www.sada.co.za / SADJ Vol. 79 No.5
https://doi.org/10.17159/sadj.v79i05.18355

Ethical considerations for artificial intelligence in dentistry

SADJ JUNE 2024, Vol. 79 No.5 P260-262

RD Maart, Riaan Mulder

ABSTRACT

The incorporation of artificial intelligence (AI) is accelerating in the dental field and even patients are catching on to the trend. There is a form of perceived pressure mounting on practitioners to incorporate modern dental equipment and online services to accelerate treatment time or supplement the diagnosis with visual treatment planning. Many of these applications utilise AI as part of the software to process the inserted data. The use of these products in practice presents various ethical dilemmas the clinician would need to mitigate. Practitioners who own or are considering adding applications and equipment that are AI-based to their treatment repertoire have an ethical and legal responsibility to ensure that the best interest and safety of the patient are observed. Patient autonomy and protection of all information become a paramount consideration over and above improving profit or personal gain. By no means could the ethical dilemmas in this communication be exhausted, as the rapid AI innovation and the dynamic nature of technological advances have the potential to raise even more debate. As a fraternity, we need to be vigilant and remain grounded with the basic ethical principles underpinned by autonomy, patient confidentiality/ privacy and the practitioner-patient relationship.

Keywords
Artificial intelligence, ethics, dentistry, autonomy, treatment, diagnosis.

INTRODUCTION

The use of digital workflow and various 3D-based technologies has become synonymous with modern dental practices. Many of the applications and data processing software are based on algorithms and machine learning to achieve the data processing leading to a diagnosis. The incorporation of artificial intelligence (AI) is accelerating in the dental field and even patients are catching on to the trend. The World Health Organization (WHO) also recognises the importance of AI in medicine and identified the elements of risk such as unethical data collection, cyberattacks and malfunctions.[1]

Authors' information
1. Ronel Maart, BChD, MSc, PhD, Senior Lecturer, Department of Prosthodontics, University of the Western Cape, Cape Town, South Africa ORCID: 0000-0002-1560-040X
2. Riaan Mulder, BChD, MSc, PhD, Associate Professor, Department of Prosthodontics, University of the Western Cape, Cape Town, South Africa ORCID: 0000-0002-8722-7632

Corresponding author
Name: Ronel Maart
Email: rmaart@uwc.ac.za

Author's contribution
1. Ronel Maart: First author – writing, review and editing article (70%)
2. Riaan Mulder: Second author – writing, review and editing article (30%)

AI IN DENTISTRY

A recent study asked 265 patients about AI in dentistry. The patients presented with a feeling and expectation of improved diagnostic confidence (60.8%) and anticipate that AI will be well integrated in the dental workflow within 1-5 years (42.3%) and 6-10 years (46.8%). The patients recognise, however, that cost of treatment may increase (31.7%) and that there could be a decrease in the clinician-patient relationship (36.2%).[2]

There is a form of perceived pressure mounting on practitioners to incorporate modern dental equipment and online services to accelerate treatment time or supplement the diagnosis with visual treatment planning. Many of these applications utilise AI as part of the software to process the inserted data. The use of these products in practices presents various ethical dilemmas, with one at the centre that the clinician would need to mitigate:

- How can practitioners ensure that they are using AI applications and products as a supplemental tool in the armamentarium with ethical guidelines at the centre of patient autonomy?

The adoption of new technologies and their place in dental practice is a constant debate. In most cases, it was a debate about advertising the service and the economic outcomes to the patient coupled with the ethical guiding issues. Practitioners who own or are considering adding applications and equipment that are AI based to their treatment repertoire have an ethical and legal responsibility to ensure the best interest and safety of the patient, above the consideration of improving profit or personal gain.[3] With the incorporation of AI applications into the dental industry it could be debated to become a little more grey and less clear-cut due to the abstract nature of our understanding of what exactly AI is. Already, AI and data processing algorithms are incorporated to various degrees in the software and applications clinicians use in dental practice. So the question is when does the clinician become the student and will the clinician even realise they are not the master of the diagnosis anymore? These two ethical and, some might say, philosophical questions are at the heart of the user training, clinician-patient relationship and potentially other issues described in this communication.

AI-GENERATED DIAGNOSIS

For a new technology such as an instrument or material, it is easier to ask: where is the evidence that it is better than the instrument/material I am currently using? In some cases, it could take years for adoption and the generation of "sufficient evidence" with well-structured academic centred research that excludes case reports. With AI it is more subtle and, in some cases, more obvious. There could already be AI applications in the dental practice where the clinician needs to realise that they are "less in

https://doi.org/10.17159/sadj.v79i05.18355

control" and must mitigate the potential pitfalls. This is an ethical predicament for the clinician to realise that they are becoming the student and no longer the master that leads to the AI application generated diagnosis. Just because the AI application say so, does not mean it is so.[4] When the clinician considers the possibility, for example, of offering AI-generated services to their patients such as CBCT DICOM volume reports – based on AI applications that "identify" and, to a large extent, then "offer a diagnosis" for various items in the CBCT DICOM volume – the practitioner's skill and diagnostic prelude must be able to identify and critically evaluate the "offered diagnosis" as an adjunct to their diagnosis made previously. The clinician should not be reliant on the AI application to make the diagnosis and generate the radiological report. If the clinician perceives AI as a whole as a tool to progress their diagnostic accuracy and treatment options and not to provide the answer to the diagnostic/treatment plan questions, then the clinician will remain the master.[5] Ethically the clinician should perform a radiographic diagnosis and report before the DICOM volume is uploaded to an AI application for "diagnostic purposes". In medical radiology clinicians are required to first assess the accuracy of the curated data that is provided to the AI application.[6] This continuation of best practice in the dental field will also ensure the clinician remains the master and the AI application becomes an adjunct to the diagnosis, since the clinician always remains responsible legally and clinically for the diagnosis and treatment plan.

PATIENT DATA

Clinicians should be careful to upload their patient DICOM volume to AI applications using the data to additionally perform AI self-training. Some AI applications outsource the diagnosis and treatment plan to a community of application user-clinicians and this already is an ethical dilemma. This is not only happening with radiology applications but also with intra-oral scans serving as digital impressions and DICOM volumes of patients being sent to off-site centres where the diagnosis is made and a provided treatment plan with appliances are manufactured, with the clinician then subsequently providing the treatment. Patient autonomy with the patient's right to self-determination, confidentiality and the clinicians' expertise to provide treatment.[7] Moreover, this practice reduces the dentist-patient communication and shared decision-making that follows the "traditional" diagnosis and treatment plan. Therefore, negative impacts of AI in clinical dentistry include less communication and humanistic care[8] through the clinician being perceived to be more removed from the treatment plan.

The development of AI applications and their improvement rely on computer information, data protection, date extraction quality, reliability of the data and data sharing as methods to ensure continuous development for AI application deep learning. This poses ethical barriers to the clinician and developers as patients' medical and personal protection of information are the main concerns in clinical dentistry[8] and regulated by country laws such as POPIA. Application developers should be guided by skilled clinicians to ensure the training of the AI applications commences only from validated and accurate training data and that continuous "deep learning" does not occur in real time from patient DICOM volumes without validated diagnoses. This can be ensured by using AI applications that subscribe to compliance and protection of patient privacy through initiatives such as the Health Insurance Portability and Accountability Act (HIPAA)-compliant storage systems.[6]

FIRST DO NO HARM

Apart from the fact that the clinician should be firmly rooted in the principle of "primum non nocere" – "first do no harm" – it is imperative the clinician realise their own limitations if the AI application is providing diagnosis and treatment options outside the skillset of the clinician. Additionally, the conundrum of the clinician not recognising the inaccuracies generated by AI applications becomes an ethical issue as well since the clinician would have failed the patient. The potential harm of any diagnosis/treatment must be recognised by the clinician and the patient must be appropriately referred. The practitioner should continue to work within their training of expertise and scope that allow the effective and safe treatment/diagnosis of a patient. AI should not become a tool to venture outside the training and area of expertise, as defined in the Scope of the Professions of Dentistry under the Health Professions Act, 1974.[9] The Health Professions Council of South Africa (HPCSA) guidance is set out in the following Ethical Rule 21, Performance of Professional Acts: "A practitioner shall only perform, except in an emergency, a professional act for which he or she is adequately qualified and sufficiently experienced." In cases where a practitioner is not adequately qualified and sufficiently experienced, the practitioner "shall not fail to communicate and co-operate with appropriately qualified health practitioners in the treatment of a patient." [9] A statement was released by multiple radiology societies regarding AI in radiology and there is "an increasing need to critically evaluate claims for its utility and to differentiate safe product offerings from potentially harmful, or fundamentally unhelpful, ones".[10] Outsourcing diagnosis and treatment plans is already an ethical consideration with the sharing of 3D scans of patient occlusion being sent to off-site centres where the diagnosis is made and appliances manufactured, with the clinician then subsequently providing the treatment. Patient autonomy with the patient's right to self-determination and confidentiality should always be observed by the clinician.[7]

The clinician provides and remains responsible for treatment, irrespective of what outsourcing or AI applications were used to arrive at a diagnosis and treatment plan. The onus falls on the clinician being able to make informed and evidence-based treatment plans. It is the clinician's responsibility to attend accredited continuous professional development (CPD) refresher courses, seek HPCSA-accredited postgraduate courses and to stay abreast of evidence-based dentistry from high quality peer-reviewed scientific research to ensure that the treatment provided is truly evidence-based and constitutes ethical practice.

CONCLUSION

Ultimately, the clinician's treatment recommendations (with and without specialist referral) to the patient are based on holistic consideration of the patient. This will ensure the net benefits of available treatment options and the patient compliance with treatment can result in a successful clinical outcome.[11] Considering the exponential rise of AI applications in clinical dentistry, the following ethical dilemmas were highlighted:

- Protection of the patient's personal data, medical data and the related privacy are at risk.
- Limitation of the decision-making from the dental practitioner using AI to aid diagnosis and treatment

www.sada.co.za / SADJ Vol. 79 No.5
https://doi.org/10.17159/sadj.v79i05.18355

planning.
- Limitation of dental practitioner and patient shared decision-making process.
- Threat to the "humanness" between the practitioner-patient
- Increased synergistic impact and role of AI application/ equipment manufacturers for clinical practice.

By no means could these ethical dilemmas be exhausted, as the rapid AI innovation and the dynamic nature of technological advances have the potential to raise even more debate. As a fraternity, we need to be vigilant and remain grounded with the basic ethical principles underpinning autonomy, patient confidentiality/privacy and the practitioner-patient relationship. During Covid-19, we were challenged with ethical dilemmas and suggested the moral theory and virtue of ethics that includes characteristics such as integrity and discernment to be considered.[12] In light of the AI ethical challenges and rapid evolution, it is suggested that we consider the moral theory and virtue of ethics to guide clinical practitioners.

Conflict of interest
The authors declare no conflict of interest.

REFERENCES

1. van den Heuvel M. WHO Offers Recommendations for AI Guidelines in Healthcare. 2023; [cited 2024 01/04]. Available from: https://www.medscape.com/viewarticle/998216?ecd=mkm ret 231111 mscpmrk-OUS IntStories etid6040496&uac=208239MR&impID=6040496
2. Ayad N, Schwendicke F, Krois J, van den Bosch S, Bergé S, Bohner L, Hanisch M, Vinayahalingam S. Patients' perspectives on the use of artificial intelligence in dentistry: a regional survey. Head Face Med. 2023; 19(1): 23
3. Health Professions Council of South Africa. Guidelines for good practice in the health care professions. Ethical and Professional Rules of the Health Professions Council of South Africa. Government Gazette R717/2006 Booklet 2. Professional Conduct & Ethics [Internet] 2008. Available from: http://www.hpcsa.co.za/conduct/Ethi
4. Morris ZS, Wooding S, Grant J. The answer is 17 years, what is the question: understanding time lags in translational research. JR Soc Med. 2011; 104(12):510-20
5. Hofmann B. Is there a technological imperative in health care? Int J Technol Assess Health Care. 2002; 18(3): 675-89
6. Hosny A, Parmar C, Quackenbush J, Schwartz LH, Aerts HJWL. Artificial intelligence in radiology. Nature reviews. Cancer. 2018; 18(8): 500-10
7. Health Professions Council of South Africa. Ethical guidelines for good practice in the health care professions – Protecting the Public and Guiding the Professions in the Health Care Professions [Internet]. HPCSA; 1-335. Available from https://www.hpcsa.co.za/Uploads/Professional_Practice/Ethics_Booklet.pdf
8. Huang YK, Hsu LP, Chang YC. Artificial intelligence in clinical dentistry: The potentially negative impacts and future actions. Journal of dental sciences. 2022; 17(4): 1817-18
9. Health Professions Council of South Africa. Health Professions Act, 1974. Regulations defining the scope of the Profession of Dentistry. Government Gazette No. 31958 R238/2009. [Internet] Available from: https://www.gov.za/sites/default/files/gcis_document/201409/319582389039.pdf
10. Brady AP, Allen B, Chong J, Kotter E, Kottler N, Mongan J, Oakden-Rayner L, Pinto Dos Santos D, Tang A, Wald C, Slavotinek J. Developing, Purchasing, Implementing and Monitoring AI Tools in Radiology: Practical Considerations. A Multi-Society Statement From the ACR, CAR, ESR, RANZCR & RSNA. Journal of the American College of Radiology. JACR. 2024; S1546-1440(23): 01020-7
11. Pethani F. Promises and perils of artificial intelligence in dentistry. Aust. Dent. J. 2021; 66(2): 124-35
12. Maart R, Mulder R, Khan S. COVID-19 in dentistry – Ethical considerations. South African Dental Journal. 2020; 75(7): 396-99