

CED Resolution

Artificial Intelligence in Dentistry

NOVEMBER 2020

I – Introduction

The Council of European Dentists (CED) is a European not-for-profit association which represents over 340,000 dentists across Europe. The association was established in 1961 and is now composed of 33 national dental associations from 31 European countries.

Artificial intelligence (AI), machine learning or deep learning are terms that are interchangeably used to describe the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings.¹ AI is also increasingly applied in healthcare, and dentistry is no exception. It includes a wide range of methods and applications which are meant to provide more precise and objective decisions.

Promotion of AI and exploitation of the big data potential have been identified as one of the top priorities of the current European Parliament and the new European Commission. With a significant amount of funding foreseen in the next EU budget, and private investments that would optimally lead to 20 billion EUR annually over the next decade, AI has clearly become one of the most strategic technologies that can transform healthcare.²

Despite the AI revolution being underway, the ethical and regulatory framework to take into account the development of AI is not yet in place. In particular, there is a potential lack of clarity about where the responsibility in the decision-making process lies.

As stated by the World Health Organisation, ‘digital technologies, machine learning and artificial intelligence are revolutionizing the fields of medicine, research and public health. While holding great promise, this rapidly developing field raises ethical, legal and social concerns, e.g. regarding equitable access, privacy, appropriate uses and users, liability and bias and inclusiveness.’³

National health regulatory systems currently do not fully take into account the rapid developments in new technologies and AI. To encourage confidence in AI systems amongst the profession, there needs to be clarity about who is liable for AI failure and misdiagnosis. The limits of the dentist’s liability when using AI have to be clearly defined.

AI has also become an area of strategic importance for the European Union, and the attainment of objectives listed in the European Commission’s Communication⁴ such as ensuring an appropriate ethical and legal framework and preparation for socio-economic changes should be accelerated as the AI-revolution is taking place while the system is unprepared.

With the Digital Single Market Strategy, the European Commission has put forward the Ethics Guidelines for Trustworthy AI developed by the High-Level Expert Group on Artificial Intelligence.⁵ The Guidelines list several principles such as non-discrimination, transparency, safety, accountability etc. to be fulfilled by the public and private sector, when uptaking up AI technologies. Given the crucial importance of ethics in healthcare, the CED supports the development of guidelines and calls for measures facilitating implementation and compliance.

Role of AI

Algorithms can help dentists in making diagnoses, guided by the principles of patient-centered health care, but they should never replace them in this task. In healthcare, trust and empathy are of crucial importance; they cannot be replaced. The human factor is particularly relevant for professions such as dentists that are relying on patient trust. Decisions about treatments and detailed treatment planning should also take into account the patient’s understanding of

¹ <https://www.britannica.com/technology/artificial-intelligence>

² <https://ec.europa.eu/digital-single-market/en/news/factsheet-artificial-intelligence-europe>

³ <https://www.who.int/ethics/topics/big-data-artificial-intelligence/en/>

⁴ <https://ec.europa.eu/digital-single-market/en/news/communication-artificial-intelligence-europe>

⁵ <https://ec.europa.eu/futurium/en/ai-alliance-consultation/guidelines#Top>

the importance of oral healthcare, as well as their physical and financial limitations. AI should be a mere tool to this process.

The CED supports the assisting role of AI that can help dentists with diagnosing and suggesting possible treatment options at a faster rate. AI can facilitate the decision-making process by analyzing large amounts of data in a short time.

Application in dentistry

Apart from diagnosis and treatment, the CED recognises the wider potential for the application of AI in dentistry. Patient management in terms of scheduling appointments, other administrative tasks, as well as alerting about the patient's medical history could significantly facilitate the management of the dental practice.

Digital technologies are already widely used in the field of restorative and prosthetic dentistry where computer-aided design and manufacturing technology have generated dental restorations for decades. An example of recent innovation could be AI-driven orthodontics where 3D scans and virtual models allow for fully customised and personalised appliances. In addition, AI application in implantology and endodontics creates even more opportunities for more precise treatment and preventive actions.

Transparency and Liability

As per the Commission's Communication, AI needs vast amounts of data to be developed. Machine learning, a type of AI, works by identifying patterns in available data and then applying the knowledge to new data.⁶ The larger a data set, the better even subtle relations in the data can be discovered. The objective of the Commission is to facilitate the access to data that is a key ingredient for a competitive AI landscape.

In terms of data collection, patient consent must always be obtained, and patients need to be informed about who accessed their medical records and when, ensuring that personal health data is used in a manner which is scientifically sound and ethically acceptable.⁷

The CED stresses a need to ensure algorithmic transparency which would help in understanding exactly how algorithms are making decisions and how to intervene if necessary.

Algorithmic transparency is also crucial to ensure patient and consumer rights to information and explanation of how a decision might have been reached. Clear standards and legally binding assessment criteria to ensure transparency of AI systems in healthcare are needed.

In order to not reinforce the disparities in healthcare related to socioeconomic status or other biases, the data criteria selection must be developed on an ongoing basis and regularly verified. Transparent, clinically validated AI and systematic quality checks could foster the acceptance and trust for AI among the end-users; dentists would need to assess the reliability of the proposed AI decisions according to agreed-upon standards. Software could be validated against a standard database of images (or other diagnostic records) and certified for release only if a minimum level of correct responses is achieved.

In general terms, healthcare professions are regulated by several laws including clear legal obligations when it comes to accountability, liability and patient safety. However, despite the AI revolution being underway, there is currently no such regulatory framework in the context of AI use. The existing EU legislation is not up to date and needs to be adapted accordingly. There is a risk of unregulated individuals using AI technology on patients. CED therefore believes that in order to allow for a confident application and use of AI by dentists, the EU needs to design a robust legal framework on liability, in which it clearly defines liability in case

⁶ <https://ec.europa.eu/digital-single-market/en/news/communication-artificial-intelligence-europe>

⁷ [CED Resolution on Data Sharing as part of eHealth: Workflow, Prescription and Protection](#)

of AI failure and/or misdiagnosis.

Education and CPD

To digitally revolutionize the healthcare system, an educated, well-trained workforce is paramount. Therefore, starting at university level, priority should be given to the implementation of digital skills education into the dental studies curriculum. As part of their professional lives, dentists should address the increased need for improved digital skills through continuing professional development (CPD) arrangements.⁸ Professionals should have the opportunity to undertake courses on algorithm functioning, as well as receiving adequate training on AI tools management, which should be supported by appropriate structures in the practicing environment.

Understanding AI processes and their application is a first step in supporting confidence in AI technologies among dentists.

The explanation of AI methods to the patient is important in terms of patients' right to information. However, it is unlikely that dentists possess detailed technical knowledge. Therefore the role of AI should be limited to a supporting tool which does not affect the dentist's autonomy in the final decision-making process.

AI Implementation

The CED recognises and values the potential of AI in terms of augmenting capabilities, enhancing efficiency and accuracy, as well as reducing costs. However, these benefits can be achieved only with the support of the national health systems over time. AI technologies should be introduced in a well-structured system with a functioning regulatory framework. The workforce needs to be appropriately trained and financially supported during the introduction of AI systems.

The CED acknowledges the difficulty of creating the 'ideal' environment for AI implementation and advocates for early inclusion of dentists in the discussion on the process of health care AI design and development as well as professional oversight over AI clinical validation. Dentists should be represented in the relevant advisory bodies at EU and national level. It would allow the early detection of the most urgent practical challenges, ensure a user-centred approach and allow to adjust it to the needs of dental patients and dentists, instead of creating an additional burden or increasing the cost to dental practices. The involvement of healthcare professionals at the early stages of every discussion on digital technologies in healthcare is a prerequisite in making the system operational.⁹

CED RECOMMENDATIONS

- New digital technologies that use algorithms can help dentists in making diagnosis, but they should never replace them in this task.
- Algorithmic transparency is crucial to ensure the need to respect patient rights to information and explanation.
- Privacy of the individual patient must be safeguarded.
- In terms of data collection, patient consent must always be obtained.
- An educated, well-trained workforce is a paramount to the successful introduction of new technologies into healthcare
- An ethical and regulatory framework is needed. CED calls on the European Commission to design a robust legal framework for liability with respect to the use of AI in healthcare.

⁸ [CED Resolution on Continuing Professional Development of dentists - Update](#)

⁹ [CED Resolution on Data Sharing as part of eHealth: Workflow, Prescription and Protection](#)

- The involvement of healthcare professionals at an early stage of every discussion on digital technologies in healthcare is essential.

Adopted at the CED General Meeting on 20 November 2020