

# Integrated Health Studies Poster

## How Artificial Intelligence in Dentistry Plays a Role in Scientific and Statistical Reasoning and Ethics

A closer look at how the world of artificial intelligence is altering the world of healthcare, specifically dentistry.

### Abstract

This document contains a snapshot into the new world of artificial intelligence and its implications in the field of dentistry, including the scientific and statistical reasonings and its role in health ethics. While new technology can be challenging to implement considering the lack of authenticity and creativity that goes along with it, this poster will provide insight into its applications and the positive and negative outcomes of its use in dental offices.



Image from vecteezy.com (<https://www.vecteezy.com/free-videos/tooth>)

### Statement of Interests

This topic is one of interest to me because I have been exposed to the use of AI in dentistry at the dental practice I work at. The use of CEREC machines and CAD/CAM technology is heavily implemented when making crowns and bridges to minimize the use of messy impression material. The patient database we use also incorporates AI into x-ray images, as shown in the graphic on the right. It shows measurements, suggests treatment plans, tooth/bone loss, etc. This technology is only going to become more and more prevalent as I go through dental school and become a dentist. It is of interest to me mostly because I will have to choose how much or how little I implement AI into my practice. Being exposed to it as early as possible will allow me to assess its advantages and disadvantages and decide if it will benefit my practice and patients or not.

Relating to ethics, some AI tools might not be considered ethical if they completely replace the job of a person, and decrease the creativity involved in creating crowns and other prosthetic devices. Scientific and Statistical reasoning plays a role in AI in the sense that it has great ability to process and analyze vast datasets with incredible speed and accuracy. It can also help providers make confident measurements and cultivate precise dental crowns, implants, and prosthetic devices in the blink of an eye.

### Lit Review and Analysis

#### What is artificial intelligence?

- AI was first coined by John McCarthy in the 1950s and it refers to machines that can imitate human knowledge and behavior. The technology of AI has the potential to improve peoples lives and continuously influence the world (Chen et al, 2020).
- In dentistry, the potential of AI lies in enhancing diagnostic accuracy, improving patient outcomes, and streamlining workflows.
- Can enhance diagnostic precision within the field of endodontics
- Not limited to the field of general dentistry, but extends across dental and oral hygiene specialties (see figure 4)
- Administration can also benefit from its uses, in managing patient databases and information

#### Some uses of AI in the field of dentistry

- Diagnosis and treatment: AI algorithms can assist with classifying and examining patient dental records. This can support dentists in making accurate diagnoses and propose personalized treatment plans (Nissinoff, 2023).
- Use of CAD/CAM systems to cultivate dental crowns, implants, bridges, dentures, etc. Utilizing complex measurements and logarithms to create aesthetically pleasing dental prosthetic devices
- Databases such as Pearl, DentAI, Diagnocat, and ORCA Dental AI which implement AI into their x-ray features which assist dentists in making more informed decisions and improve image interpretation procedures (see figure 3) (Nissinoff, 2023) (Chen et al, 2020).

#### Benefits of AI and its uses in dentistry

- The utilization of AI-based tools could expedite diagnostic processes and grant dentists convenient access to medical and dental history information, essential for tailored patient approaches which is essential for managing patients with complex medical histories (Roganovic et al 2023).
- AI-based technology could mitigate disparities by enhancing access to oral and dental health services in resource-limited settings through applications such as oral cancer, periodontitis, or caries detection (Roganovic et al, 2023).
- Considering sustainability, if AI is employed in preventive measures or early identification of oral/dental disease signs, it could markedly diminish costs and resources involved in therapeutic treatments (Roganovic et al, 2023).
- AI has the power to alter patient engagement, commercial partnerships, and the labor market. AI could be used to improve knowledge sharing by gathering vast amounts of data to build a database of techniques and procedures that can be contrasted with outcomes (Roganovic et al, 2023).
- Improved diagnostic confidence, time reduction, personalized and evidence-based disease management (Ayad et al, 2023).

#### Ethical considerations connected to AI and its affects on patients

- AI should be utilized in dentistry if it contributes to the quality of oral and systemic health, while also being cost-effective (Roganovic et al, 2023).
- Both the patient and the dentist will need to come to a resolution about whether the best course of action involves the utilization of AI-based tools (Roganovic et al, 2023).
- Complete transparency regarding the procedure and how the benefits of using AI outweigh the benefits of not using AI (Chen et al, 2020).

#### Statistical and scientific reasoning associated with AI

- A total of 49.4% of participants reported knowing what AI is; 44.5% reported having basic knowledge of AI principles, and 42.2% know of AI uses in dentistry. The most common AI information source was social media (66.07%) (See figure 2) (Aboalshamat, 2022).

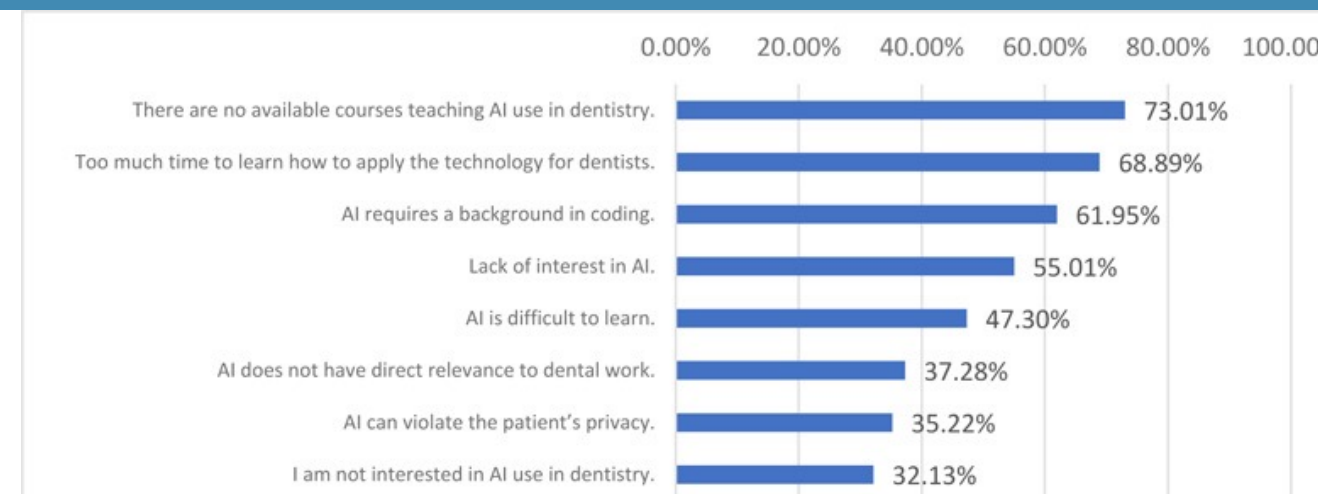


Figure 2. Image from: (Aboalshamat, 2022).

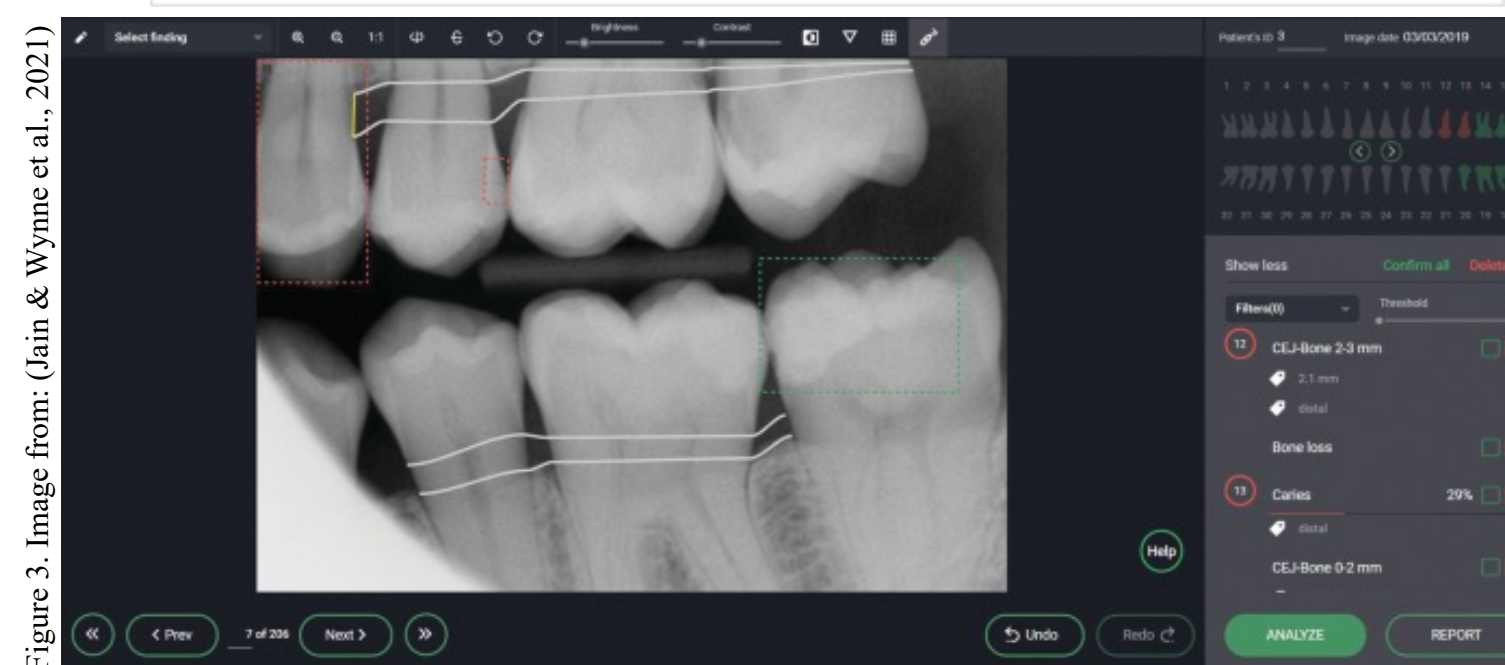


Figure 3. Image from: (Jain & Wynne et al., 2021)

### Conclusion

Research regarding the use of AI in dentistry leads to the conclusion that it overall has a positive outcome on the world of healthcare. The uses of AI are endless, and its implications are only going to increase in the coming years as the world becomes more dependent on technology. The creative aspect of dentistry includes cultivating dental prostheses which could heavily be assisted by AI. However, the creative intelligence and skills that dentists learn throughout their extensive years of education would not be of use if AI took over. Furthermore, the ethical considerations of AI also play a role when determining if a procedure should involve the use of AI. Full transparency with the patient must be advised, since some patients might not want AI to be used for their oral health. As a future dental student, AI and its uses will be heavily implemented during my education. It is good to have early exposure to these technologies since I will likely be utilizing them in my dental practice in the future.

### Implications, next steps, and questions

#### Implications:

- The findings of the studies that have been conducted so far to investigate the use of AI in clinical medicine and dentistry indicate that while there are some very promising futures for this most advanced area of computer use in healthcare, even more intense research and advancements in the field are needed. To develop high-quality automation systems for the development of novel medications and therapeutic approaches, a significant and robust body of research is required.

#### Next Steps:

- To reap the early rewards of this future technology, research must be as closely aligned with clinical practice as feasible. Every patient's medical record should be digitally saved, properly processed, and prepared so that AI algorithms can examine it.

#### Questions for consideration:

- What potential risks or limitations could be associated with having a dental practice that heavily uses AI?
- How can the success of AI be measured to continue to validate its benefits over its drawbacks?
- What data privacy and security measures are necessary when working with AI systems to prevent exploitation against HIPAA procedures and keep patients' information private?

### References

- Awadweh, M., & Dervis, H. Artificial Intelligence (Ai) Application in Dentistry: The Knowledge, Concerns and Challenges Of Syrian Dental Care Professionals. *Concerns and Challenges Of Syrian Dental Care Professionals*.
- Ayad, N. et al. (2023). Patients' perspectives on the use of artificial intelligence in dentistry: a regional survey. *Head & Face Medicine*. <https://head-face-med.biomedcentral.com/articles/10.1186/s13005-023-00368-z>
- Chen, Y. W., Stanley, K., & Att, W. (2020). Artificial intelligence in dentistry: current applications and future perspectives. *Quintessence Int*, 51(3), 248-257.
- Joda, T., Yeung, A. W. K., Hung, K., Zitzmann, N. U., & Bornstein, M. M. (2021). Disruptive innovation in dentistry: what it is and what could be next. *Journal of dental research*, 100(5), 448-453.
- Aboalshamat, K. (2022). Perception and Utilization of Artificial Intelligence (AI) among Dental Professionals in Saudi Arabia. *The Open Dentistry Journal*. DOI: 10.2174/18742106-v16-e2208110.
- Miladinović, M., Mihailović, B., Mladenović, D., Duka, M., Živković, D., Mladenović, S., & Šubarić, L. (2017). Artificial intelligence in clinical medicine and dentistry. *Vojnosanitetski preglad*, 74(3), 267-272.
- Nissinoff, D. (2023). The AI & Dentistry Landscape Isn't That Crowded...Yet. *LinkedIn.com*. <https://www.linkedin.com/pulse/ai-dentistry-landscape-isn-t-crowded-yet-doug-nissinoff-2023>
- Roganovic, J., & Radenković, M. (2023). Ethical Use of AI In Dentistry. *IntechOpen*. doi: 10.5772/intechopen.1001828
- Schwendicke, F. A., Samek, W., & Krois, J. (2020). Artificial intelligence in dentistry: chances and challenges. *Journal of dental research*, 99(7), 769-774.

### Machine Learning in dentistry

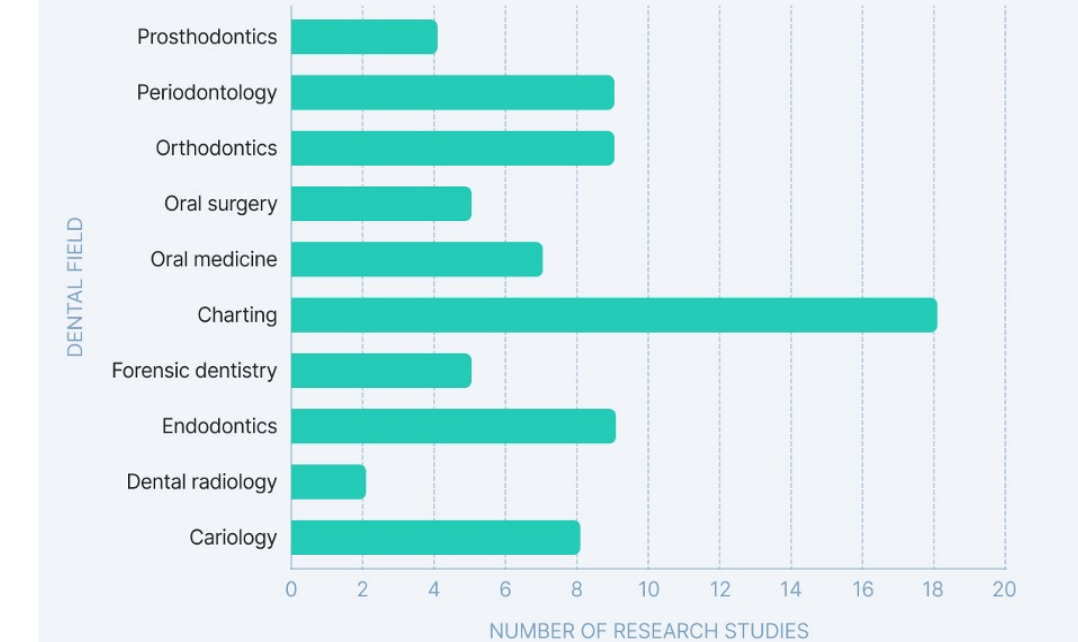


Figure 4. Image from: (Nissinoff, 2023)

### Presenter

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