GRADUATION PROJECT

Degree in Dentistry

SMARTPHONES IN CLINICAL DENTISTRY, A SURVEY AMONG DENTISTS

Madrid, academic year 2025/2026

Identification number: 131

RESUMEN

Introducción: Los smartphones se han incorporado progresivamente a la odontología contemporánea como herramientas útiles para la fotografía clínica, la comunicación con laboratorios, la educación del paciente, la teleodontología y, más recientemente, el apoyo diagnóstico mediante inteligencia artificial en distintos contextos asistenciales clínicos actuales. **Objetivos:** Analizar, mediante una encuesta transversal, el uso actual de los smartphones entre odontólogos en ejercicio, identificando las aplicaciones más frecuentes, los beneficios percibidos, las barreras de implementación y el grado de interés en futuras herramientas móviles. **Metodología:** Se realizó un estudio descriptivo transversal con un cuestionario en línea distribuido a profesionales de la odontología en ejercicio. Se obtuvieron 44 respuestas completas y los datos se analizaron mediante estadística descriptiva con Microsoft Excel. **Resultados:** El 77% de los participantes declaró utilizar smartphones en la práctica clínica, sobre todo para fotografía clínica, documentación y comunicación con laboratorios. El uso de fotogrametría, inteligencia artificial y teleodontología fue claramente menor. La preocupación más repetida fue la privacidad de los datos, y la mayoría manifestó interés en adoptar más soluciones móviles si existieran protocolos estandarizados y formación específica. **Conclusiones:** Los smartphones ya forman parte de la práctica odontológica cotidiana, pero su incorporación a aplicaciones digitales más avanzadas sigue siendo limitada. La estandarización, la validación clínica, la capacitación profesional y unos marcos éticos claros serán esenciales para favorecer una integración más amplia y segura.

PALABRAS CLAVE

Dentistry, smartphone, inteligencia artificial, teleodontología, fotografía clínica.

ABSTRACT

Introduction: Smartphones have progressively become part of contemporary dentistry as useful tools for clinical photography, communication with laboratories, patient education, teledentistry, and, more recently, diagnostic support through artificial intelligence. Despite this potential, their integration into daily clinical practice is not uniform, and important concerns remain regarding clinical validation, privacy, and professional training. **Objectives:** To analyze, through a cross-sectional survey, the current use of smartphones among practicing dentists, identifying the most frequent applications, perceived benefits, implementation barriers, and interest in future mobile tools. **Methodology:** A descriptive cross-sectional study was conducted using an online questionnaire distributed to practicing dental professionals. A total of 44 complete responses were obtained, and the data were analyzed using descriptive statistics in Microsoft Excel. **Results:** Seventy-seven percent of participants reported using smartphones in clinical practice, mainly for clinical photography, documentation, and communication with laboratories. The use of photogrammetry, artificial intelligence, and teledentistry was clearly lower. Data privacy was the most frequently reported concern, and most respondents expressed willingness to adopt more mobile solutions if standardized protocols and specific training were available. Participants also identified variability in image quality, limited familiarity with advanced applications, and the absence of clear clinical protocols as barriers to wider implementation in routine care. These findings outline current use patterns and conditions required for responsible adoption. **Conclusions:** Smartphones are already part of everyday dental practice, but their incorporation into more advanced digital applications remains limited. Standardization, clinical validation, professional training, and clear ethical frameworks will be essential to support broader and safer integration.

KEYWORDS

Dentistry, smartphone, artificial intelligence, teledentistry, clinical photography.

TABLE OF CONTENTS

1. INTRODUCTION 1

1.1. The digital transformation of dentistry 1
1.2. Smartphones and mobile health (mHealth) in dental practice 2
1.3. Artificial intelligence and diagnostic innovation 4
1.4. Opportunities, challenges and future perspective 4

2. OBJECTIVES 6

2.1. Research question (PICO) 6
2.2. Hypothesis 6
2.3. General objective 7
2.4. Specific objectives 7

3. MATERIAL AND METHODS 7

3.1. Target population and sample 7
3.2. Inclusion criteria 7
3.3. Exclusion criteria 8
3.4. Survey design and distribution 8
3.5. Data collection and storage 8
3.6. Statistical analysis 8
3.7. Ethical considerations 8

4. RESULTS 9

4.1. Demographic profile of the sample 9
4.2. General smartphone usage 11
4.3. Clinical applications (diagnostic, preventive, and therapeutic) 12
4.4. Photogrammetry and digital workflow 13
4.5. Artificial intelligence (AI) and imaging 14
4.6. Benefits, challenges, and ethics 15
4.7. Future perspectives and innovation 16

5. DISCUSSION 16

5.1. The dominance of clinical photography and communication 17
5.2. The innovation gap: AI and photogrammetry 17
5.3. Teledentistry and remote monitoring 17
5.4. Ethical barriers and training needs 18
5.5. International comparisons and contextual positioning 18

6. CONCLUSIONS 18

7. SUSTAINABILITY 19

7.1. Social sustainability (SDG 3: Good Health and Well-being) 19
7.2. Economic sustainability (SDG 9: Industry, Innovation, and Infrastructure) 20
7.3. Environmental sustainability (SDG 12: Responsible Consumption and Production) 20

8. REFERENCES 20

9. ANNEXES 22

9.1. Survey questionnaire 23

1. INTRODUCTION

Smartphones have become central tools in modern healthcare, increasingly used not only for communication but as platforms for clinical data acquisition, diagnostics, and patient monitoring. As described in "Smartphone as a Personal, Pervasive Health Informatics Services Platform: Literature Review," smartphones now incorporate sensors, imaging capabilities, and wireless technologies that support a wide range of medical functions. Their portability and constant availability make them especially well-suited for health informatics, enabling applications in diagnosis, treatment, rehabilitation, and prevention. (1)

Beyond general medical applications, smartphones have also demonstrated significant potential in influencing patient behavior and improving clinical outcomes. The randomized field experiment "Empowering Patients Using Smart Mobile Health Platforms" shows that mHealth applications can enhance self-management in chronic diseases such as diabetes. Patients who used a smartphone-based health platform increased physical activity, improved dietary habits, and achieved measurable reductions in blood glucose levels, while also reducing hospital visits. This demonstrates the ability of smartphone-based systems to support long-term behavioral change and contribute to preventive and personalized medicine. (2)

1.1. The digital transformation of dentistry

As smartphone technology advances, its integration into dental care has expanded, with new technologies gradually replacing or enhancing traditional clinical workflows. Smartphones, once limited to basic communication and casual photography in dentistry, have rapidly evolved into multifunctional devices capable of supporting diagnostic, educational, and even therapeutic tasks. Their portability, processing power, and user-friendly interfaces make them attractive tools in clinical settings, especially as modern applications increasingly integrate advanced imaging and data-analysis features. (1)

One notable development is the adaptation of photogrammetry techniques for implant dentistry. Previously, three-dimensional registration of implants required specialized stereoscopic cameras, but recent studies show that smartphones equipped with dedicated algorithms can provide clinically acceptable accuracy for full-arch implant capture (3). In clinical workflows, smartphone-based photogrammetry has already been incorporated into the fabrication of implant-supported prostheses, offering a more accessible and cost-effective alternative to conventional systems (4, 5).

Beyond implant applications, smartphone photography itself is becoming an important part of digital dentistry. A 2025 study demonstrated that modern iPhone and Samsung devices can produce tooth measurements comparable to those obtained with a DSLR camera at common working distances, supporting their use for documentation, communication, and smile-design planning (6).

Recent developments in digital dentistry have introduced smartphone-based applications specifically designed for shade matching. The study "Repeatability of different mobile phone applications for color measurement in dentistry" by Dang et al. (2024) demonstrated that several mobile apps provide high repeatability in dental color measurements when used under standardized conditions. Their results indicate that while smartphone applications may not yet replace spectrophotometric devices, they offer a reliable and accessible tool for routine shade selection, helping reduce operator variability and improving communication between clinicians and dental laboratories. (7)

Furthermore, a recent survey of 195 pediatric dentists in Turkey revealed that 78.46% use smartphones as their primary camera for dental photography, far exceeding the use of DSLR cameras (16.41%) or intraoral cameras (4.1%). Notably, 70.26% of respondents had never received formal training in dental photography, yet 87.18% believed it should be routine in clinical practice, and 95.38% agreed that training would improve their work. The study also raised concerns about data management, as 73.33% of dentists stored clinical photos on personal smartphones and only 45.13% consistently obtained written or verbal consent from patients (8).

1.2. Smartphones and mobile health (mHealth) in dental practice

The growth of mobile health (mHealth) has significantly expanded the role of smartphones in patient-centered dental care. Through specialized apps, dentists can monitor treatment progress, conduct remote consultations, and encourage better oral-hygiene habits (9). A wide range of dental applications now offer features such as hygiene reinforcement, appointment reminders, postoperative monitoring, and patient education. A recent scoping review shows that these tools can improve plaque control in children and adolescents, support preventive strategies, and even help manage conditions like obstructive sleep apnea or xerostomia (9).

mHealth also enhances access to care. In older adults, for example, asynchronous teledentistry based on smartphone intraoral photos sent through WhatsApp showed very high agreement with clinical examinations, demonstrating that remote screening and referral are

feasible for individuals with mobility or access limitations (10). This type of connectivity aligns closely with the concept of teledentistry, which has proven valuable in reaching remote and underserved populations (10). Video calls, asynchronous consultations, and image-based evaluations help clinicians deliver follow-up care more efficiently while reducing the need for in-person visits. This patient-centered communication is especially useful in preventive dentistry, where ongoing motivation plays an important role in long-term outcomes (10). Beyond remote screening, smartphone-based platforms have also opened new possibilities for AI-assisted diagnostic support in dentistry (11).

Smartphones have also been explored as tools for monitoring everyday oral behaviors. New applications, for instance, send brief prompts throughout the day, allowing patients to report jaw activity in real time. This helps clinicians obtain more accurate and objective information about awake bruxism, capture fluctuations throughout the day, and limit the bias typically associated with retrospective self-reports (12).

A comprehensive scoping review of 45 studies confirmed the growing evidence base for patient-oriented mobile apps in oral health. The review found that 69% of studies focused on oral health promotion, while areas such as diagnostics and remote consultations remained largely unexplored. Among the 23 randomized controlled trials included, 39% demonstrated significant reductions in dental plaque and 26% reported improvements in gingival health (13). These findings suggest that smartphones, when paired with well-designed applications, can produce measurable clinical improvements.

The importance of app design in achieving these outcomes was demonstrated in a randomized controlled trial comparing a gamified oral health app to a simple version among 58 mother-child pairs. The gamified version, incorporating scoring, rewards, badges, and daily notifications, led to significantly greater reductions in plaque index ($B = -0.210$, $P = 0.038$) and was used regularly by 72.4% of participants, compared to 48.3% for the simple app (14).

In the domain of postoperative care, a cluster-randomized trial involving 1,525 patients across 42 dental providers evaluated an mHealth platform for managing acute dental pain. Although no significant differences in pain intensity were observed, providers reported improved communication and better identification of complications. Providers specifically requested integration of in-app camera functionality for patients to upload intraoral images, highlighting the increasing convergence between mHealth and smartphone imaging (15).

1.3. Artificial intelligence and diagnostic innovation

Incorporating artificial intelligence (AI) into smartphone platforms has created new possibilities for dental diagnostics. Several studies have shown that AI algorithms are capable of identifying dental caries and other oral conditions from simple photographs with high accuracy and reproducibility (11,16). Umbrella reviews and systematic analyses report that convolutional neural networks (CNNs) can reliably detect and classify carious lesions from radiographs and even from smartphone images, sometimes reaching performances comparable to trained clinicians (11,16). These systems provide rapid, objective, and consistent assessments, making them a valuable complement to conventional diagnostic techniques.

Recent studies have explored the use of artificial intelligence for caries detection from smartphone-acquired intraoral images. In a 2022 study involving 695 patients, four deep-learning models were evaluated using photographs captured with an iPhone 7; the best-performing model, Faster R-CNN, reported 87.4% accuracy and 92.9% specificity for cavitated caries, while sensitivity for initial lesions was 36.9% (17). In another clinical evaluation, a MobileNet-v3 system assessed 4,361 teeth from 191 patients and reported an overall accuracy of 93.40% and specificity of 95.65%, with higher values in anterior teeth than in molars (18).

Other studies have focused on the development and usability of smartphone-based AI applications. A YOLOv5s model trained on 7,465 intraoral images captured with mobile phones reported 90.7% precision and 85.6% sensitivity and was later implemented in an open-source smartphone application (19). Usability studies have also been published: the AICaries application obtained a System Usability Scale score of 78.4, whereas the TestMyTeeth plaque-screening application obtained a score of 56.2 (20,21).

Review studies have also summarized the available literature in this field. A review including 40 studies on AI in caries detection reported accuracy values above 92% in many of the included investigations and identified convolutional neural networks and artificial neural networks as the most frequently used models (22). In addition, a scoping review on artificial intelligence and oral photography found that 41.2% of the included studies used smartphones for image acquisition and that 94.1% were published from 2020 onward (23).

1.4. Opportunities, challenges and future perspective

As the literature shows, smartphones now support a wide range of clinical tasks, from implant capture to behavioral monitoring, patient education, and diagnostic assistance. Their affordability, portability, and versatility make them well-suited to the digital evolution of

dentistry. However, integrating them into everyday clinical workflows still requires thoughtful consideration (1).

Important challenges remain, particularly in relation to data protection, secure image storage, and compliance with ethical standards. The performance of smartphone-based tools can also be affected by technical factors such as lighting conditions, device calibration, image quality, and overall user experience. Operator-dependent variability is especially relevant in procedures like photogrammetry or diagnostic imaging, where even small inconsistencies may influence accuracy (3,12). Moreover, the effectiveness of AI models depends largely on the quality and diversity of the datasets used to train them, which continues to be a limitation in current research.

Despite these concerns, the development of smartphone-based technologies is expected to continue expanding across multiple dental specialties. They offer valuable support for diagnostics, documentation, remote follow-up, and patient management (11). Recognizing both their strengths and their limitations is essential for integrating these tools responsibly into evidence-based practice.

This growing adoption also underscores the importance of understanding how dentists perceive and use smartphones in their daily work. Survey-based research can help identify barriers, training needs, and factors that influence clinicians acceptance of these technologies. Ultimately, the willingness and confidence of dental professionals will shape how widely smartphone-based solutions are implemented in the years ahead (2,9).

Studies on smartphone-based teledentistry have also been described in the literature. Previous research has reported a high level of agreement between remote photographic assessment performed with smartphone applications and face-to-face clinical examination for the detection of dental caries (24). In addition, other studies have evaluated smartphone photography captured by trained family members and have reported acceptable validity and reliability for caries detection in teledentistry settings (25).

Despite the rapidly expanding literature on smartphone applications in dentistry, most studies focus on the technical performance of individual tools rather than on how clinicians actually integrate these technologies into their workflows. Survey-based studies from China (26) and Turkey (8) have provided valuable regional data, but no comparable study has assessed the patterns of smartphone adoption among dentists practicing in Europe or internationally diverse settings. Understanding the current level of adoption, the perceived benefits and barriers, and the willingness to embrace emerging tools such as AI diagnostics and photogrammetry is essential for guiding the development of standardized protocols, targeted training programs, and ethical frameworks. This study addresses this gap by surveying practicing dentists to provide

a comprehensive picture of smartphone use across diagnostic, preventive, therapeutic, and technological domains in clinical dentistry.

2. OBJECTIVES

2.1. Research question (PICO)

The research question was formulated following the PICO framework adapted for survey-based observational studies:

P (Population): Licensed dentists currently practicing in clinical settings.

I (Intervention/Exposure): Use of smartphones and smartphone-based applications (clinical photography, AI diagnostics, photogrammetry, mHealth, teledentistry) in clinical dental practice.

C (Comparison): Non-use of smartphones or reliance on traditional clinical methods without digital integration.

O (Outcome): Adoption rates, types of clinical applications used, perceived benefits, identified barriers, and willingness to adopt new smartphone-based technologies.

Among licensed dentists in clinical practice, what are the current patterns of smartphone use (including clinical photography, AI-based diagnostics, photogrammetry, and teledentistry), what benefits and challenges do they perceive, and what factors influence their willingness to adopt new smartphone-based technologies compared to traditional clinical methods?

2.2. Hypothesis

The main hypothesis of this study is that, despite the widespread ownership of smartphones among dentists, the adoption of advanced smartphone-based clinical tools (such as AI-assisted diagnostics, photogrammetry, and teledentistry) remains low, and that the primary barriers to adoption are related to insufficient training, lack of standardized protocols, and concerns about data privacy rather than resistance to technological innovation itself.

Alternative hypothesis: Dentists who report using smartphones in clinical practice will predominantly use them for basic functions (photography and communication) rather than for advanced applications (AI diagnostics, photogrammetry), and the majority will express willingness to adopt new tools if adequate training and ethical guidelines are provided.

2.3. General objective

To assess through a cross-sectional survey how dentists use smartphones during clinical practice in order to identify the most common applications, perceived benefits, and challenges related to the integration of mobile technology in dentistry.

2.4. Specific objectives

1. To examine how smartphones and related applications are utilized in diagnostic, preventive, and therapeutic aspects of dental care.
2. To evaluate existing research on smartphone-based photogrammetry for implant position capture and digital workflow integration.
3. To explore the role of AI-assisted smartphone imaging in detecting dental caries and other oral pathologies.
4. To discuss the practical benefits, challenges, and ethical considerations involved in incorporating smartphones into clinical dental routines.
5. To highlight potential areas for future investigation and innovation in smartphone-enabled dental technologies.

3. MATERIAL AND METHODS

This study follows a descriptive, cross-sectional survey-based research design, aimed at evaluating how dentists use and perceive smartphones in their clinical practice.

3.1. Target population and sample

Population: Licensed dentists currently practicing in clinical settings (public or private).

Sample: Convenience sample of dentists recruited through professional dental networks, social media groups, and direct contact via email and messaging platforms. A total of 44 complete responses were collected from approximately 80 dentists contacted.

3.2. Inclusion criteria

- Dentists with a valid dental license.
- Actively working in clinical practice (general or specialist).
- Voluntary participation with informed consent.

3.3. Exclusion criteria

- Dental students (undergraduate or postgraduate).
- Retired or non-practicing dentists.
- Incomplete survey responses.

3.4. Survey design and distribution

A structured, self-administered online questionnaire was developed using Microsoft Forms. The survey consisted of 8 sections encompassing 20 questions covering demographics, general smartphone use, diagnostic/preventive/therapeutic applications, photogrammetry, AI-assisted dentistry, benefits and challenges, ethics, and future perspectives. The questionnaire included single-choice and multiple-choice questions. The full survey instrument is provided in the Annexes.

The survey was distributed electronically between February and March 2026 via professional dental networks, social media groups, and direct contact through email and messaging platforms (WhatsApp). The survey link was shared with approximately 80 dentists, and a total of 44 complete responses were collected, yielding a response rate of approximately 55%.

3.5. Data collection and storage

Responses were automatically recorded and stored on the Microsoft Forms platform. No identifying information (name, email, or institutional affiliation) was collected at any point, ensuring complete anonymity of the participants.

3.6. Statistical analysis

Descriptive statistics were used to analyze the collected data. Categorical variables were summarized as absolute frequencies and percentages. Results were presented using bar charts and pie charts generated with Microsoft Excel (Microsoft Corporation, Redmond, WA, USA). Given the descriptive cross-sectional design and the nature of the data collected, no inferential statistical tests were applied.

3.7. Ethical considerations

This study was conducted in accordance with the ethical guidelines of the Universidad Europea de Madrid for graduation projects. The survey was fully anonymous; no personal data such as

names, email addresses, student numbers, or any other identifying information were collected. Participation was entirely voluntary, and informed consent was obtained as the first question of the survey, where participants were required to agree before proceeding. Respondents were informed of their right to withdraw at any time without consequence. The study was approved by the university's Ethics Committee with reference number 2026-143 and the Department code OD.058/2526

4. RESULTS

4.1. Demographic profile of the sample

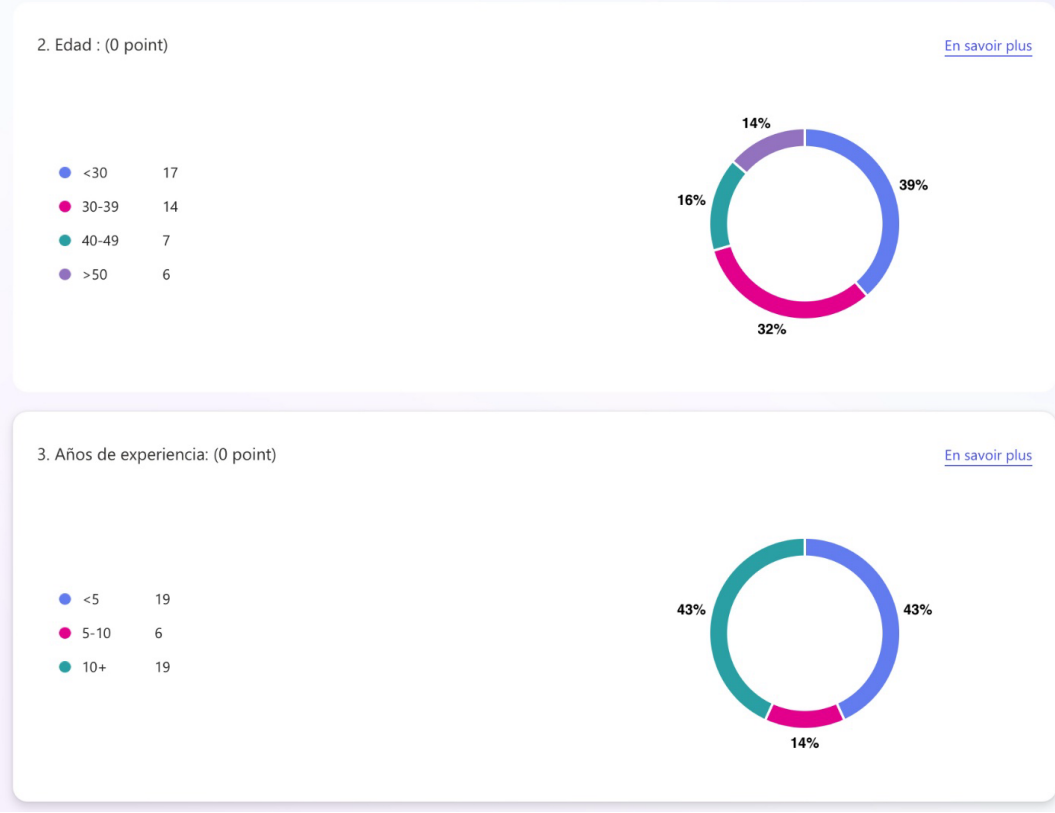


Figure 1. Age distribution of respondents

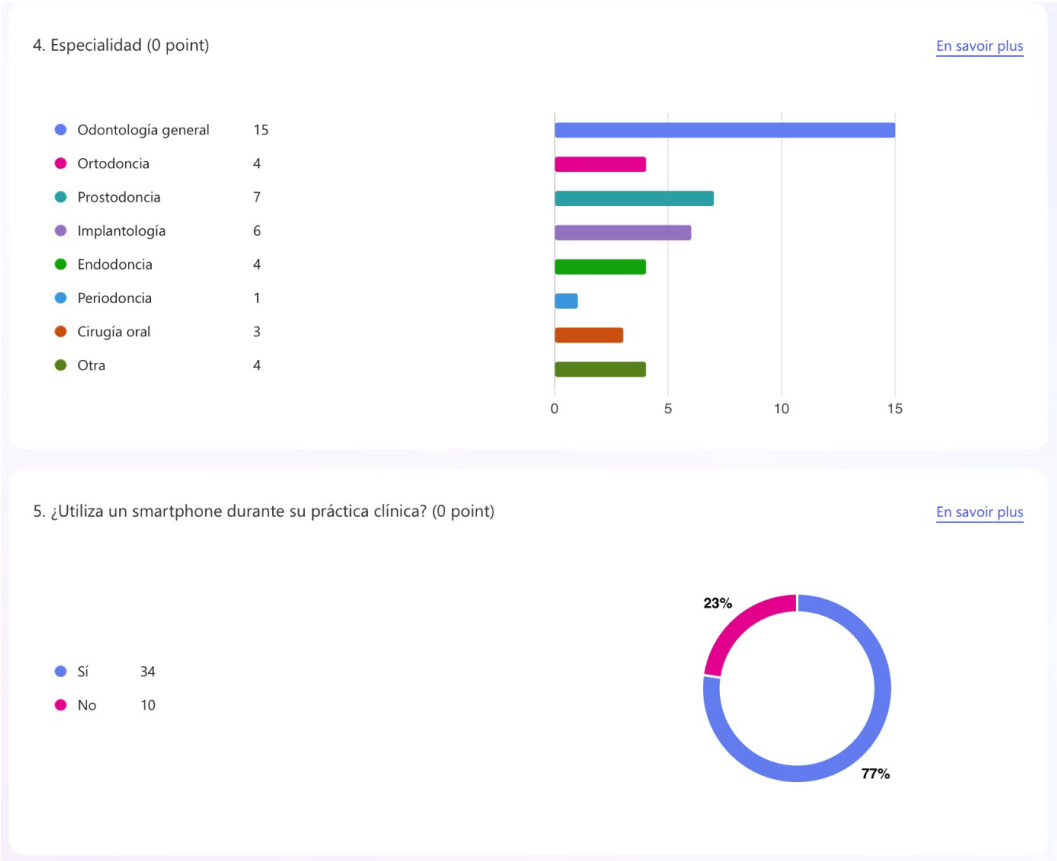


Figure 2. Distribution by dental specialty

The survey was distributed to approximately 80 dentists, and a total of 44 complete responses were collected, yielding a response rate of approximately 55%. No incomplete responses were received, as the survey required all questions to be answered before submission. The sample exhibits a diverse distribution in terms of age and clinical experience.

- **Age:** A significant majority of respondents are under 40 years old, with 39% aged <30 and 32% aged 30-39.
- **Experience:** The sample is split between early-career and seasoned professionals, with 43% having less than 5 years of experience and another 43% having more than 10 years.
- **Specialty:** General dentistry is the most represented specialty (15 answers), followed by prosthodontics (7), implantology (6), and orthodontics/endodontics (4 each).

4.2. General smartphone usage

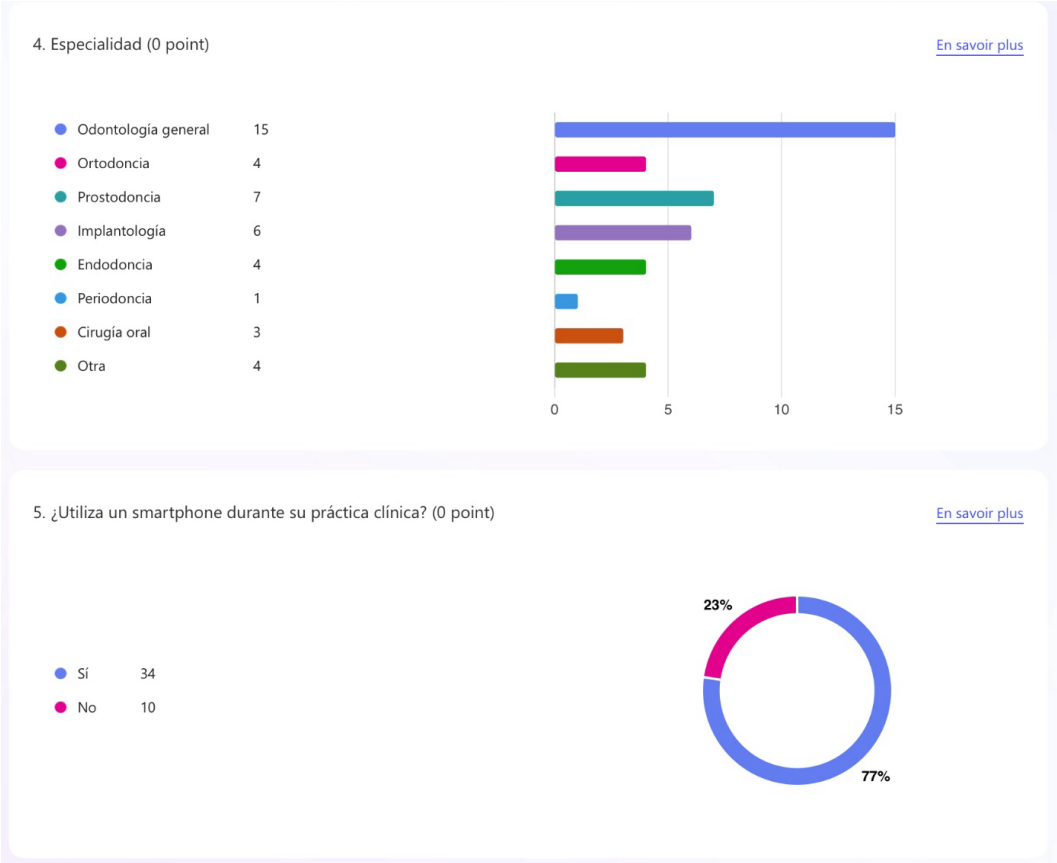


Figure 3. Use of smartphones in clinical practice

The integration of smartphones into dental practice is widespread among the participants:

- **Adoption Rate:** 77% of surveyed dentists (34 out of 44) report using a smartphone during their clinical practice.
- **Non-users:** 23% of the sample (10 respondents) do not utilize these devices in a clinical setting.

4.3. Clinical applications (diagnostic, preventive, and therapeutic)

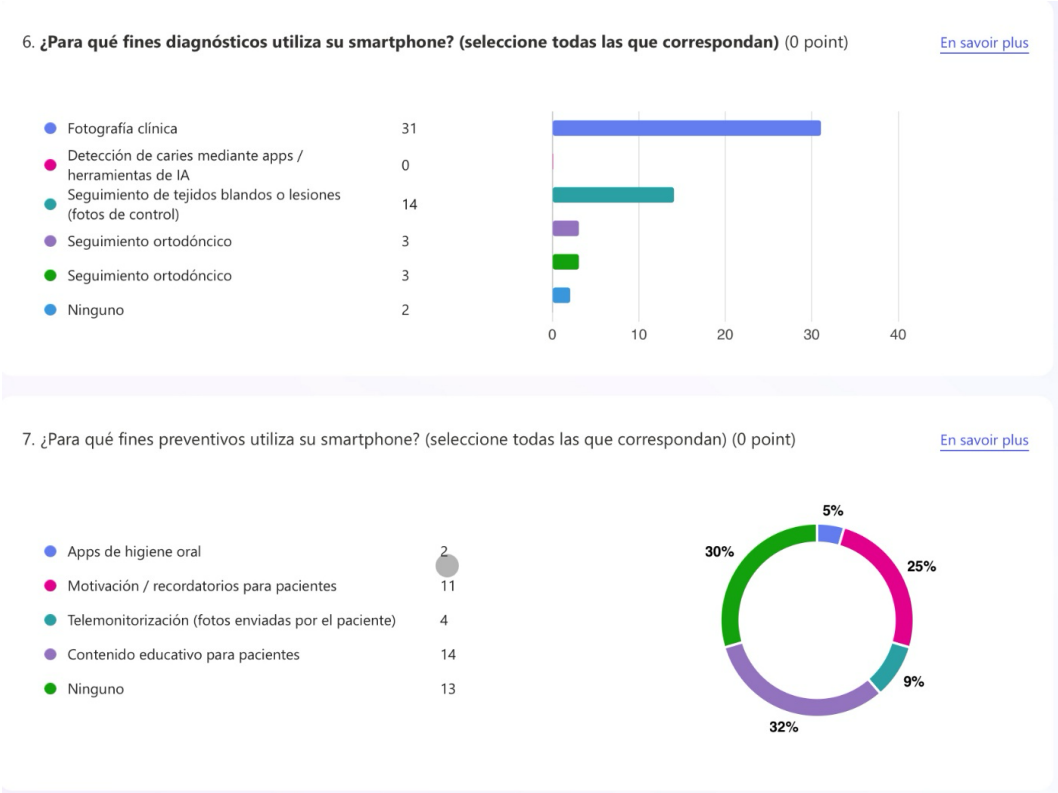


Figure 4. Diagnostic and preventive uses of smartphones in the clinic

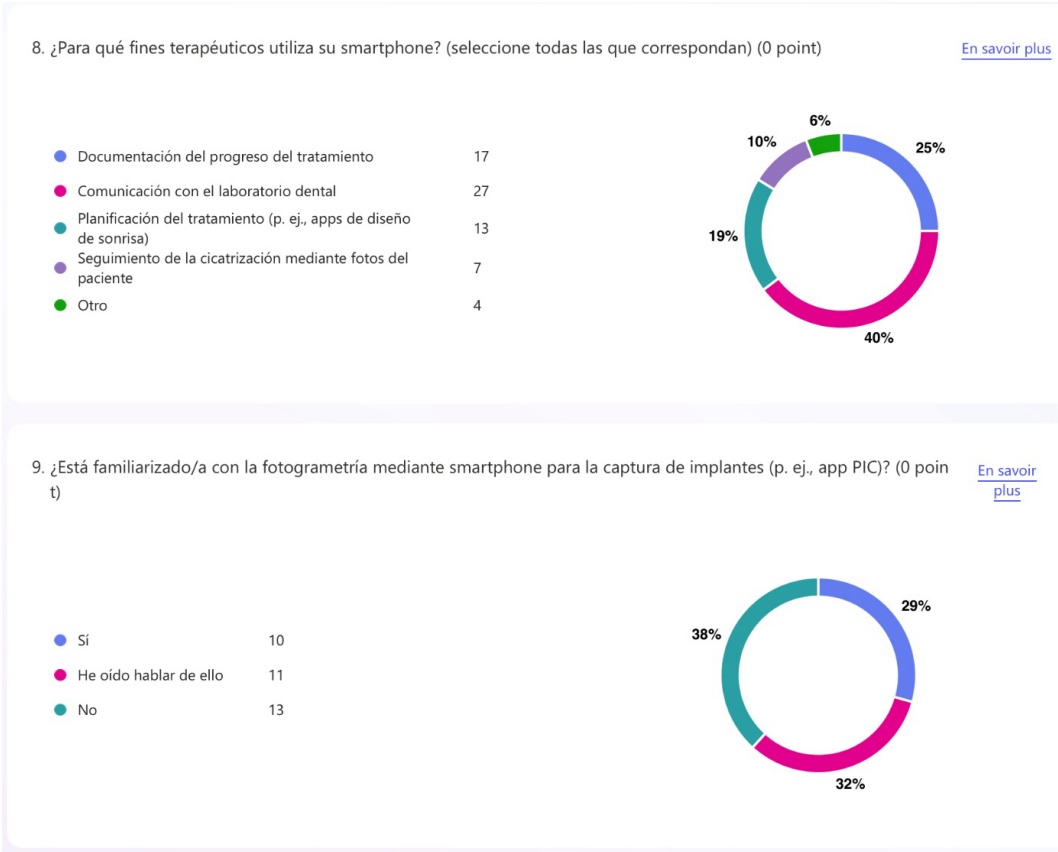


Figure 5. Therapeutic use of smartphones in the clinic

- **Diagnostic Use:** The primary diagnostic application is clinical photography, cited by 31 respondents. Monitoring soft tissues or lesions (14 respondents) is also common, whereas the use of AI tools for caries detection was not reported by any participant in this category (0 respondents).
- **Preventive Use:** Educational content for patients (32%) and patient motivation/reminders (25%) are the leading preventive applications. However, 30% of practitioners do not use smartphones for preventive purposes.
- **Therapeutic Use:** Smartphones serve as a vital communication bridge, particularly with dental laboratories (40%). They are also used for documenting treatment progress (25%) and treatment planning/smile design (19%).

4.4. Photogrammetry and digital workflow

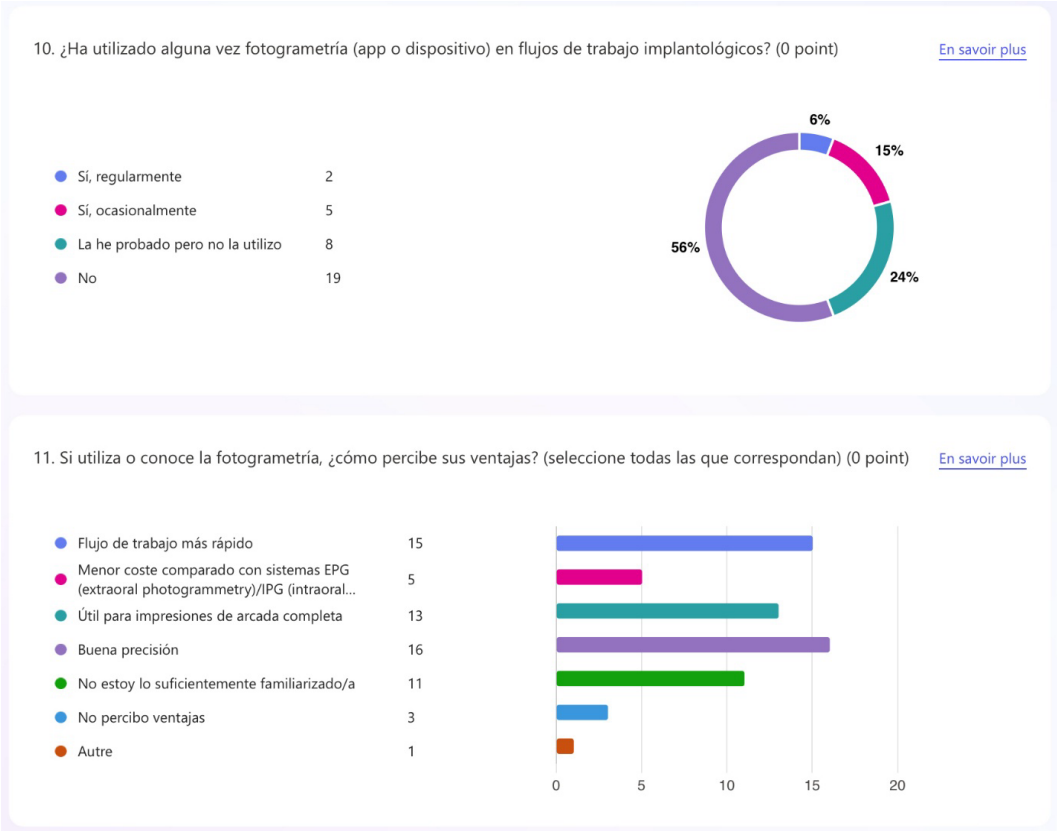


Figure 6. Photogrammetry use and perceived advantages

While the concept of smartphone-based photogrammetry is known to the majority, its clinical implementation remains limited.

- **Familiarity:** 61% of respondents have at least heard of photogrammetry for implant capture, but 38% are completely unfamiliar with it.

- **Usage:** Only 15% of practitioners use it (6% regularly, 9% occasionally), while 56% have never used it.
- **Perceived Advantages:** Those familiar with the technology identify accuracy (16 answers) and a faster workflow (15 answers) as the main benefits.
- **Concerns:** Accuracy (35%) and device limitations (21%) remain the primary concerns preventing wider adoption.

4.5. Artificial intelligence (AI) and imaging

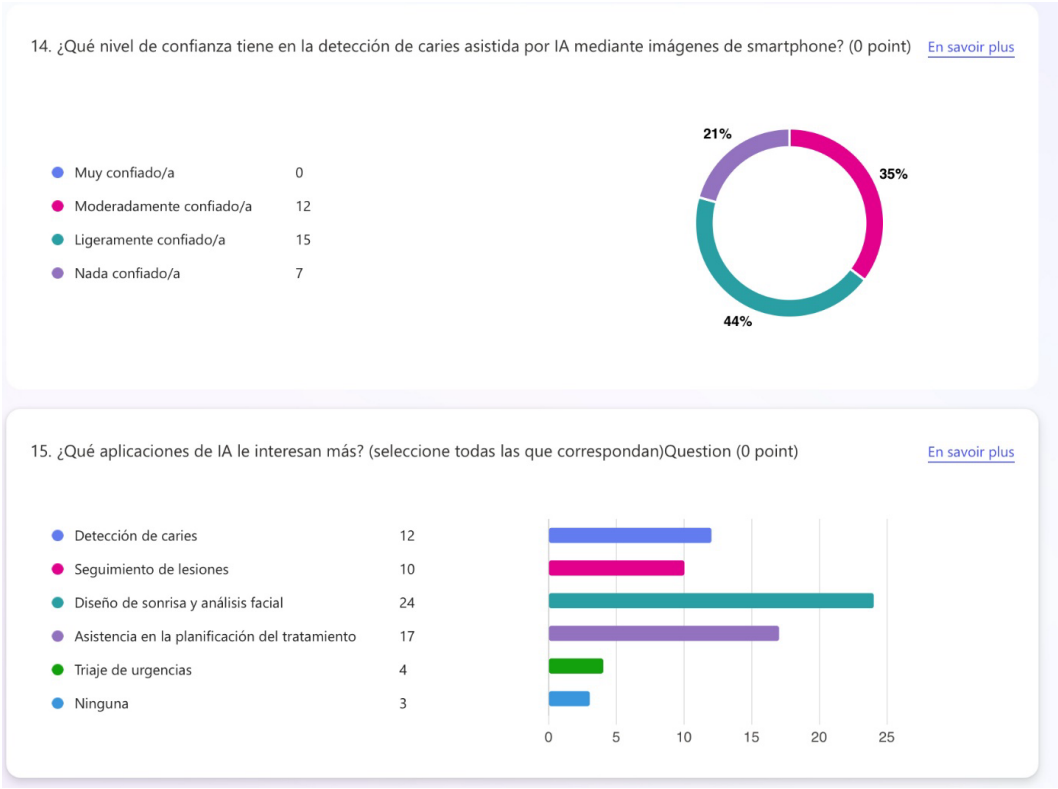


Figure 7. Dentists' trust in AI for caries detection and AI application interests

- **Experience:** 50% of the surveyed dentists have never used or tested AI-supported smartphone tools. Frequent use is extremely rare (2%).
- **Trust Levels:** Confidence in AI-assisted caries detection is low to moderate, with 44% feeling only "slightly confident" and 21% "not confident" at all.
- **Future Interest:** The AI application generating the most interest is smile design and facial analysis (24 answers), followed by treatment planning assistance (17 answers).

4.6. Benefits, challenges, and ethics

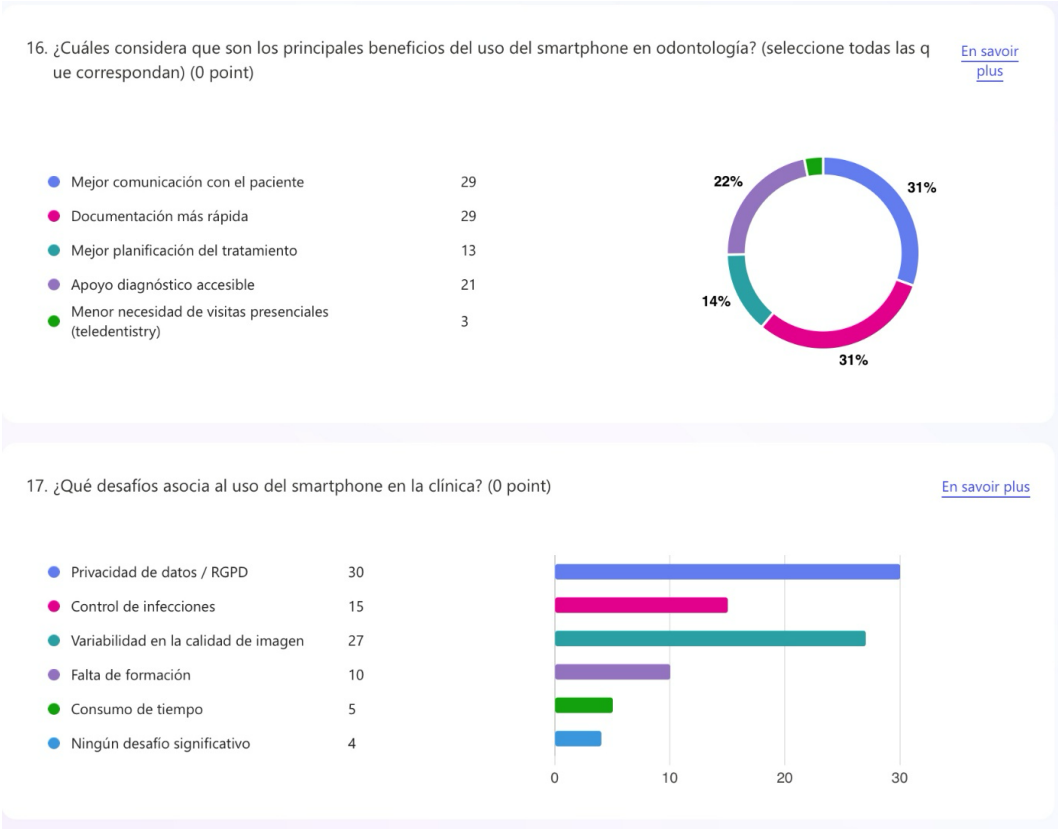


Figure 8. Benefits and challenges of smartphone use in dentistry

- **Benefits:** The most significant advantages are improved patient communication (31%) and faster documentation (31%). Accessible diagnostic support was noted by 22% of respondents.
- **Challenges:** Data privacy and GDPR compliance is the leading concern (30 answers). This is followed by image quality variability (27 answers) and infection control issues (15 answers).
- **Teledentistry:** Despite the theoretical potential for remote care, 45% of respondents never use smartphones for teledentistry, and only 5% do so regularly.

4.7. Future perspectives and innovation

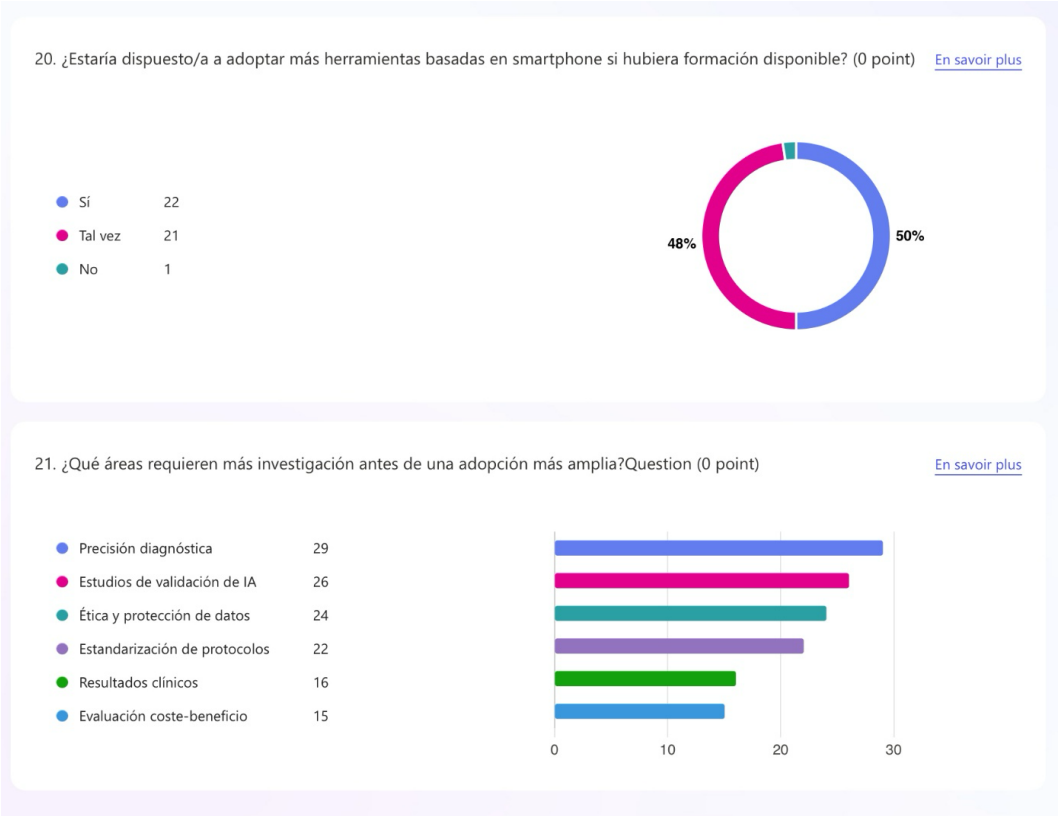


Figure 9. Desired fields of investigation for smartphone use in clinical dentistry

- **Desired Advancements:** Practitioners are most interested in seeing the integration of standardized clinical photography protocols (12 answers) and improved AI diagnostic tools (11 answers).
- **Willingness to Adopt:** There is a very high openness to new technology, as 98% of respondents would consider adopting more smartphone-based tools if training were available (50% "Yes", 48% "Maybe").
- **Research Priorities:** To facilitate adoption, dentists believe research should prioritize diagnostic accuracy (29 answers), AI validation studies (26 answers), and data protection ethics (24 answers).

5. DISCUSSION

The findings of this survey provide a comprehensive overview of how smartphones are currently integrated into clinical dentistry, highlighting a significant gap between theoretical potential and practical adoption.

5.1. The dominance of clinical photography and communication

Our results show that 77% of dentists use smartphones in their practice, primarily for clinical photography (31 respondents) and communication with dental laboratories (40%). This aligns with recent literature suggesting that modern mobile devices can produce measurements and images (6). However, while the literature emphasizes the precision of these devices, 27 of our respondents still identified image quality variability as a major challenge. This suggests that while the hardware is capable, there is a lack of standardized protocols, which 12 respondents identified as a priority for future integration.

5.2. The innovation gap: AI and photogrammetry

A striking finding is the discrepancy regarding Artificial Intelligence (AI) and photogrammetry. Although studies indicate that AI algorithms can identify caries with high accuracy (11), none of our participants currently use AI for diagnostic purposes. Furthermore, 65% of respondents reported low or no confidence in AI-assisted caries detection. This skepticism might be linked to the lack of clinical validation studies, which 26 respondents cited as a requirement for wider adoption.

Similarly, while smartphone-based photogrammetry is described in recent 2025 studies as a cost-effective and accurate alternative for implant workflows (3, 4, 5), its actual use remains marginal, with 56% of participants never having used it. The primary barrier remains accuracy concerns (35%), despite evidence suggesting these tools provide clinically acceptable results for full-arch captures.

5.3. Teledentistry and remote monitoring

The literature highlights the success of mHealth and teledentistry in improving patient outcomes and monitoring chronic conditions like awake bruxism (2, 9, 12). However, our data reveals that 45% of dentists never use teledentistry, and only 3 respondents viewed it as a primary benefit. This may be due to the fact that while remote screening is feasible, practitioners still prioritize in-person clinical examinations for definitive diagnosis.

5.4. Ethical barriers and training needs

The most significant hurdle identified is Data Privacy and GDPR compliance (30 responses), which echoes the "thoughtful consideration" required for everyday clinical

workflows mentioned in the literature. Interestingly, there is a nearly universal willingness to adopt more tools (98%) if training were provided. This indicates that the barrier to "Smart Dentistry" is not a lack of interest, but rather a need for better education, ethical frameworks, and clinical standardization.

5.5. International comparisons and contextual positioning

Our adoption rate of 77% aligns with international data. Zhang et al. (2020) found that 76% of Chinese dentists had medical apps installed, with smartphone use reported at 100% (26). In a more recent survey from Turkey, Sahin (2026) found that 78.46% of pediatric dentists used smartphones as their primary clinical photography tool (8). These converging figures suggest that while smartphone ownership is nearly universal among dental professionals, approximately one-quarter consistently choose not to integrate these devices into clinical workflows, pointing to systemic rather than individual barriers.

The gap in AI adoption observed in our sample is consistent with the literature. Although Al-Khalifa et al. (2024) documented AI accuracy above 92% in most studies, and Adnan et al. (2024) demonstrated that a smartphone-based YOLOv5s model performed comparably to junior dentists ($p = 0.157$), the clinical translation of these technologies remains limited (19, 22). The low confidence expressed by 65% of our respondents may reflect a lack of exposure to validated AI tools rather than an inherent resistance to the technology, given that 98% expressed willingness to adopt new tools if training were available.

Regarding teledentistry, the disconnect between evidence and practice is particularly notable. Avci and Kaptan (2023) demonstrated that smartphone-based teledentistry achieves ICC values above 0.98 for DMFT indices, and Lamas-Lara et al. (2025) showed that even budget smartphones can reach 90.19% sensitivity for caries detection when used by trained non-professionals (24, 25). Yet 45% of our respondents never use teledentistry. This gap may be partially explained by the usability challenges documented by Al-Zubaidy et al. (2025), whose AI plaque-screening app scored only 56.2 on the System Usability Scale, suggesting that available tools may not yet meet clinical workflow expectations (21).

6. CONCLUSIONS

Based on the results of this cross-sectional survey of 44 dentists and the supporting scientific evidence, the following conclusions can be drawn:

1. This study confirms that smartphones are already integrated into contemporary clinical dentistry; however, their use among the surveyed dentists remains mainly limited to routine clinical support rather than to the broader adoption of advanced digital applications.
2. Their principal clinical uses are diagnostic and therapeutic, especially clinical photography, communication with dental laboratories, and treatment documentation, whereas preventive applications appear to be less consistently incorporated into daily practice.
3. Although smartphone-based photogrammetry has been presented in the literature as a promising tool for implant position capture and digital workflow integration, its use in the present sample remains limited, mainly due to concerns regarding accuracy, technical constraints, and insufficient familiarity with the technique.
4. In the case of AI-assisted smartphone imaging, the available literature indicates significant potential for diagnostic support; nevertheless, its practical adoption among the surveyed dentists is still low and professional confidence in these tools remains limited.
5. The main perceived advantages of smartphone use in dentistry are improved communication, faster documentation, and support for clinical management, whereas the principal barriers are associated with data privacy, image quality variability, lack of training, and the need for clear ethical and legal frameworks.
6. The future integration of smartphone-enabled technologies into clinical dentistry will require standardized clinical photography protocols, stronger clinical validation of AI-based tools, improved professional training, and further research focused on their reliability, safety, and routine applicability.

7. SUSTAINABILITY

This study contributes to sustainability across the social, economic, and environmental dimensions, aligning with the United Nations Sustainable Development Goals (SDGs).

7.1. Social sustainability (SDG 3: Good Health and Well-being)

Smartphone-based technologies in dentistry have the potential to improve access to oral healthcare, particularly for underserved and remote populations through teledentistry. By identifying the barriers to adoption, this study contributes to efforts aimed at promoting equitable access to innovative dental care tools. Improved smartphone integration could support early diagnosis, preventive care, and patient education, thereby contributing to better oral health outcomes at a population level.

7.2. Economic sustainability (SDG 9: Industry, Innovation, and Infrastructure)

The use of smartphones as clinical tools represents a cost-effective alternative to specialized equipment in many dental applications. Smartphone-based photogrammetry, for example, can reduce the need for expensive dedicated scanning systems. AI-assisted diagnostic tools deployed on mobile devices could lower the costs associated with specialist referrals and enable more efficient resource allocation in dental practices. By documenting current adoption patterns and barriers, this study supports the development of scalable, affordable technological solutions in dentistry.

7.3. Environmental sustainability (SDG 12: Responsible Consumption and Production)

The integration of smartphone-based solutions in dental practice can contribute to reducing the environmental footprint of clinical workflows. Digital documentation and communication reduce paper consumption, while teledentistry decreases the need for patient travel, thereby lowering carbon emissions associated with transportation. Furthermore, repurposing smartphones already owned by clinicians avoids the production, packaging, and disposal of additional specialized devices, supporting responsible consumption and production patterns in healthcare settings.

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9. ANNEXES

9.1. Survey questionnaire

SECTION 1 — Consent

Do you agree to participate in this anonymous survey?

- ○ Yes
- ○ No → End survey

SECTION 2 — Demographics

Age:

- ○ <30
- ○ 30–39
- ○ 40–49
- ○ ≥50

Years of experience:

- ○ <5
- ○ 5–10
- ○ >10

Specialty:

- ○ General dentistry
- ○ Orthodontics
- ○ Prosthodontics
- ○ Implantology
- ○ Endodontics
- ○ Periodontics
- ○ Oral surgery
- ○ Other

SECTION 3 — General Smartphone Use in Dentistry

Do you use a smartphone during your clinical practice?

○ Yes

○ No

If No, skip to Section 7.

SECTION 4 — Diagnostic, Preventive & Therapeutic Use

For which diagnostic purposes do you use your smartphone? (select all that apply)

○ Clinical photography

○ Detection of caries using apps / AI tools

○ Monitoring soft tissue or lesions (photos for follow-up)

○ Orthodontic monitoring

○ None

For which preventive purposes do you use your smartphone? (select all that apply)

○ Oral hygiene instruction apps

○ Patient motivation / reminders

○ Remote monitoring (photos sent by patient)

○ Educational content for patients

○ None

For which therapeutic purposes do you use your smartphone? (select all that apply)

○ Documenting treatment progress

○ Communication with the dental lab

○ Treatment planning (e.g., smile design apps)

○ Follow-up of healing via patient photos

○ Other: _____

SECTION 5 — Photogrammetry and Digital Workflow

Are you familiar with smartphone-based photogrammetry for implant capture (e.g., PIC app)?

○ Yes

○ I have heard of it

○ No

Have you ever used photogrammetry (smartphone app or device) in implant workflows?

- ○ Yes, regularly
- ○ Yes, occasionally
- ○ I have tested it but do not use it
- ○ No

If you use or are aware of photogrammetry, how do you perceive its advantages? (select all that apply)

- ○ Faster workflow
- ○ Lower cost compared to EPG/IPG systems
- ○ Useful for full-arch implant impressions
- ○ Good accuracy
- ○ Not familiar enough
- ○ No perceived advantage

What are your concerns regarding smartphone photogrammetry?

- ○ Accuracy
- ○ Lighting variability
- ○ Learning curve
- ○ Device limitations
- ○ No concerns

SECTION 6 — AI-Assisted Dentistry and Imaging

Have you used or tested AI-supported smartphone tools for diagnostics (e.g., caries detection, segmentation apps)?

- ○ Yes, frequently
- ○ Yes, occasionally
- ○ Heard of them but never used
- ○ No

How confident are you in AI-assisted caries detection using smartphone images?

- ○ Very confident
- ○ Moderately confident
- ○ Slightly confident
- ○ Not confident

Which AI applications interest you the most? (select all that apply)

- ○ Caries detection
- ○ Lesion monitoring
- ○ Smile design and facial analysis
- ○ Treatment planning assistance
- ○ Emergency triage
- ○ None

SECTION 7 — Benefits, Challenges & Ethics

What do you consider the main benefits of smartphone use in dentistry? (select all that apply)

- ○ Improved patient communication
- ○ Faster documentation
- ○ Better treatment planning
- ○ Accessible diagnostic support
- ○ Reduced need for in-person visits (teledentistry)

What challenges do you associate with smartphone use in clinical settings?

- ○ Data privacy / GDPR concerns
- ○ Infection control issues
- ○ Image quality variability
- ○ Lack of training
- ○ Time consumption
- ○ No significant challenges

Do you use smartphones for teledentistry (remote consultations or follow-up)?

- ○ Yes, regularly
- ○ Occasionally
- ○ Rarely
- ○ Never

SECTION 8 — Future Perspectives & Innovation

In your opinion, which smartphone-based technological advancements should be integrated more into dental practice?

- ○ Improved AI diagnostic tools
- ○ Real-time photogrammetry
- ○ Standardized clinical photography protocols
- ○ Integration with electronic health records
- ○ Augmented reality for patient education
- ○ None

Would you be willing to adopt more smartphone-based tools if training was available?

- ○ Yes
- ○ Maybe
- ○ No

What areas require further research before wider adoption?

- ○ Diagnostic accuracy
- ○ AI validation studies
- ○ Ethics and data protection
- ○ Standardization of protocols
- ○ Clinical outcomes
- ○ Cost–benefit evaluation