

Artificial Intelligence: The Future in Dentistry

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Abstract

Artificial intelligence (AI) is an area of computer technologies in influencing our lives. These functions by digital use of algorithms to learn data and form statistical patterns to understand the outcomes thus help in decision making. This article reviews the utility of AI in health care in precise diagnosis and better treatment and patient care. It would provide superior quality and comprehensive patient care in dentistry. These innovations would enable dentists to work with precision in all aspects of diagnosis and treatment planning.

Keywords: Artificial Intelligence, Comprehensive care, Diagnosis.

Introduction

The human brain is a complex structure that functions by synchronous activity of the neurons. The longer and faster-acting dendrite along with its faster-acting potential of the neuron during activity determines the intelligent quotient.¹ Newer technologies are continuously made upgraded that would mimic the activities of the brain. Applications that have a virtual imagination, reasoning abilities with auto-learning methodologies and capability of functioning without being manually operated.²

Artificial agency (AI) is defined as the study of intelligent agents, any device that perceives its environment and takes action that maximizes its chance of successfully achieving its goals.³

AI is been used in numerous technological applications like gaming, theorem solving & proving, Image and language recognition along with robotics in

fields like space, satellites & telecommunications. There has been innovation even in the technologies involved in health care applications and services. The conventional method have been replaced by digitalization. Starting from recording data and maintaining records with capacities in recoding relevant data.⁴ They can be widely used for clinical trials and help in treatment planning along with prognosis.

Moreover there are patients who at times doubt the dentists work. So at times this dissatisfaction amongst patients makes them liable to get sued. With the era of computers that work faster with better precision using artificial intelligence, there are chances of better patient satisfaction & care.⁵

Neural Networks: Neural networks are method of information processing which is developed to imitate the brain to concede knowledge and learning. The advantage of artificial neural networks is that this type of system solves issues that are too complicated for standard techniques and people that don't have associate algorithmic solutions or the answer is simply too complicated. Thus are now utilized in diagnostic procedures and health care.⁶

Computer-Aided Detection & Diagnosis: Computer-Aided Detection & Diagnosis software utilizes algorithms in radio diagnosis where computer diagnosis is utilized as an opinion before delivering or confirming the final diagnosis. They provide a differential diagnosis

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for different abnormalities in radio images in various imaging modalities.⁷ Thus digital imaging modalities have enabled the usage of Computer-aided diagnosis in dentistry which is progressing. It was primarily used to determine osteoporosis, arteriosclerosis, and maxillary sinusitis. Though its use even in the detection of dental caries, evaluation of dental and maxillofacial lesions, identification periodontitis and Jaw lesions. Nowadays Computer-aided detection and diagnosis are used in orthopantomography as well as cone beam computed tomographic images.⁸

Augmented reality and virtual reality: Virtual reality utilizes software to create a virtual environment for the evaluation of various anatomical structures for diagnosis and treatment planning. Augmented reality is the process of overlaying an image & creating a three dimensional computed real image that is patient specific to create a virtual working environment. It is found to have an effective role in the dental implants in ensuring decreased risk and better success rates. This system can be utilized to effectively plan pre-surgical, surgical with accurate placement of implants with better healing due to a smaller wound. Even the prediction of the position of the nerve is accurate enabling easy avoiding of the nerve. Similarly, it has application in orthognathic surgeries, dentofacial orthopedics, endodontic and restorative procedures.⁹

Clinical Decision Support Systems: Clinical Decision Support Systems act as a support system for health professionals. As these systems are implanted with various clinical data comprehensions it adjunct's in making clinical decisions by utilizing the patient's data.⁷

Various such applications utilize other applications that provide records case histories and radiographs in recommending the treatment plans as well as the recall visits. They are capable of generating caution for any fatal medical condition, drug allergies. Along with it can provide a treatment protocol with prophylactic antibiotics to such patients. Thus it would simulate the human brain and thinking. This entire clinical decision making is by the stored and available data from previous treatment so all this requires a proper recording of data in a specified format.¹⁰

Merits and Demerits of Artificial Intelligence: Every advancement or technology comes with its good and bad so is this. Though not very evident but artificial intelligence has already starting to take over and is recreating a better future.

Assisting surgeries: Here robots can be used for assisting surgeries along with augmenting nursing faculties

Record Keeping: Maintain a detailed list of the patients along with their histories and treatment administered with subsequent recall and revisits ‘

Diagnosis: They provide an efficient and accurate diagnosis by carefully correlating and comparing with the radiographic features and comparing it with every possible detailed data.

Treatment: Due to the auxiliary assistance and aids the possible treatment time is reduced.

Time-saving: They don't require breaks as they don't get tired or require breaks from work.¹¹

Despite all the advantages, there are certain limitations to the applications:

- Job concerns: as several works is managed it requires less staff so concerns of unemployment
- Initial investment for the application is high because of the expensive software.
- Acceptance by the staff could be difficult along with the lack of efficiency in operating. There are chances of limiting the creativity of the faculties.
- Another important concern is maintaining the privacy and security of the data.¹²

Dental applications of artificial Intelligence:

Oral Medicine & Dentofacial radiology: It can be employed in the diagnosis and treatment of lesions of the oral cavity. Any alteration of the oral mucosa, potentially malignant disorders that are at risk of developing in carcinomas can be easily screened using AI that would be missed otherwise. Assists in evaluating osteoporosis in the panoramic radiographs, also determine the proximity of the mandibular canal, dental biometrics.¹³ Effective in interpreting the radiographs for different radiographic lesions, caries detection, assessment of vertical root fractures, evaluating the developing the tooth development phases. Lately the Cone Beam Computed Tomographic images utilize AI in analyzing the slices. Making interpreting and processing of the images fast and easy.¹⁴

Dentomaxillofacial orthopedics: The initial treatment for analysis done using the photographs

and radiographs can be easily done using an intraoral scanner. They decrease the time and impression making procedures with complete eradication of human errors. The advancement of three-dimensional printers orthodontics casts and models can be made on which aligners can be placed. The Software can suggest the direction of tooth movement along with the pressure points of the tooth. There is a possibility of making digital impressions, thus providing a precise customized treatment planning. They also provide a futuristic outcome of the treatment that the patient can visualize.^{15,16}

Prosthodontics: Computer-aided design/Computer-aided manufacturing helps in scanning and designing restoration along with fabrication without the casting steps. They provide perfect occlusion, margins with contacts.¹⁷ Thus providing ease in fabrication. The ideal esthetics of patient can be analyzed using various factors like anthropological calculations, facial measurements, ethnic variations along with the patient fondness can be incorporated.¹⁸

Oral and Maxillofacial Surgery: Oral surgical procedures can be easily assisted using robotics. This enhances the human skills and prevents any human errors. It helps in treatment planning by decreasing the treatment time and protecting the vital structures simulating a practice surgery thereby increasing the operating accuracy. It even helps in bioprinting of the tissues leading to regeneration of the structures that are damaged.¹⁹

Forensic Odontology: Age estimation plays a vital role in forensic odontology which is utilized widely in identifying individuals in mass disasters. As it's based on radiographic assessment of eruption of tooth comparing radiographs can be easily done by AI. Though the utility of AI in forensic odontology is sparse.²⁰

Conclusion

Artificial Intelligence is the future of dentistry. So it calls for research that understands the algorithms which would enhance the use of it in dentistry. It should act as an adjunct to human skills and we cannot deny the fact that it cannot replace human analyzing skills and knowledge.

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