone density analysis, implant planning)

□ Prosthodontics / Aesthetic dentistry (smile design, shade selection)

□ Dental education / training

16. For which purposes do you mainly use Artificial Intelligence in dentistry?

(Multiple choice, required)

□ Diagnostic support

□ Treatment planning

□ Monitoring and follow-up

□ Time optimization / workflow efficiency

□ Patient communication and education

□ Academic learning or training

□ I do not use AI

Section 5 — Attitudes, Perceptions and Ethics

17. I trust AI-based systems to assist clinical decision-making.

(5-point Likert scale, required)

□ Strongly disagree □ Disagree □ Neutral □ Agree □ Strongly agree

18. What are your main concerns regarding AI in dentistry?

(Multiple choice, required)

□ Lack of transparency

□ Risk of diagnostic errors

□ Data protection and patient privacy

□ Legal responsibility

□ Replacement of human clinicians

□ No concerns

19. Do you think dentists and dental students should receive formal training in AI?
(Single choice, required)

□ Yes

□ No

20. Do you believe AI will play an important role in the future of dentistry?
(Single choice, required)

□ Yes

□ No

21. Would you be interested in using AI-based tools in the future?
(Single choice, required)

□ Yes

□ No

Annex 2 — Cuestionario (versión en español)

Título: Perspectivas sobre el uso de la Inteligencia Artificial de odontólogos y estudiantes
Plataforma: Microsoft Forms. Idioma: español. Período de recogida de datos: febrero de 2026.

Está invitado/a a participar en un estudio de investigación realizado como parte de un Trabajo de Fin de Grado (TFG) en la Universidad Europea de Madrid. La participación es voluntaria y anónima. No se recopilarán datos personales ni identificables. El cuestionario tarda aproximadamente 5 minutos en completarse.

Sección 1 — Consentimiento informado

El presente cuestionario forma parte del Trabajo de Fin de Grado en Odontología de la Universidad Europea de Madrid titulado Perspectivas sobre el uso de la Inteligencia Artificial por parte de odontólogos y estudiantes de odontología, El propósito del presente trabajo es analizar el uso y la percepción de la inteligencia artificial entre odontólogos y estudiantes de odontología. Su participación es voluntaria y puede solicitar ser excluido/a en cualquier momento sin justificación previa ni perjuicio para usted. La información recogida será confidencial y no se usará para ningún otro propósito fuera de esta investigación. Los datos recogidos serán completamente anónimos. Los datos se tratarán de acuerdo con la Ley Orgánica 3/2018, de 5 de diciembre, de Protección de Datos Personales y garantía de los derechos digitales. Para ejercer sus derechos de acceso, rectificación, cancelación u oposición, diríjase al tutor a través de los canales oficiales de la universidad.

1. ¿Da su consentimiento de participación en la encuesta como voluntario/a para que los resultados se utilicen en el TFG?
(Opción única, obligatoria)

- □ Sí
- □ No

2. Confirmo que tengo al menos 18 años y que acepto participar en este estudio.
(Opción única, obligatoria)

- □ Sí, acepto participar
- □ No

Sección 2 — Información demográfica

3. Edad
(Campo de texto, obligatorio)

4. Género
(Opción única, obligatoria)

- □ Hombre
- □ Mujer
- □ No binario/a
- □ Prefiero no decirlo

5. Situación profesional

(Opción única, obligatoria)

- □ Estudiante de odontología
- □ Odontólogo/a en ejercicio

6. Año actual de estudios de odontología

(Opción única, obligatoria — solo para estudiantes)

- □ 1.º año
- □ 2.º año
- □ 3.º año
- □ 4.º año
- □ 5.º año

7. Años de experiencia clínica

(Campo de texto, obligatorio — solo para odontólogos)

8. País donde realizó sus estudios de odontología

(Opción única, obligatoria)

- □ España
- □ Francia
- □ Otro

9. Si el país es "otro", indique cuál.

(Campo de texto)

Sección 3 — Conocimiento sobre Inteligencia Artificial

10. ¿Cómo valoraría su nivel de conocimiento sobre la Inteligencia Artificial aplicada a la odontología?

(Escala Likert de 5 puntos, obligatoria)

□ Muy bajo □ Bajo □ Moderado □ Alto □ Muy alto

11. ¿Había escuchado anteriormente sobre aplicaciones de Inteligencia Artificial en odontología?

(Opción única, obligatoria)

□ Sí

□ No

12. ¿Con cuáles de las siguientes herramientas de IA en odontología está familiarizado/a?
(Opción múltiple, obligatoria)

□ Alisone

□ Dental Monitoring

□ CephX

□ Software de detección de caries asistido por IA

□ IA para planificación de implantes

□ Ninguna de las anteriores

Sección 4 — Uso de la Inteligencia Artificial

13. ¿Utiliza actualmente alguna forma de Inteligencia Artificial en su práctica clínica o estudios?
(Opción única, obligatoria)

□ Sí

□ No

14. ¿Con qué frecuencia utiliza herramientas basadas en IA?
(Opción única, obligatoria)

□ A diario

□ Semanalmente

□ Ocasionalmente

□ Raramente

15. ¿En qué áreas utiliza la Inteligencia Artificial?
(Opción múltiple, obligatoria)

□ Radiología dental (detección de caries, lesiones apicales)

□ Ortodoncia (seguimiento del movimiento dental, análisis cefalométrico)

□ Implantología (análisis de densidad ósea, planificación de implantes)

□ Prótesis / Estética dental (diseño de sonrisa, selección de color)

□ Educación o formación

16. ¿Para qué fines principales utiliza la Inteligencia Artificial?

(Opción múltiple, obligatoria)

- □ Apoyo diagnóstico
- □ Planificación del tratamiento
- □ Seguimiento y control
- □ Optimización del tiempo o del flujo de trabajo
- □ Comunicación con el paciente
- □ Formación académica
- □ No utilizo IA

Sección 5 — Actitudes, percepciones y ética

17. Confío en los sistemas basados en IA para ayudar en la toma de decisiones clínicas.
(Escala Likert de 5 puntos, obligatoria)

□ Totalmente en desacuerdo □ En desacuerdo □ Neutral □ De acuerdo □ Totalmente de acuerdo

18. ¿Cuáles son sus principales preocupaciones respecto a la IA en odontología?
(Opción múltiple, obligatoria)

- □ Falta de transparencia
- □ Riesgo de errores diagnósticos
- □ Protección de datos y privacidad del paciente
- □ Responsabilidad legal
- □ Sustitución del profesional
- □ No tengo preocupaciones

19. ¿Considera que los odontólogos y estudiantes deberían recibir formación específica en Inteligencia Artificial?
(Opción única, obligatoria)

- □ Sí
- □ No

20. ¿Cree que la IA desempeñará un papel importante en el futuro de la odontología?
(Opción única, obligatoria)

- □ Sí
- □ No

21. ¿Estaría interesado/a en utilizar herramientas basadas en IA en el futuro?

(Opción única, obligatoria)

□ Sí

□ No

Annex 3 — Ethics Approval

The study was reviewed and approved by the Comisión de Investigación (Research Ethics Committee) of Universidad Europea de Madrid.

Title of project: Insights into the Use of Artificial Intelligence by Dentists and Dental Students – a pilot study
Type of project: TFG (Final Degree Project)
Principal investigator: [anonymised per TFG submission requirements]
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