

**UNIVERSITY OF MEDICINE AND PHARMACY
"CAROL DAVILA", BUCHAREST
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FIELD OF DENTAL MEDICINE**

DOCTORAL THESIS SUMMARY

***MEDICAL INFORMATION:
AT THE BORDER BETWEEN PROFESSIONAL SECRECY
AND PERSONAL DATA***

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LIST OF PUBLISHED SCIENTIFIC WORKS

During the doctoral program, the following scientific papers were published in extenso, in journals indexed in international databases, with the central theme of the present doctoral thesis:

1. Cozmescu AF, Cernega A, Mincă DG, Didilescu AC, Imre MM, Totan AR, Pârvu S, Pițuru SM. Embracing artificial intelligence in dental practice: An exploratory study of Romanian clinicians' perspectives and experiences. Dentistry Journal. 2025;13(9):390. doi: 10.3390/dj13090390. ISI/Web of Science indexed journal, impact factor 3.1. Available at: <https://doi.org/10.3390/dj13090390>
2. Cozmescu AF, Cernega A, Didilescu AC, Imre MM, Dimitriu B, Pițuru SM. Administrative perspectives on digital workflow transformation and artificial intelligence implementation in dental clinics. Dentistry Journal. 2026;14(4):206. doi: 10.3390/dj14040206. ISI/Web of Science indexed journal, impact factor 3.1. Available at: <https://doi.org/10.3390/dj14040206>

INTRODUCTION

Medical confidentiality is one of the oldest principles of the medical profession, with documented continuity over more than two and a half millennia, beginning with the Hippocratic Oath. For a long time, medical secrecy functioned as an individual ethical guarantee, ensured through the practitioner's professional conscience, in a context in which information circulated slowly and clinical documentation was kept exclusively on physical support.

The contemporary context is, however, fundamentally different. The digitalization of health systems has radically transformed the nature, volume, and speed at which medical information is generated, processed, and transmitted. Electronic health records, digital imaging, integrated management platforms and, more recently, artificial intelligence (AI) systems have generated an unprecedented volume of sensitive medical data. Medical information has thus acquired a new legal status: that of a special category of personal data, regulated through the Personal Data Protection Regulation.

Through this evolution, medical professional secrecy has intersected with a complex legal framework for personal data protection. Artificial intelligence accentuates and redefines this tension: it does not limit itself to making the clinical act more efficient, it transforms the way medical information is collected, correlated, stored and valued. Fundamental questions arise concerning algorithmic transparency, the distribution of responsibility and the limits of informed consent.

The present thesis places this tension at the centre of its analytical approach, examining it through the lens of dental medicine, one of the most representative ambulatory specialties, and from the perspective of the three essential actors of the dental ecosystem: the dentist, the administrator of the health unit and the patient.

The importance, novelty and timeliness of the topic are given by the convergence of legislative, technological and societal developments without precedent. At the legislative level, the European Union adopted in June 2024 Regulation (EU) 2024/1689 on Artificial Intelligence (the EU AI Act), the most comprehensive normative framework dedicated to AI regulation at the global level, which classifies AI systems in the health sector as high-risk systems. Combined with the GDPR and with Regulation (EU) 2025/327 on the European Health Data Space (EHDS), it establishes a layered protection regime with direct implications for dental practices.

The topic addresses a gap in the literature: although the clinical applications of artificial intelligence in dentistry (caries detection, implant planning, periodontal parameter assessment) are increasingly well documented, the perspectives of the actors directly involved in implementing and experiencing these technologies remain insufficiently studied, especially in the Romanian context. A multidimensional research that simultaneously integrates the three perspectives constitutes a necessary original contribution.

The convergence of unprecedented developments - the adoption of the EU AI Act (June 2024), the entry into force of the EHDS (2025), the accelerating adoption of AI in dentistry, the lessons of the COVID-19 pandemic regarding informational resilience - makes this research respond to a real and immediate need. Artificial intelligence systems in healthcare are classified as high-risk systems, which imposes strict obligations of transparency, auditability, robustness and human oversight. Romanian dental practices, mostly of small size, now face a dual challenge: to comply with an increasingly complex European regulatory framework and, simultaneously, to integrate technologies whose benefits are real but whose risks are still insufficiently mapped. The thesis offers a rigorous empirical radiography of the way the three main actors - the dentist, the manager and the patient, perceive, accept and apply this transformation, providing concrete benchmarks for policies of responsible AI implementation in the Romanian dental sector and a contribution to the international debate on AI governance in medicine.

GENERAL PART

Chapter 1. Historical and legislative evolution of medical professional secrecy

The chapter opens the general part with a review of the historical and legislative evolution of medical professional secrecy, from the Hippocratic Oath (5th–3rd centuries BC) to the contemporary European framework.

The modern legislative area at the international level is addressed through Percival's Medical Ethics (1803), the Napoleonic Penal Code (1810), the WMA Declaration of Geneva (1948, revised through 2017), the Oviedo Convention (1997) and the Charter of Fundamental Rights of the EU (2000). At the national level, Law no. 46/2003 on patients' rights, Law no. 95/2006 on health reform, the Criminal Code (art. 227) and the Code of Ethics of the CMSR are analysed.

The GDPR (Regulation EU 2016/679) is analysed as a moment of confluence between the traditional protection of medical secrecy and the modern legal framework for personal data: health data are classified as a special category (art. 9), with a general processing prohibition and strictly regulated exceptions. The chapter highlights the structural tensions between the principle of data minimization and the real needs of medical research and AI development.

Finally, the new Regulation on the European Health Data Space (EHDS, 2025/327) is presented, which creates a unified framework for the primary and secondary use of electronic health data, with phased implementation through 2034. For the dental sector, EHDS brings dual pressure: on the one hand, it accelerates the requirement for digitalization and interoperability (FHIR), and on the other hand, it opens up the practice's data to a broader European information ecosystem.

Chapter 2. The transition of medical information into the digital era

The transition from the physical record to the electronic health record (EHR) is not a simple format conversion: digital data allow instantaneous replication, remote transmission, correlation with other datasets and indefinite storage, which fundamentally changes the nature of risks. EHR adoption in the US went from below 10% in 2008 to over 96% in 2017.

Interoperability, embodied through the FHIR standard (HL7), remains the major structural problem: the technical exchange of data has advanced, but semantic interoperability (the harmonization of clinical meaning) is still deficient. In dentistry, integrating practice software data with the patient's general record remains difficult.

Cybersecurity is analysed in empirical dimensions: between 2009 and 2024, more than 6,468 breaches affecting more than 500 records each were reported; the Change Healthcare attack alone (February 2024) compromised the data of 190 million patients and cost approximately USD 2.4 billion. The dental sector, composed predominantly of small practices, is particularly vulnerable.

The chapter finally addresses: patient privacy and the limits of informed consent in the big data era; algorithmic dehumanization and the erosion of clinical autonomy; algorithmic bias and the implications for equity; medical misinformation and the infodemic phenomenon (amplified by COVID-19); and, finally, the issue of institutional resilience, defined as preparedness for future health crises through investment in robust systems, professional training and data governance mechanisms.

Chapter 3. Artificial intelligence in contemporary medicine and dental practice: from technological promise to systemic transformation

The chapter proposes a reconceptualization of the dental ecosystem in the era of artificial intelligence. The classical ecosystem is built on a triad: the dentist, the administrator of the health unit and the patient, each with their own functions, values and constraints, but structurally interdependent.

The emergence of artificial intelligence brings, however, a fourth element. This is not an autonomous agent with its own interests, but neither is it a simple passive instrument: it is an actor, through which the wills, decisions and interests of entities previously absent from the medical act enter the practice - software developers, technology providers, research institutions. Unlike a microscope or a CAD/CAM system, AI systems carry prior decisions in their architecture: which data were used for training, which metrics were optimized, which decision thresholds were calibrated.

The central concept proposed in this chapter is that of multidimensional informational asymmetry. The classical triad operated in a framework of relative transparency, the physician could explain to the patient how they arrived at the diagnosis, could justify to the administrator the reason for the intervention. Artificial intelligence breaks

this chain at several points simultaneously: between the physician and the algorithm (the physician sees the result, but not the path); between the patient and the algorithm (mediated by a physician who cannot fully explain the process); and between the administrator and technology providers (limited technical documentation, no access to the training data).

The chapter closes with a framework of rational optimism: AI integration can bring real benefits (diagnostic accuracy, predictive treatment planning, optimized workflow), but it requires careful calibration. The proposed regulatory framework is analysed from the perspective of its concrete implications for dental practices.

PERSONAL CONTRIBUTIONS

Chapter 4. Working hypothesis and general objectives

The working hypothesis of the thesis is the following: artificial intelligence, as a catalysing factor of digitalization in dentistry, transforms medical information from an element protected within the classical paradigm of professional secrecy into a resource with multiple value - clinical, organizational and strategic. The adequate protection of this resource requires an integrated framework that brings together the traditional ethics of confidentiality, the modern legal regulation of personal data, and the specific governance of AI systems.

The scientific objectives of the research target four complementary directions:

- (1) evaluating the perception of dentists regarding the difficulty, readiness and impact of AI integration in the five stages of the clinical workflow (scheduling, diagnosis, treatment planning, feedback, follow-up);
- (2) exploring the perspective of administrators of health units on the digital transformation of the workflow, resource allocation and decision-making process in the context of AI;
- (3) investigating patients' perception of the impact of AI on the dental treatment experience;

Chapter 5. General research methodology

The doctoral research was conceived as a multidimensional project, structured along three complementary directions, conducted within a unified methodological framework.

The general design is cross-sectional, observational, based on structured questionnaires, with adherence to the STROBE recommendations for reporting observational studies. The exploratory (pilot) character was justified by the absence of validated instruments capable of capturing the emerging dynamics of AI integration in Romanian dental practice.

The target groups were represented by three samples of 200 participants each: 200 dentists active in Bucharest and surrounding areas, selected from a total population of 5,708 dentists registered with the CMSR; 200 managers of dental clinics with organizational responsibilities (practice manager, administrator, operational manager, medical director,

owner-manager); and 200 adult patients who were benefiting or had recently benefited from dental services.

The data collection instruments were questionnaires developed de novo, structured along five subdomains corresponding to the stages of the patient pathway: scheduling, diagnosis, treatment planning, feedback, follow-up. Each of these with 15 items on a Likert scale (1–5). The dependent variables assessed were perceived difficulty, readiness to adopt and perceived impact.

Statistical analysis was performed in IBM SPSS Statistics v25. Quantitative variables were reported as medians with IQR or means with standard deviations, with the distribution evaluated through the Shapiro-Wilk test. Comparisons used the Kruskal-Wallis H tests (with Dunn-Bonferroni post-hoc) and Mann-Whitney U; correlations, Spearman's rho coefficient. For categorical variables, Fisher's Exact Test with Bonferroni-corrected Z-tests was used. For each subdomain, scores were constructed through Principal Component Analysis (PCA), with validation through Cronbach's alpha. The significance threshold: $\alpha = 0.05$. Ethical approval was obtained in accordance with national and international regulations.

Chapter 6. The adoption of artificial intelligence in dental practice: an exploratory study of Romanian clinicians' perspectives and experiences

The first original study of the thesis investigated the perceptions of 200 active dentists regarding AI integration in current clinical practice. The study was published in *Dentistry Journal* (2025, MDPI), an ISI-indexed journal with an impact factor of 3.1.

The sample was demographically balanced: 51% women, 49% men; ages between 25 and over 60 years; the majority from urban areas (~89%), the rest from rural areas. Professional qualifications covered the entire range recognized by the CMSR.

Subdomains of the patient pathway. The highest interest scores were observed for diagnosis (median = 3.25; IQR = 2.78-3.62) and follow-up (median = 3.25; IQR = 2.62-3.87). Treatment planning (median = 3.10) and feedback (median = 3.00) received moderate interest. Scheduling registered the lowest score (median = 2.77; IQR = 2.22-3.33), suggesting a more limited concern with the administrative aspects.

Perceived level of difficulty. Differences between age groups were significant (Fisher's Exact Test, $p < 0.001$). Dentists aged 31-35 most frequently reported low difficulty (40.7%), while those aged 46–50, 56–60 and over 60 years more frequently reported high difficulty. Professional experience follows the same pattern: dentists with 4-10 years of

practice report low difficulty (48.3%), while those with more than 21 years report high difficulty. The urban-rural difference is sharply significant ($p = 0.001$).

Readiness to adopt. 58.6% of respondents declared high readiness for AI integration. Dentists from urban areas reported high readiness in 93.8% of cases, compared to 60% in rural areas ($p < 0.001$). The urban-rural digital divide is one of the most consistent findings of the study.

Use of digital tools. 80.5% of dentists already use digital technologies (scheduling software, data transfer platforms, e-learning). In urban areas: 91.5%; in rural areas: 62.8% ($p < 0.001$).

Interest scores (constructed through PCA). Four synthetic scores describe dentists' attitudes: moderate maladaptation (median = 3.08) - reflecting the preservation of human involvement and scepticism toward full automation; moderate-low simplification (median = 2.53); high desire to reduce procedural time (median = 3.54); and moderate-low emphasis on data security versus costs (median = 2.44).

Conclusions. Romanian dentists manifest a conditional acceptance of artificial intelligence: they accept it where it supports clinical reasoning without substituting professional judgment and without diminishing the therapeutic relationship. There is a significant digital divide visible across the axis of age, experience and practice setting, which calls for targeted continuing-education policies and investments in the digital infrastructure of the areas where these are needed. The study also proposed a conceptual model that articulates the benefits (diagnostic accuracy, predictive planning, workflow optimization, savings) and the vulnerabilities of artificial intelligence (data security, algorithmic bias, legal aspects, technological dependence) at the level of the macro-system, managerial, micro-system of the practice and dentist-patient-administrator relationship.

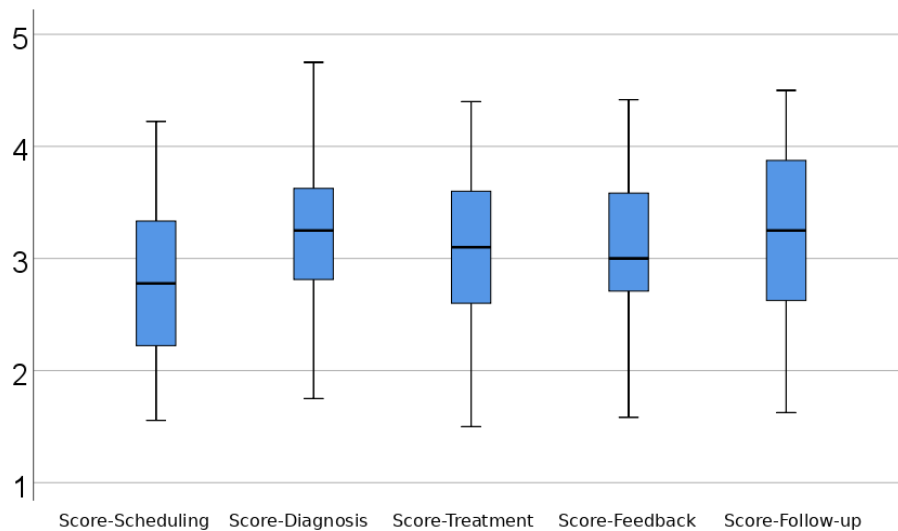


Figure 6.1. Interest scores across subdomains of the patient pathway - dentists' perspective ($N = 200$). Diagnosis and follow-up register the highest scores (median = 3.25), followed by treatment planning (3.10) and feedback (3.00). Scheduling - with the lowest score (2.77) - reflects a more limited concern with the administrative aspects of the clinical workflow.

Chapter 7. Administrative perspectives on digital workflow transformation and artificial intelligence implementation in dental healthcare units

The second original study explored the perspective of 200 managers of dental units in Bucharest and surrounding areas. Published in *Dentistry Journal* (2026, MDPI), an ISI-indexed journal with an impact factor of 3.1.

Demographic profile. The average age of managers varied significantly with the use of digital tools: active users had a median of 37 years (IQR = 33–41), while non-users - 42 years (IQR = 36–47); the difference is significant ($p = 0.002$). In urban areas, 99.4% of managers used digital tools, compared to 74.1% in rural areas ($p < 0.001$).

Subdomains of the patient pathway. The highest interest scores were observed for scheduling (median = 3.33; IQR = 2.91–3.78) and follow-up (median = 3.60; IQR = 2.80–4.00). The lowest score was for feedback (median = 2.83). This pattern is distinct from that of dentists: managers prioritize the areas with immediate operational impact, scheduling and follow-up, in other words, the areas that bring them direct efficiency.

Main statistical associations. Perceived difficulty was significantly correlated both with setting (rural > urban; $p = 0.003$) and with readiness: managers who reported low difficulty had high readiness 6 times more often (84.2%) compared to those reporting

moderate (32.7%) or high (0%) difficulty ($p < 0.001$). The use of digitalization was also strongly associated with low difficulty (73.4% vs. 7.4%; $p < 0.001$).

Interest scores (PCA). Two synthetic scores were identified: the managerial pragmatism score regarding digitalization (median = 2.84; IQR = 2.29–3.44), which reflects the acceptance of digitalization mainly for efficiency and control, with resistance to major organizational change; and the interest score for efficiency versus human impact (median = 3.90; IQR = 3.46–4.20), which shows that managers clearly prioritize resource optimization and cost reduction.

The DISC model adapted to the artificial intelligence sector. The chapter proposes an original contribution: applying the DISC model (Dominance, Influence, Steadiness, Conscientiousness) to understand how different managers relate to its integration. D profiles (results-oriented) see technology as a competitive advantage and are willing to pilot; I profiles (relational) act as "ambassadors" of change; S profiles (stability) support colleagues and stabilize processes; C profiles (conscientiousness) are suitable for data governance and algorithmic audit. Balancing the four styles within the decision structures of dental practices is proposed as a strategy for responsible AI integration.

Conclusions. The study outlines the profile of the "digital manager", younger, more technologically experienced, but pragmatic and prudent. Managers' acceptance of artificial intelligence is conditional: they accept the technology when it supports stability and predictability, but show reluctance toward solutions with disruptive potential on the organizational structure or on the direct relationship with the patient.

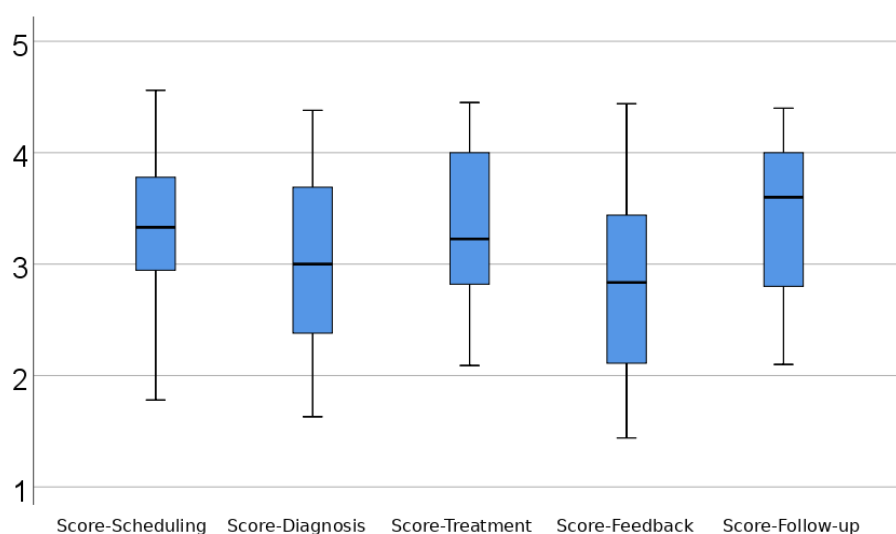


Figure 7.1. Interest scores across subdomains of the patient pathway - managers' perspective of dental clinics (N = 200). Scheduling (median = 3.33) and follow-up (3.60) receive the highest scores,

reflecting the prioritization of areas with immediate operational impact. Feedback (2.83) - with the lowest score, suggests a more limited managerial interest in the qualitative dimension of post-treatment communication.

Chapter 8. The patients' perspective on the integration of artificial intelligence in dentistry

The third study, in finalization and prepared for publication, investigates the perspective of 200 adult patients on AI integration in dental care, closing the research triad of the thesis.

Demographics. The sample included patients aged between 18 and over 70 years, distributed across various educational levels (academic vs. non-academic studies) and setting of provenance (urban-rural).

Subdomains of the dental pathway. The highest interest scores were observed for diagnosis (median = 3.30; IQR = 2.7–3.9) and feedback (median = 3.11; IQR = 2.78–3.67), followed by follow-up (median = 3.00) and the treatment plan (median = 2.86). The lowest score, scheduling (median = 2.70). Interestingly: patients prioritize the clinical and relational areas, distinctly from the operational prioritization of managers.

Level of difficulty. The association with age is strongly significant ($p < 0.001$): patients with low difficulty have a mean age of 35.9 years, those with high difficulty - 58.1 years. The educational level is equally discriminating: 70.8% of those with high difficulty have non-academic studies, and 81.5% of those with low difficulty have academic studies ($p < 0.001$).

Readiness. Also significantly associated with age ($p < 0.001$): patients with low readiness have a mean age of 53.3 years, those with high readiness - 36.8 years. Academic studies are associated with moderate/high readiness (74.7% and 75.3% respectively).

Dual attitudinal profile. PCA identified two key scores. The digital prudence score (mean = 3.28 ± 0.65) reflects a marked level of prudence. The technological sustainability score (mean = 2.98 ± 0.69) reflects moderate-high concerns regarding the durability of AI integration. Both scores correlate negatively with age ($R = -0.260$ and -0.208 respectively; $p < 0.001$), an apparently counterintuitive result: younger patients are more prudent and more aware of financial implications. The explanation lies in higher digital literacy and early exposure to public debates on AI ethics.

Two original conceptual frameworks. The chapter proposes two theoretical contributions. The first is the application of Maslow's hierarchy of needs to the dental patient

in the era of artificial intelligence, with the five levels mapped onto the pathway subdomains: physiological/data security (diagnosis), safety and financial security (treatment plan), social and belonging (follow-up), esteem and recognition (feedback), self-actualization (scheduling). The second conceptual framework proposed is informational VUCA, a model adapted from the VUCA concept (Volatility, Uncertainty, Complexity, Ambiguity) to the informational specifics of AI-mediated dentistry.

Conclusions. The patient is not merely a beneficiary of services: he/she is the experiential connector of the dental triad, the only actor crossing both the administrative and clinical dimensions simultaneously. AI acceptance is conditional, it offers clarity, safety and participation in decision-making, but patients maintain reservations regarding confidentiality, costs, decisional opacity and the diminishing of human contact.

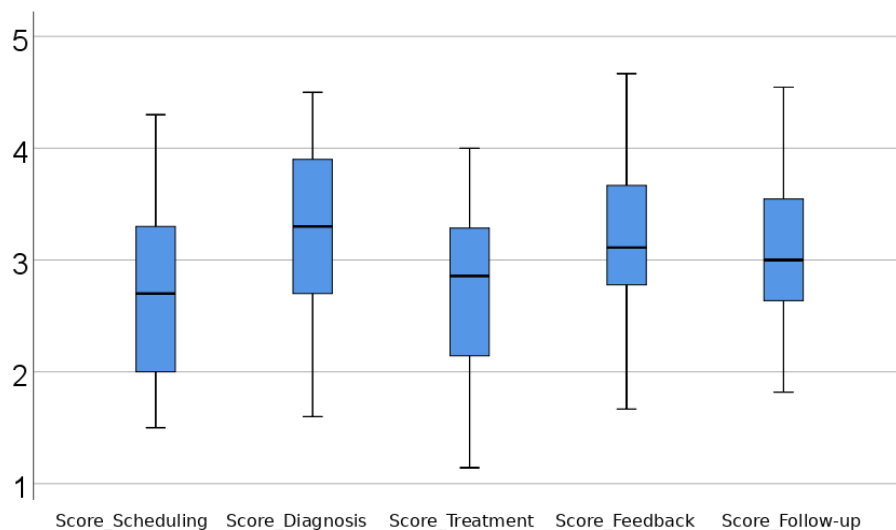


Figure 8.2. Distribution of interest scores across subdomains - patients' perspective (N = 200). Diagnosis (median = 3.30) and feedback (3.11) receive the highest scores, signalling the prioritization of clinical and relational dimensions. Scheduling (2.70) - the lowest score - suggests that patients do not perceive scheduling digitalization as a component with major impact on the quality of care.

9. Conclusions

The doctoral research leads to five main conclusions that reframe the understanding of the AI phenomenon in dentistry.

- Medical information becomes the central object of the transformation. The three perspectives value the same informational reality differently: clinically (the dentist),

organizationally (the manager), identity-wise (the patient), and intelligence adds values previously less visible: scientific, commercial, strategic.

- The classical paradigm of medical professional secrecy is necessary, but insufficient. The protection of information can no longer be reduced to the dentist's discretion. Professional secrecy must be understood as a distributed institutional architecture, built through the interaction of professional conduct, organizational policies, technological infrastructure, informed consent and the legislative framework.
- Artificial intelligence is the fourth functional element of the dental ecosystem, alongside the dentist, the manager and the patient, but with a different status: a technological actor, without consciousness or its own will, through which design decisions, commercial interests and standards formulated outside the clinical relationship enter the practice. Responsibility is not transferred to the algorithm, it is redistributed among the actors.
- Acceptance of artificial intelligence is, for all actors, conditional and differentiated. Neither the dentists, nor the managers, nor the patients are simplistically pro or against. Acceptance is easier in the administrative area (scheduling, routine communication, reminders) and considerably more cautious in the clinical area (diagnosis, treatment plan, communication of the decision).
- The patient is the experiential connector of the dental triad, the only actor crossing both the administrative and clinical dimensions simultaneously. The success of artificial intelligence implementation cannot be evaluated solely through clinical accuracy or administrative efficiency, but also through the coherence of the patient's experience.

10. Personal Contributions

The thesis proposes an integrative framework for the encounter between the dental profession and artificial intelligence, structured in four successive moments: Information, Understanding, Acceptance, Application. These are not technical stages of adoption, but distinct modes of being in relation to the technology. The framework becomes operational when superimposed on the actors' triangle: the dentist bears more heavily the tension between understanding and application; the manager, the tension between acceptance and application; the patient, the rupture between information and understanding.

The maturity of a profession in its relationship with a new technology is not measured by the frequency of use or the volume of investments, but by the moral continuity of the path

through which its actors come to use it. Where the path is continuous, technology supports the medical act; where it is interrupted, it deforms it, however advanced it may be from a technical point of view.

The border between professional secrecy and personal data is not, in the era of artificial intelligence, a line that separates two competing regulatory regimes, but a shared space of responsibility. Keeping the secret no longer means staying silent, it means designing systems that deserve the trust they ask for.

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