

TECHNOLOGY AND AI IN DENTISTRY

by

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Abstract

When the word “technology” is spoken, most individuals imagine their cell phones or laptops that they take everywhere. Or maybe they imagine gamers playing Call of Duty for hours on end. Technology is an important aspect of our society, and we place value upon it. The technological advancements in the medical world, particularly in dentistry, have impacted present and future generations. Although dentistry often gets overlooked in the medical world, oral health is incredibly vital for the health of an individual by preventing infections, diseases, and contributing to a better quality of life. Dentistry is ever-changing with new developments and technologies trying to continuously improve the oral health of patients. Understanding how dental technology evolved to where it is today, how the prevalence of artificial intelligence can be beneficial, and how this knowledge can be applied in an office setting is key to improving the lifestyles of dental patients in today’s society and the future.

THE EVOLUTION OF DENTAL TECHNOLOGY

New technology was constantly developed throughout the history of dentistry. From the mass production of toothpaste in 1850 to the invention of the electronic toothbrush in 1939, scientists and researchers are always trying to find a more efficient and thorough way to practice dentistry (Spielman). Technology over the ages of dentistry seeks to optimize the areas of prosthetics, customization, invasiveness, and comfort for the patients. Some inventions were so widespread in the entire dental field that they completely changed the face of dentistry. Digital x-rays instead of film are quicker to develop and expose the patients to lower doses of radiation. Intraoral scanners rather than taking impressions allow for more precision, detail, and comfort for the patient. 3D printing is quicker, more cost efficient, and creates highly detailed customizations of crowns, dentures, bridges, and other oral pieces (Gracco, et al.). Implementing these designs require doctors and other staff members to keep an open mind and be willing to work with new instruments, but if they do, they often find an increase in productivity, patient comfort, and cost efficiency.

THE EMERGENCE OF AI

A new source of technology that has taken social media and the medical world by storm is artificial intelligence. How could AI be implemented in dentistry? Should AI be used in dentistry? The prevalence of this new technology has provoked many questions surrounding the topic. In the article, “AI May Be Just What The Dentist Ordered,” the Harvard School of Dental Medicine interviews medical, dental, and research personnel on their take on the rising popularity of AI in dentistry. One interviewee, the CEO of VideaHealth states, “AI-powered tools are now helping dentists identify dental decay in patients up to five years earlier”

(McAlpine). Being able to identify symptoms of disease and infection five years earlier will help increase prevention in the deterioration of oral health, allow for earlier treatment implementation, and reduce the pain of patients. The director of the Harvard Data Science Initiative states, “Reduced air quality from fires and higher temperatures from warming climate can cause mouths to be drier, making people more prone to oral disease and tooth decay” (McAlpine). AI is capable of comparing data from several different practices, whether that be biological, geographical, demographics, and so on. It is able to identify commonalities in populations and issues that need to be addressed using this wide range of data analysis. AI also analyzes patients and allows for a customizable treatment plan to be produced for each individual based on aspects such as medical history and personal health. Some argue that doctors should already be doing this, but AI can provide another layer of detail and precision for input. Doctors still make treatment plans, but they are able to use extra data and statistics to determine the best possible treatment plan for a patient using the technology. Another big area of AI is its prevalence in prosthetics (McAlpine). AI imaging can even show patients the predicted result after surgery or braces. Being able to show patients what will happen can decrease their anxiety and help them make well-informed decisions.

EFFECTS IN THE OFFICE

Working as a dental assistant, I am in contact with a variety of technological advancements in the office. We keep in mind that many patients feel stress and discomfort when going to the dentist, so we use many tools with the goal of establishing their comfort and lowering their anxiety while also providing the best oral care. We utilize CT scans to produce highly detailed and 3D scans of the jaw, canals in individual teeth, and the entire mouth. This

helps the doctor not only look at certain teeth that might be problematic, but the overall issue that could be fixed. We use lasers to clean the canals of the teeth, which is a much less invasive way of cleaning out decay. How could the addition of AI improve the advanced technology that we currently have? The dentist I work for specializes in endodontics. This means he is typically completing root canals, root canals, and more root canals, so how could he make this process more efficient? AI is able to analyze data from patients to give exact root lengths, precise canal measurements, and even tells the doctor how much force and torque to use while utilizing an instrument (Asgary). My boss is very experienced with root canals, so he does not necessarily *need* this information, however, it would aid him in making quicker decisions and have more exact measurements. Additionally, AI can provide real-time feedback during procedures to increase time efficiency (Asgary). With the patient data the technology can analyze, if something does not go as smoothly as the dentist hopes, a new possible treatment plan can be produced in minutes to save time from trying overall ineffective solutions. The AI is not a dentist, and it can not perform procedures, but it can aid dentists in maximizing their efficiency, customization, and accuracy.

Technology will continue to change, and AI will definitely not be the last great innovation. The use of technology in dentistry is vital for treatment efficiency, precision, and patient comfort. Oral health is an important aspect in every individual's overall health and lifestyle. Technology has the capacity to revolutionize treatment plans, developments of new drugs, and so on. Understanding the past, present, and future of dental technology can help healthcare providers improve their practices and the quality of life of their patients. Adding the influence of ever-developing technology to dentistry is a massive change to the field, but

technology will be a world-changing tool for generations to come. Embracing developments with an open mind is vital to changing dentistry today and in the future.

Works Cited

Asgary, Saeed. "Artificial Intelligence in Endodontics: A Scoping Review." *Iranian endodontic journal* vol. 19,2 (2024): 85-98. doi:10.22037/iej.v19i2.44842.

Gracco, Antonio et al. "Influence of New Technology in Dental Care: A Public Health Perspective." *International journal of environmental research and public health* vol. 20,7 5364. 3 Apr. 2023, doi:10.3390/ijerph20075364.

McAlpine, Kat J. "Ai May Be Just What the Dentist Ordered." *Harvard Medical School*, 30 Nov.

2023, hms.harvard.edu/news/ai-may-be-just-what-dentist-ordered.

Spielman, Andrew I. "Technology in Dentistry through the Ages." *NYU Dentistry*, dental.nyu.edu/aboutus/history/technology-in-dentistry-through-the-ages.html#:~:text=In%20the%20mid%2D19th%20century,resin%20of%20the%20rubber%20tree. Accessed 11 Apr. 2024.