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Artificial intelligence in diagnostic dentistry: technology and Islamic ethical compliance

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Abstract

Artificial Intelligence (AI) has advanced in dental diagnostics, improving accuracy, efficiency, and clinical decision-making through Machine Learning (ML) and Deep Learning (DL). However, ethical concerns, particularly those from an Islamic perspective, remain inadequately explored. This narrative review aims to (1) summarise current applications of AI in dental diagnostic practice, (2) discuss ethical challenges of AI, and (3) evaluate these applications through an Islamic ethical point of view. A structured, non-systematic narrative was conducted using a two-stream literature search. The first stream identified peer-reviewed studies on AI applications in dental diagnostics. Meanwhile, the second stream explored Islamic ethics, bioethics, and jurisprudential sources relevant to healthcare technologies. Building on this, searches utilised predefined keywords, with inclusion restricted to English language full-text articles, primarily published between 2015 and 2025. Accordingly, titles, abstracts, and full-text availability were screened for relevance. While AI demonstrates high diagnostic performance in various dental fields, it faces ethical challenges related to data quantity, quality, bias, transparency, generalisability, and clinical integration. In line with this, Islamic ethical principles, particularly the purpose of Islamic law (*Maqaṣid al-Shariah* and *Al-Masadir al-Aqliyya)*, can serve as the primary basis for AI applicability in dentistry. Integrating Islamic ethical values into AI-driven dental diagnostics promotes a human-centred, accountable, and ethically robust approach, ensuring technological rapid expansion aligns with patient safety, social justice, and moral respectability.

Keywords: *artificial intelligence, dental fiqh, diagnostic dentistry, ethical, Islamic perspectives*

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Introduction

Artificial Intelligence (AI) simulates human intelligence through machines and technology, particularly in areas such as learning, problem-solving, and decision-making that typically involve human capabilities. The most common explanation of AI is the development of a computer framework capable of executing human thought, including visual perception, speech recognition, decision-making, and prediction daily problems. AI combines different fields such as medicine, mathematical, and science to solve daily problems. By training on wide prepared data, AI machines performing more complex tasks efficiently, thus making it easier for people handle routine challenges (Ding *et al.*, 2023). Over the years, AI has advanced significantly, integrating clinical datasets into the pipeline of automated AI models, thereby enhancing healthcare performance, particularly in diagnostics. Clinical assistance from AI has been proven to reduce clinicians' workload, improve diagnostic accuracy and aid in decision-making (Akram, 2025; Surdu *et al.*, 2024). In dentistry, which relies heavily on clinical experience, AI addresses this limitation by helping dentists avoid errors and misinterpretations. It also excels in precise detection and classification tasks, thereby enhancing efficiency (Butnaru *et al.*, 2025) and reducing the burden of the conventional human diagnostic approach. For example, AI has been evaluated and demonstrated to perform accurate teeth charting and is also capable of diagnosing the presence of caries (Ezhov *et al.*, 2021, Kabir *et al.*, 2022).

While numerous studies highlight the efficacy of AI in dental diagnostics, others address ethical and legal challenges to its use in clinical applications (El Khoury *et al.*, 2025). Essentially, these challenges can be overcome when clinicians develop AI that aligns with the ethical principles of justice and beneficence, thereby upholding human responsibility in practice (Yunos & Hamdan, 2025). In addition, the AI model's development suggests that patient data and clinicians are closely linked, raising ethical concerns. These include the risk of data manipulation, the clinician's bias in interpreting data, and the lack of transparency in AI development. Notably, Western or secular views often dominate the early stages of AI evolution, where ethical dilemmas frequently arise and are sometimes overlooked in the pursuits of advanced technological models.

As AI is increasingly used in daily life, its plausible performance eventually leads individuals to face dilemmas in which they must choose between trusting technology alone or considering ethical values when using or developing AI. In Islam, the most profound values in Muslim daily life rely on human-to-God (*habl min Allah*) and human-to-human (*habl min al-nas*) relationships (Samsudin, 2018). This concept can also be applied to humans while developing or using AI (Ali *et al.*, 2025). These principles are rooted in *Shariah* objectives such as trusteeship (*Amanah*), justice (*Al-'Adalah*), authorisation (*Isti'zan*), public welfare (*Maslahah*), and preservation (*Hifz*). Thus, whenever human activity adheres to Islamic ethics literally, they prioritise societal benefits and seek Allah's pleasure (*habl min Allah*) (Yunos & Hamdan, 2025). In essence, this attitude is a practice of Islam as a way of life that empowers humans to fulfil their role as servants (*'ibad*) and vicegerents (*khalifah*) on Earth.

While many studies focus on AI advancement, there is a significant shortage of research addressing AI issues related to Islamic ethics. After all, in each step of AI deployment, humans still play a vital role in how the AI process should run. Hence, the reliability and accountability of AI will still be the responsibility and power of humans. However, nowadays, the technological framework has focused on ethical guidelines that did not stem from Islamic teaching. This paper, therefore, aims to provide a general overview of current applications of AI in dental diagnostics while directly exploring them through the lens of Islamic ethics to foster a balanced perspective on technological advancement.

This narrative review consolidates the extant literature on AI applications in oral health diagnostics and their confluence with Islamic ethical considerations. Although the application of AI in the diagnostic field has certain limitations regarding Islamic ethical conduct, clinicians cannot disregard this and succeed in balancing this world and hereafter (*duniawi* and *ukhrawi*).

Materials and Methods

The literature search was conducted by a single reviewer, and all article screening was performed independently. Firstly, all studies relevant to the keywords were screened, and any duplicate titles were removed. The inclusion criteria for this review were limited to only English-language full-text publications from January 2015 to December 2025. All searches were restricted to electronic databases, and no manual search was performed. The literature search used the same keywords throughout all five databases: Scopus, PubMed, Wiley, ClinicalKey, and ScienceDirect. This search implements a structured, non-systematic method since direct "AI dentistry" AND "Islamic ethics" papers are scarce. Therefore, a two-stream strategy was employed, which keywords included "Artificial Intelligence", "Machine Learning", "Islamic ethics", "*Maqasid al-shariah*" and "diagnostic dentistry". Boolean operators (AND/OR) were applied to refine results.

The first stream focused on identifying academic literature on AI applications in dental diagnostics. In contrast, the second stream concurrently explored research on Islamic ethical principles relevant to emerging technologies and healthcare.

First Search Terms:

("artificial intelligence" OR "deep learning" OR "machine learning") AND ("dent*" OR "oral") AND ("diagnos*" OR "detection" OR "screening")

The second stream included "Islamic ethics AI," "Islamic bioethics healthcare," "*Sharia* AI regulation," and Muslim perspectives on technology ethics, enabling a comprehensive exploration of ethical frameworks to AI in healthcare.

Second Search Terms:

("Islamic ethics" OR "*maqasid*" OR "*Maqaṣid al-Shariah*" OR "*shariah*" OR "*fiqh*" OR "*fatwa*") AND ("AI" OR "artificial intelligence" OR "deep learning" OR "machine learning "OR "algorithm*")

The search terms were applied to the titles and keywords in the database in which relevant to artificial intelligence application in dental diagnosis and Islamic ethics with AI implementation. The inclusion criteria for this review were full-text English-language articles from original research, narrative reviews, scoping reviews, and systematic reviews addressing the application of AI in oral and dental diagnosis. The primary dataset types utilised were photos, periapical bitewing, Orthopantomography (OPG), and Cone Beam Computed Tomography (CBCT). All studies are most closely related to disease detection, classification, and comparison of AI-based tools.

On the other hand, articles focusing on non-diagnostic aspects of dentistry would be excluded from the list. Articles were also further screened if they lacked sufficient relevance to the search, were duplicates, or were not full-text available. We also limited the studies to those published within the last 10 years (2015 - 2025) to ensure the review captures only recent, reliable advancements in AI. The search dates refer to the dates on which database searches were executed, and the final search was conducted to ensure inclusion of the most relevant articles from 3 December 2025 to 25 January 2026.

Results

The literature search was done across five databases. Firstly, the first stream only focuses on AI in dentistry diagnostic studies. A total of 144 articles were screened based on the available abstract; these were 8 from ClinicalKey, 13 from PubMed, 74 from ScienceDirect, 39 from Scopus and 10 from Wiley. After eliminating duplicate records and considering the exclusion criteria, only 32 articles remained for further scrutiny (Figure 1).

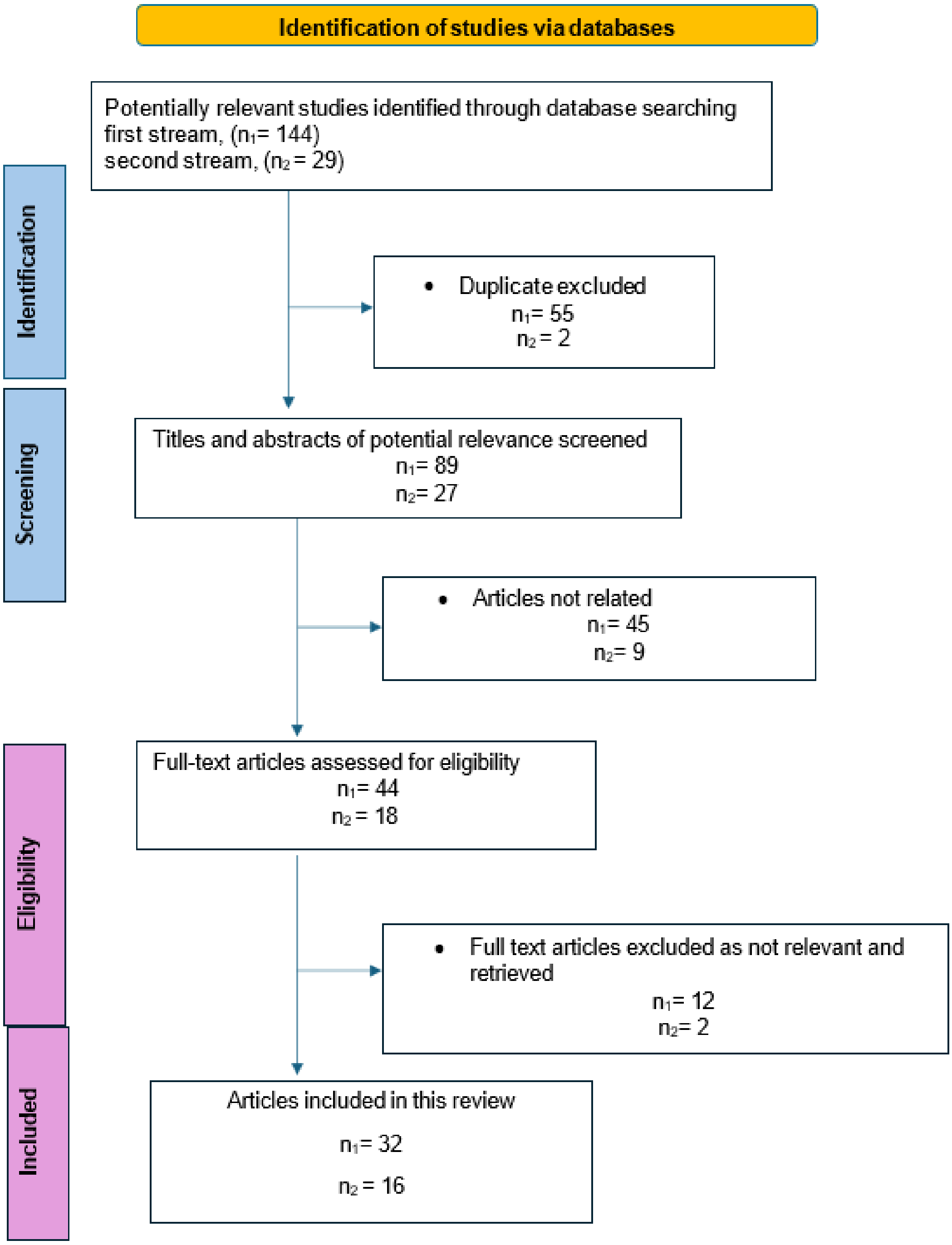

Figure 1. Workflow diagram of search procedure for narrative review.

Discussion

AI in diagnostic dentistry

AI empowers machines to execute tasks that mirror human intelligence through iterative training cycles that focus on data analysis, interpretation, and model deployment. This adaptive learning enables an AI system to identify patterns first, then generate predictions, and eventually evolve with more incoming datasets, all of which significantly advance its role in dental diagnostics machines (Alinazi *et al.,* 2024*;* Shimizu *et al.,* 2022*)*.

AI encompasses several subfields, including Machine Learning (ML), Deep Learning (DL), natural language processing (NLP), and computer vision. Notably, ML and DL are both subsets of AI, also commonly used in dentistry, though they differ in data processing, complexity and learning mechanisms (Table 1). In particular, ML typically relies on simpler networks suited to smaller datasets, with learning patterns predefined mainly by humans. Thus, ML primarily learns from human-guided data, as observed in general daily applications such as spam email detection and weather trend prediction. Conversely, DL is a subset of ML that employs complex multi-layered neural networks, which require large training datasets and substantial computational power. This complex learning is also known as Convolutional Neural Networks (CNN), which can process and integrate all data from various sources such as visual, voice, and text. The examples of daily use of DL includes ChatGPT, Siri, and Gemini (Khattak *et al.*, 2025).

Following this, AI can be further classified into narrow AI and general AI depending on their functions and abilities. Narrow AI performs specific tasks within limited domains, such as data analysis or processing. As it works well with smaller datasets, its algorithms use linear regression, decision trees, and support vector machines. Nevertheless, the selection of criteria and problem formulation depend mainly on human expertise. For example, AI can reduce human error, be a time saver, and enable clinician-independent practice when AI automatically and precisely determines dental impression tray size (Hasan *et al.*, 2021).

Although its efficiency has been proven in various dental specialties, it serves as an adjunct to and assists the clinician's workflow, rather than replacing the dentist's judgement (Lin *et al.*, 2024).

On the other hand, general AI aims to achieve broad, human-like cognitive performance by integrating data across multiple domains. CNN is a model of general AI also known as DL, which demonstrates high efficiency in dental caries diagnosis and anatomical extraction. The key advantage is that it automatically extracts pivotal features from datasets, reducing manual dependence. For example, an AI model can accurately determine the mandibular incisive canal within a short time frame and outperform a clinician's judgement (da Andrade-Bortoletto *et al.*, 2025). Nonetheless, DL requires extensive dataset annotation, substantial computational input, and specialised technical expertise, especially for fine-tuning hyperparameters and neural network architecture.

In AI, both ML and DL can work across various supervision modes, including supervised, semi-supervised, and unsupervised learning (Figure 2). In AI, both ML and DL can work across various supervision modes, including supervised, semi-supervised, and unsupervised learning. As such, supervised learning requires human experts to first label data, such as dental images, as either caries or non-caries. Both ML and DL models are trained to compare their predictions with these known answers. However, ML relies on human-defined patterns and justification, whereas DL automatically learns the features from raw data. Meanwhile, in semi-supervised learning, there will be a small number of datasets with labels and a large number without.

Table 1. Comparison of AI learning for diagnostic study (Khattak *et al.*, 2025; Shujaat, 2025).

Aspect	Machine Learning	Deep Learning	Automated Machine Learning
Definition	Systems learn from data to identify complex, nonlinear interactions and make predictions.	A subset of ML using deep neural networks to learn hierarchical features automatically.	Automates the entire ML application process, from data preprocessing to model deployment.
Relationship	Broad field of AI.	Subset of ML.	Builds upon ML and DL, automates their processes.
Key characteristic	Excels in identifying complex patterns; requires expert oversight for model development.	Automates feature extraction; highly effective for image analysis; requires extensive data and specialised knowledge.	Simplifies complex ML tasks for non-experts; automates steps.
Expertise required	Data scientists/computer engineers for critical tasks like data preprocessing, feature extraction, algorithm selection, and hyperparameter tuning.	Specialised knowledge for fine-tuning hyperparameters and neural network architecture.	Minimal technical expertise required for users, enabling non-experts to create models.
Typical clinical applications	Diagnostics, treatment planning, and prognosis prediction across various domains (Lin *et al.*, 2024).	Dental imaging tasks such as implant classification, caries detection, caries classification, teeth numbering and segmentation of anatomical structures (da Andrade-Bortoletto *et al.*, 2025; Farook *et al.*,2025.; Fontenele *et al.*, 2023; Ghorbani *et al.*, 2025; Kim *et al.*, 2025; Mendes *et al.*, 2025; Negi *et al.*, 2024; Sributsayakarn *et al.*, 2025)	Streamlining workflows, automating hyperparameter tuning, and enhancing diagnostic and predictive accuracy, particularly in image-based diagnostic tasks such as supernumerary, congenitally missing teeth and teeth wear progression (Makrygiannakis *et al.*, 2025; van Nistelrooij *et al.*, 2024).

Limitations	Requires expert oversight; complexity is a barrier to adoption.	Relies on large, annotated datasets, computational resources, and technical expertise.	Reduces interpretability and dependence on extensive, high-quality datasets and can be computationally demanding.

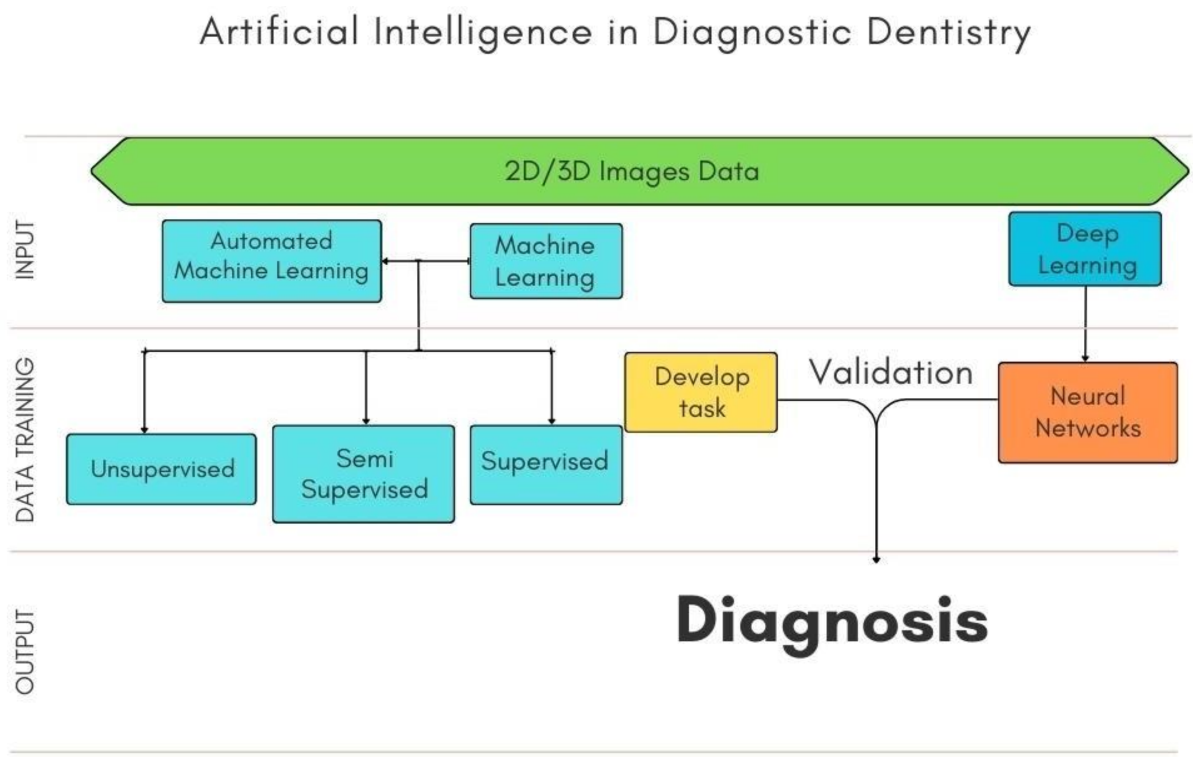

Figure 2. Flowchart of AI concept in diagnostic dentistry.

This improves performance when expert annotation is limited. Moreover, in unsupervised learning, there are no labels, and both ML and DL learn to detect hidden patterns and group data. Essentially, ML really depends on human input, while DL is more autonomous and powerful in analysing complex data, especially in dental imaging (Najeeb & Islam, 2025).

Nowadays, automated machines are gaining popularity in diagnostic dentistry, as their automated systems tune and adapt to optimise model outputs. Unlike conventional ML and DL, which involve time-consuming trial-and-error development and require expert programmer input, automated ML streamlines the process (Bichu *et al.*, 2021; Samaranayake *et al.*, 2025; Shujaat, 2025; Surdu *et al.*, 2024). Additionally, robust patient datasets, including imaging across dental specialities, further improve AI's efficiency in diagnostic precision and optimising treatment workflows (Morise Mahrous *et al.*, 2025). This model demonstrated significant diagnostic accuracy in detecting caries, restorations, implants, and other anomalies. Despite the major challenges of automated ML in dentistry, it lacks transparency in decision-making, which may affect patients, and has limited interpretability. Thus, ML, DL and automated machine learning demonstrate distinct consideration, especially the technical expertise required for developing models and their applicability in diagnostic studies.

AI model deployment

The AI model development process in dentistry can be reflected in how a clinician learns, applies knowledge, and refines judgement, though in a computational manner. It begins with data input, where the AI system receives a large volume of clinically relevant information, either in data or visual form. Notably, dental AI data most commonly consists of clinical photographs, bitewing images, OPG images, and CBCT images. These images serve as the "raw experience" for the system. At the same time, patient demographic or clinical data may be added as contextual information. However, they are not always essential; hence, they are left anonymous. Accordingly, specific models require demographic details and complete patient histories, necessitating informed consent prior to use. Moreover, this stage demands standardised data quality, generalised data feeding, and balanced datasets, whose responsibilities fall to clinicians to ensure reliable diagnostic modelling, especially in disease detection (Shoorgashti *et al.*, 2025).

The second phase of the AI model development is the training phase, which is the most crucial step and requires significant human skill and refinement. At this stage, experts annotate or label datasets to identify features that are important for recognition. Correspondingly, AI learns by noticing common visual characteristics such as shapes, outlines, colours, and surface details. The system eventually becomes better at recognising patterns after dataset iteration and mathematical rules are used for correct diagnosis.

To improve the efficiency and accuracy of the newly developed model, dataset augmentation is recommended, particularly when the data sample size is limited. Techniques such as blurring, skewing, rotating, and adjusting image parameters can help generalise the datasets to different data variations (Ghods *et al.*, 2023). Note that the AI models do not memorise images. Rather, they learn by statistical relationships between visual features and diagnostic outcomes using mathematical functions. Nevertheless, excessive data augmentation during training may introduce unintended bias and fail to accurately reflect real clinical conditions, increasing the risk of 'overfitting'.

AI learning is refined during model optimisation, an iterative process in which the AI makes predictions, compares them with expert-labelled "ground truth" and quantifies its errors. Using these errors, the system automatically adjusts its internal parameters to reduce mistakes. Over many cycles, this process improves key performance metrics, *i.e.*, accuracy, sensitivity, and specificity. This stage is analogous to clinical calibration and audit in human practice. Concurrently, the human role in this process involves validating the AI's diagnostic outputs and rectifying discrepancies that arise, ensuring the clinical relevance and safety of the AI-driven method. In line with this, an AI model must meet predetermined performance criteria prior to being used in a clinical workflow. Hence, a pilot study is required.

Finally, in the clinical stage, the AI model is tested to predict or diagnose new, unseen real-world datasets. Instead of providing a simple yes-or-no answer, the AI typically produces probability-based outputs, indicating a percentage likelihood of the correct diagnosis. In addition, the outputs are designed to support clinical decision-making by highlighting suspicious findings, prioritising areas for review, or offering a consistent second opinion. This suggests that clinicians account for the final diagnosis and justify it in relation to the patient's clinical manifestations, history, and professional judgement.

AI development challenges in relation to ethical values

To ensure AI model development is not manipulative or overrides human control, ethics are essential. AI development challenges involve clinicians, data and patients (Sitaras *et al.*, 2025). Hence, ethical considerations must address all aspects. For example, clinicians should be fair and trustworthy, using accurate data and unbiased validation to ensure accountability and reliability. In addition, they should also uphold professional ethics by prioritising patient safety and rights. Furthermore, to collect more data for AI development, there may be a temptation to overprescribe radiological exposure in unnecessary cases, which sways clinicians' decisions rather than the patients.

Additionally, data screening and preprocessing are crucial, as imbalances and repetitive patterns exacerbate biases and overfitting, and need rigorous external validation on diverse datasets to demonstrate robustness and prevent diagnostic errors (Cross *et al.*, 2024; Shoorgashti *et al.*, 2025; Albalawi & Abalkhail, 2022; Gracea *et al.*, 2025; Kim *et al.*, 2024). AI pipelines demand excellent algorithms, where the integration of substantial volumes of high-quality, large datasets thus, precise annotations is indispensable for plausible models. In dental diagnostics, while two-dimensional (2D) and three-dimensional (3D) imaging modalities offer unique advantages, they also pose limitations. Specifically, 2D imaging, such as periapical and panoramic radiographs, is readily available and cost-effective. Still, it is often at risk of superimposition and a lack of depth perception, which can potentially lead to misinterpretations in complex anatomical regions (Mallineni *et al.*, 2024). However, 3D imaging of CBCT offers superior resolution for anatomical structures despite higher costs and radiation exposure (Gao *et al.*, 2025; Khattak *et al.*, 2025). Therefore, selecting image modalities must prioritise specific diagnostic requirements, balancing benefits against risks.

AI model evaluation emphasises performance metrics such as sensitivity, specificity, Area Under the Curve (AUC)and predictive values. Human oversight of high-accuracy models demonstrates high reliability and the potential for clinical workflow challenges, such as overfitting, biases from non-standardised data, and real-world limitations (Lal *et al.*, 2025). In essence, human justice confirms the reliability of using AI in diagnosis and being accountable in their clinical judgement, not solely depending on AI output (Albalawi & Albalkhail, 2022; Gracea *et al.*, 2025; Kim *et al.*, 2024; Koçak *et al.*, 2025).

In terms of patient-related ethical considerations, these align closely with standard clinical practice, with a strong emphasis on informed consent, data privacy, and autonomy. These principles are the foundation for fostering and sustaining patient trust in clinicians. First, patients must be well-informed regarding the use of their data, with confidentiality rigorously maintained throughout the AI development process. Furthermore, patients retain the right to withdraw consent or restrict their data's involvement in the data collection stage. For these reasons, upholding patient autonomy and privacy preferences is central to ethical data stewardship (Naeem *et al.*, 2023).

Islamic perspectives and AI in dental diagnostic

The integration of AI in healthcare, particularly in dental diagnostics, necessitates a comprehensive examination through the lens of bioethics principles, which provide a framework to guide AI advancement. However, from an Islamic perspective, the AI framework extends beyond solely technical efficacy to address issues of justice, beneficence, non-maleficence, and autonomy within AI applications. These principles serve as a moral compass, guiding the development and implementation of AI systems to ensure they align with religious values, human well-being, and societal interests, preventing the exacerbation of existing disparities (Kannike & Fahm, 2025).

Source: principles of Islamic ethics

The central sources of Islamic ethics are the Holy Quran and Hadith, which serve as the primary guiding texts for regulating a Muslim's daily life, including the use of AI in health applications. Although the Quran and Hadith contain no direct references to AI, especially a novel issue in the contemporary world, Islamic principles highlight two main concepts: Tawhid and *Ihsan*. Tawhid, denoting the oneness of God, emphasises divine justice and precludes disruptions to social cohesion, exploitation of vulnerable groups, or ethical fragmentation (Mohammed *et al.*, 2025).

In the context of AI, *Ihsan* translates into the ethical imperative to develop AI systems characterised by fairness, transparency, and human-centred design. While these foundational principles offer a broad ethical framework, their practical application to specific AI dilemmas requires further interpretation and jurisprudential reasoning. Following the jurisprudential methodology (known as *Usul Fiqh*), the role of the Mufti and Fatwa comes into play, where they present arguments based on moral and contextual rationales. Further guidance is drawn from *Maqasid al-Shariah*, the five universal principles of Islamic law, which include the preservation of religion, life, intellect, progeny, and property. This offers a holistic perspective on AI's ethical implications. Collectively, these principles provide a robust ethical foundation, moving beyond jurisprudential rulings to foster a comprehensive, cross-cultural approach to AI ethics in healthcare (Mohammed *et al.*, 2025). Following this, *Maqasid al-Shariah* are the higher objectives of Islamic law. At the same time, there are *Al-Masadir al-Aqliyya* (rational sources) and *Al-Qawa'id al-Fiqhiyyah* (legal maxims) that offer additional layers of ethical analysis for complex AI applications. This is also known as the reason-based tools of Islamic jurisprudence, when considerations for rulings are not explicitly stated in the Holy Quran. These include *Qiyas* (analogy), *Istihsan* (preference), *Istishab* (presumption of continuity), *Maslaha* (public welfare), *Sadd al-dharai'* (blocking the means to evil end), and *'Urf* (customary traditions). As such, *Maqasid al-Shariah* serve as the ethical goals of Islamic law, whereas *al-masadir al-aqliyya* and *al-qawaid fiqhiyya* represent the rational mechanisms for implementing those goals in modern, complex contexts. Both *Maqasid al-Shariah* and *Al-Masdir al aqliyya* are pivotal in rationalising the application of AI technologies, as they provide a framework for moral judgements. This approach also prioritises human interests, known as *maṣlaḥa*, as the ultimate purpose of divine order, ensuring the well-being of humanity (Elmahjub, 2023).

Islamic ethics in the AI development for dentistry

As AI development continues to move forward, particularly in dental diagnostics, ethical frameworks must be reassessed to address the increasing use of patient data for training and validation, ensuring alignment with principles like *amanah* (trusteeship) and *maṣlaḥa* (public interest) (Ali *et al.*, 2025; Yunos & Hamdan, 2025). For instance, where patients provide explicit permission, whether informed or written consent, Islamic jurists regard clinicians as exempt from liability for any subsequent harm. Furthermore, the utilisation of patient data for ML training demands scrutiny, particularly emphasising the religious dimensions often absent from secular bioethical discussions. Nonetheless, these frameworks must balance technological advancement with the preservation of human dignity, such as justice (*'adl*), and welfare, to prevent AI from compromising humanity and promote *ihsan* (excellence in ethical conduct).

In addition, AI ethics in dentistry examines human-AI interactions from two key perspectives: firstly, the benefits and potential harms of AI to humans, whether AI improves diagnostic accuracy or raises any potential harm, such as risks of biases and errors (Cannarsa, 2021; Liu *et al.*, 2025). Second, human responsibilities toward these technologies, including equitable participation in AI development and oversight to uphold tawhid-inspired social protection (Yunos & Hamdan, 2025).

Despite these imperatives, AI adoption in diagnostic models faces substantial barriers, including ethical challenges such as algorithmic biases and adverse outputs (Kim *et al.*, 2024; Koçak *et al.*, 2025), legal implications on data privacy (Naeem *et al.*, 2023), and integration issues such as high costs and incompatibility with existing infrastructures (Cannarsa, 2021; Liu *et al.*, 2025). To prioritise patient safety and trustworthiness, the following four core guidelines, informed by Islamic ethical sources like *Maqasid al-Shariah* and trustworthy AI principles, are essential:

1. AI must not introduce new risks or compromise patient safety, prioritising *hifz al-nafs* (preservation of life) (Mohammed *et al.*, 2025; Yunos & Hamdan, 2025).
2. Continuously testing, validating, and monitoring algorithms to mitigate biases and errors that could harm outcomes, embodying *maslahah* (Cannarsa, 2021).
3. Transparent AI development processes to foster accountability and reduce harm, aligning with demands for explainability (Naeem *et al.*, 2023).
4. Adherence to patient autonomy and informed consent (*isti'zan*), ensuring willingness to participate without coercion (Yunos & Hamdan, 2025).

These guidelines provide a practical bridge between Islamic jurisprudence and the deployment of modern AI, necessitating interdisciplinary efforts for robust implementation. Building on this, a human-centred approach to AI systems is vital, ensuring that clinicians and patients are actively involved in the development and evaluation of these systems. We can conclude that these guidelines align with primary Islamic ethical considerations: *Isti'zan* (autonomy), *al-amanah* (act with integrity), *al-adl* (fairness), and *mas'uliyyah* (transparency and explainability).

Integration of AI in dental diagnostics and Islamic perspectives considerations

The integration of AI into dental diagnostics offers transformative opportunities alongside complex ethical challenges, necessitating rigorous evaluation through an Islamic moral framework. This involves scrutinising AI development and deployment in dentistry to ensure alignment with core principles. This includes Maqasid al-Shariah, data governance, research objectives, and societal outcomes, thereby preventing bias, ensuring equity, and upholding human welfare

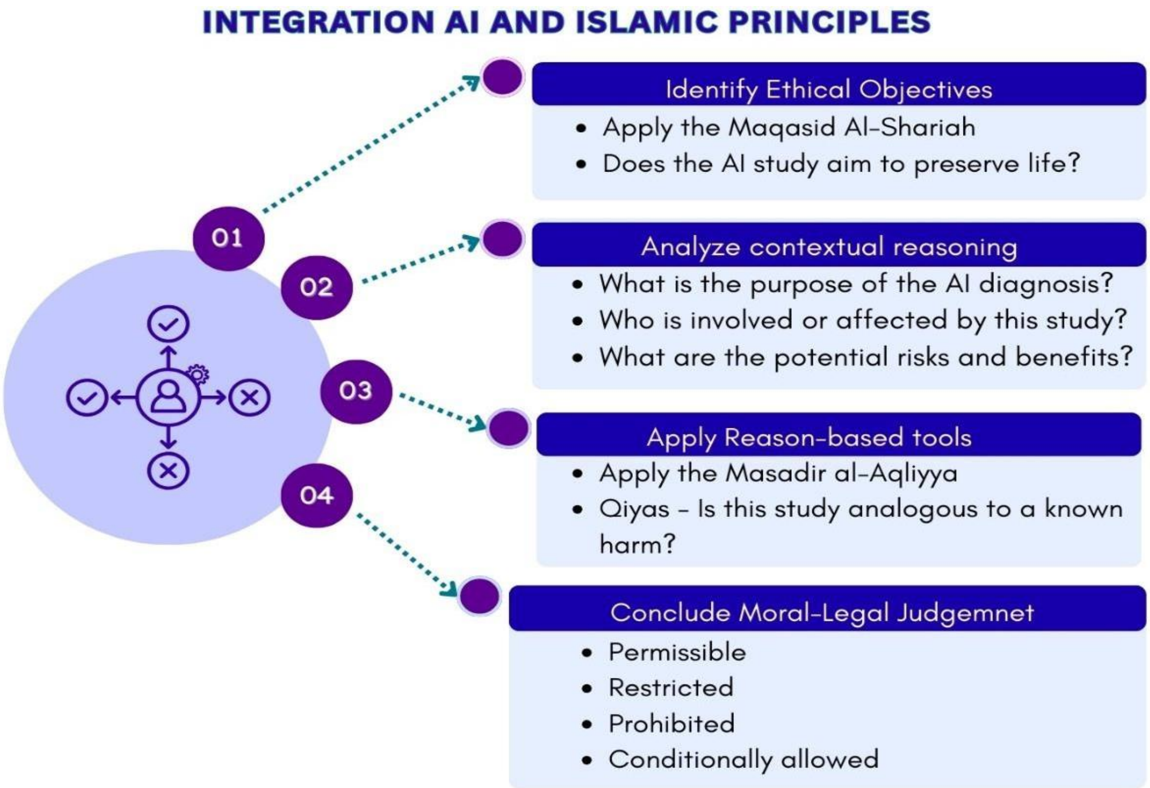

Figure 3. Islamic principles application in AI study.

There is a structured ethical framework (Figure 3) based on Islamic jurisprudence that can serve as a means to ensure that AI practices remain permissible (Ali *et al.*, 2025; Elmahjub, 2023; Yunos & Hamdan, 2025).

1. Objective Identification *via Maqasid al-Shariah*: Align AI applications with the preservation of life (*hifz al-nafs*), intellect (*hifz al-'aql*), and progeny (*hifz al-nasl*), prioritising human welfare (*maslahah*), and preventing harm (*la darar wa la dirar*), as emphasised in Islamic law's higher objectives (Ali *et al.*, 2025; Elmahjub, 2023; Yunos & Hamdan, 2025).
2. Contextual Analysis of AI Development: Evaluate data governance, including transparency, algorithm generalisation across diverse populations, and hyperparameter controls to mitigate biases and ensure fairness. This is particularly critical in dentistry, where unrepresentative training data can lead to discriminatory diagnostics (Koçak *et al.*, 2025; Naeem *et al.*, 2023; Yunos & Hamdan, 2025).
3. Implications Assessment Using Reason-Based Tools: Apply *Qiyas* (analogy), *Istihsan* (juristic preference), and other *al-masadir al-aqliyyah* (rational mechanisms) to any latest AI dilemmas, such as opaque decision-making or error-prone outcomes, adapting textual sources to modern contexts (Ali *et al.*, 2025; Yunos & Hamdan, 2025).
4. Final Moral Ethical Judgement: Identify AI's societal impact against *Tawhid*, *Ihsan*, and *maslahah*. This stage confirms no disruption to social cohesion or exploitation, deeming the study permissible only if it advances well-being without ethical fragmentation (Ali *et al.*, 2025; Elmahjub, 2023; Yunos & Hamdan, 2025).

This dynamic, multi-stage process bridges foundational texts, jurisprudential tools, and practical safeguards (Figure 4). It fortifies AI innovation in dentistry against ethical pitfalls, fostering trustworthy, human-centred technologies that align with Islamic imperatives (Cannarsa, 2021; Yunos & Hamdan, 2025).

Conclusions

This demonstrates that AI has reached a level of technical maturity that enables meaningful contributions to dental diagnostics. However, model development requires human oversight to ensure it remains tied to ethical conduct. Ultimately, AI models are operated and shaped by human adoption and decision-making. Therefore, human-centred tools must comply with specific ethical guidelines, which Muslim clinicians should oversee.

Thus, an integrated framework ensures continuous governance of AI development and clinical deployment in dental diagnostics, grounded in Islamic ethical principles. It begins with the acquisition of clinical data under *Isti'zan*, ensuring the ethical collection and preservation of patient dignity. Following this, AI data processing incorporates ethical safeguards based on *al-adl*, *al-amanah*, and *mas'uliyyah*, demanding balanced, high-quality datasets and ethical training to minimise bias and errors. In addition, generated diagnostic outputs require mandatory clinician review and adjustment, affirming human moral and professional accountability. It also concludes with an Islamic ethical appraisal that identifies pertinent *Maqasid al-Shariah*, assesses the clinical context, and applies rational sources (*al-masadir al-aqliyyah*) to inform judgments grounded in *Tawḥid*, *Iḥsan*, and *maṣlaḥah*. In summary, these principles position AI as a supportive tool within a human-centred, Shariah-compliant system that fuses technical efficacy with ethical duty. Overall, this operational integration harmoniously blends human and religious ethics, ultimately enabling the fulfilment of the commands of Allah and the human (*nas*).

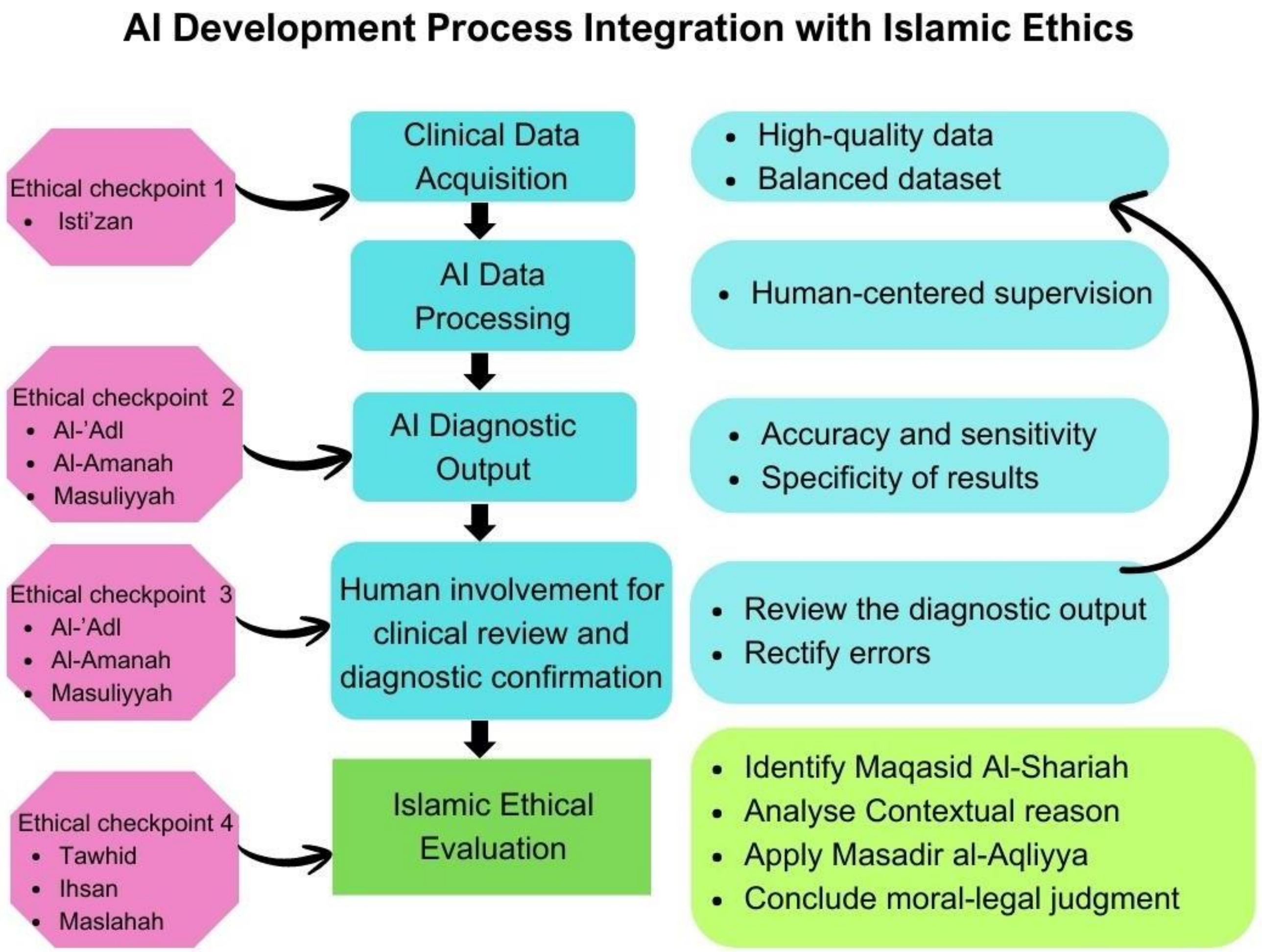

Figure 4. Islamic ethics application in AI development process.

Limitation of the Review

This review has several methodological limitations. As this narrative was intentionally designed as a structured review rather than a systematic review, thereby no formal risk-of-bias assessment was performed prior to article selection. Although a structured search strategy was fully followed, some relevant results may not have been captured due to differences in indexing systems and the constraints of a single reviewer

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