##  **Artificial intelligence, a boon to dentistry**

## **Cover Letter**

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# Abstract

Artificial intelligence (AI) is emerging as a promising modality and could be anticipated to shape the future of dental health care delivery. It appears that artificial intelligence is the solutions that assist doctors, rather than replace them, and hence are more likely to be accepted by the health care professionals. Artificial Intelligence has several clinical applications and has encompassed almost all the specialties of dental field. The common dental diseases as dental caries, pulpal pathologies, bone loss, cysts, salivary gland disease, lymph node metastasis etc are easily gets diagnosed and well treated with the help of AI as well as robotics. AI and Machine learning has made excellent and impactful way towards the changing dentistry.In dentistry, AI helps in

prediction of future of disease that is prognosis and its treatment planning. Additionally, it will open new avenues in the field of research and development.

#### KEY WORDS:

Artificial intelligence, Machine learning, Deep learning, Dentronics

# INTRODUCTION

Lately, the field of artificial intelligence (AI) is being explored tremendously for possibilities of early diagnosis, appropriate treatment and satisfying outcome. It is considered as an emerging discipline that includes set of sciences, theories, techniques, computer science, and computational neurobiology. Machine learning, deep learning, and cognitive learning are the subclass under the robotic world. It has been known to be progressing rapidly since last decade.It is an intelligence demonstrated with the help of machines (1).In 1956, Dartmouth College first coined the term. Artificial intelligence may have several applications in the healthcare field of medicine as well as in dentistry. Artificial intelligence concerned with computational understanding and emphasizes creation of intelligent machines.AI has made opportunistic route especially to mention in medical, radiology, ophthalmology, pathology, dermatology etc.

The 1950s would be the era where the concept of role of artificial intelligence in healthcare field was recognized. The huge data is collected in day to day practice in dental healthcare, the range of tools and networks used in artificial intelligence may work to some extent as a human mind to handle this data, processed, analyzed to draw the conclusions (1,2). The need for machine assistance has arisen due to piling of healthcare data which can be utilized for clinical applications, evidences, predicting the spread of diseases and research developments using computational technologies based on which various clinical decisions can be taken in relation to diagnosis, prognosis and management(3). Combining oral healthcare with artificial intelligence will pave the way for newer possibilities in dental care of patient. However, utilization of Artificial intelligence requires skilled professionals to handle, and interpret the data under investigation(4).The present review article focuses on the application of artificial intelligence in dentistry.The search strategy primarily included the searches in Pubmed and Scopus to include various

other databases additionally. Artificial Intelligence is considered to have clinical based knowledge in regards to dentistry, its speedy data handling and diagnosis enables its uses in dental field(5). The anticipated applications of artificial Intelligence in various branches of dentistry have gained its importance over a period.

## OVERVIEW

Artificial Intelligence has several clinical applications in each and every field of dentistry. It has encompassed almost all the specialties of dental field(6)Thecommondental diseases as dental caries,pulpal pathologies, bone loss, cysts, maxillary sinusitis, salivaryglanddisease, lymph node metastasis etc are easily gets diagnosed and well treated with the help of AI as well as robotics(7)AI hasmadeexcellentandimpactfulwaytowardsthechangingdentistry.Multiparametric pattern is the computerized method in diagnosis and treatment plan in the field of periodontics, prosthodontics and oral and maxillofacial surgeries(8)AI has made elegant role in the stomatology. Oral and maxillofacial surgeries, oral medicine therapy,pre-prosthetic surgeries, implants etc are possible with the help of AI.AI has made possible avenues in guidance as well as in teaching(9).

Machine learning is the subpart of AI that helps dental graduates in the field of research. In dentistry AI helps in prediction of future of disease and its treatment planning. Automated dental imaging is done very simple with the help of AI(10).AI has tremendous role in clinical research and clinical dentistry. Model data and security data privacy are all the relevant contents under AI. Commercial productions are progressing rapidly in day to day life with the help AI. AI has decreased the workload of general physician as well as dentist with their contributionin routine work(11).AI has improved the decision making powers of human and influences power of human brain in everyday life.AI helps in appropriate diagnosis and superior patient care.Research and development,clinical aspects of dentistry are all include under the AI. With the help of AI, the duration of longer treatments can be reduced(12)AI has parallel term i,e. Dentronics meaning computer science plus dental world that will help to enhance and advance the future dentistry. Diagnosis, prognosis and treatment planning get easy in regards to AI(13,14).Dentronics will help the clinicians and researchers in disease pathogenesis as well as in understanding the concept of lesion or dental defect with satisfying outcomes.Difficulties and misinterpretations will be reduced with the help of AI. Prediction of image, case record,and dental field research gets day by day easy only with the help of AI or

robotic computer science.AI not only builds up public confidence but also helps to get make their interest in the research field and clinical aspects(15)AI has made powerful impact on dentist,dental students and makes their knowledge deeper.

# Specialty wise applications of Artificial Intelligence

#### ORTHODONTICS

Malocclusion is the main domain under the entire orthodontics. So, with the help of AI, clinicians can decide and plan based on AIwhether there is the need of extraction of teeth before treating the malocclusion(16).In the field of orthodontics AI has made tremendous approach that helps the dentist in effective and efficient way.Cephalometricsa part of orthodontics has many applications based on artificial intelligence. AI has play tremendous role in cephalometrics. When we compared the cephalometrics performedby authors as a gold standard;AI cephalometrics gives clinical application and appropriate precision. All in all it plays meticulous role in orthodontics(17).

#### ENDODONTICS

In the field of endodontics, it allows to reveal the finer details as AI helps in such a way that one can determine whether the distal root of mandibular molar has one or more than one canal.This helps in treatment planning as well as in endodontic root canal therapy.

#### PERIODONTICS

Periodontitis is the main culprit in the periodontics and has the two main formsas Aggressive and chronicperiodontitis, AI enabled the finer differentiation between aggressive and chronic periodontitis.So that patient gets diagnosed easily and treated efficiently.

#### ORAL PATHOLOGY

With the help of artificial intelligence any pathological condition gets easily diagnosed and treated.Normal and abnormal structure are diagnosed in a simpler way with the help of AI. Ameloblastoma and OKC have similar clinical and radiographic symptom. At the time of diagnosis AI play its effective role. Using various modality, it has made diagnosis quicker such

as without AI, it use to take longer to diagnose these tumors, now within seconds it will possible to assimilate and interpret data for diagnose and treat ameloblastoma and OKC.

#### ORAL AND MAXILOFACIAL SURGERY

In the field of dental radiology, identification of maxillofacial defects using robotic world has made clear, simple and efficient way to treat the problems(18).Orthognathic surgeries and dentofacial deformities can be very well diagnosed radiologically and treated with the help of AI.

#### PUBLIC HEALTH DENTISTRY

AI has increases the thinking power of public health care professionals. With the help of AI, it is very easy for dental professionals to improve the public health with good results and satisfying outcomes(19).In the future there is the positive correlation between clinical files and AI. AI is the promising tool and every dental and medical has to work under the AI towards progression.

#### ONCOLOGY

AI has made provision for novel approaches in oncologic study,although the applications regarding to oral oncology need to be substantiated(20).AI enabled the elaborated and discrete study regarding oral cancers. In future scientist may progress with the help of AI in the field of oral oncology.

#### ORAL MEDICINE AND RADIOLOGY

The data handling and diagnosis has been easy for highly prevalent oral potentially malignant disorders. The precancerous and cancerous lesions as well as potentially malignant disease are well diagnosed with the robotic tool. With the help of AI, the radiologists are using the updated forms of radiography(21).The intervention of AI has definitely augmented the way the radiology is being practiced nowadays. It helps to detect landmarks as well as pathologies clearly than before. Robotic world is known to have accuracy of 99.5 and sensitivity of 74.9. The side effects of the drugs may be well detected with the help of AI. The great future we can predict with the help of AI. AI makes the upcoming challenges better. Use of artificial intelligence may be crucial in assessing the side effects. The healthier future can be envisaged using artificial intelligence guided new scientific accomplishments in the field of pharmacovigilence.

#### FUTURE WITH ARTIFICIAL INTELLIGENCE

In the upcoming years, there will be a synchronized correlation between clinicians, researchers, human brain using AI(22)Future with the help of AI is a promising tool in the form of practicing dentistry. Not only in dentistry, AI has played very significant role in medicine too. With the help of AI, there will be progressive and remarkable changes in the field of dentistry in near future.AI, Robotics, Dentronoics has creating the powerful impact on human brain. Now days, the Dentronics has gaining attention in clinical as well as surgical field. Dentronics and Robotic Neural Network have greatly influenced the prospective towards the dental and medical world. It has several clinical applications that are essential for oral and dental health. Robotics as well as Dentronics has created the new brain power with respect to health care research. Robotics has several knowledge and information based application in clinical research(23)Machine learning along with robotics and dentronics will keep changing the ideas and content in regards to dentistry as well as in medical field too. Advance dentistry envisaged to highly impact the dental field. Many similar studies has been successfully done in our university with great efforts and determination. Major challenges and difficult work become easy with the help of robotic world and these advanced technology. The people can handle difficult situation in very smartly manner. Machine learning is a basic part of AI. With the help of machine learning, the amazing future can be assumed. AI has various roles in robotics, neural networks, deep learning, record data etc. Machine learning will help the dentist and clinicians in diagnosis as well as in treatment planning. It makes the difficult work very simple. One can do skillful work with the help of machine learning. Machine learning has various scopes in field of AI as well as in health care field. In the year 1950 idea of AI has developed not only in dentistry and medical but also in medicinal therapy. AI is very useful and essential in pharmacotherapy(24). We can research variety of approaches under the field of AI. Maximum amount of online data is required for machine and deep learning(25,26). Thought, imagination power, thinking ability etc improve with the help of AI. AI is useful in making decisions as well as in maintaining record. It has many knowledge based applications under the health care field. The combination of AI and health care will help to

maximize the outcomes in healthcare field. Machine learning and Artificial intelligence may parallel the human mind to some extent(27).

**CONCLUSION**

Artificial intelligence is playing an essential role in dental practice. Artificial intelligence would be the ultimate version of advancements in technology applicable to healthcare field. However, we can get incrementally closer to that, and that is basically what we work on. In near future, it would enable to understand exactly what a dentist wants, and it would be able to perform it rightly. The rapid advancement in automation may change the working in healthcare industry swiftly. Data handling and knowledge-based management would be 2 important arms of artificial intelligence. Artificial intelligence applications can deal with the enormous data available in healthcare sector and configure the new data thus to evolve gradually. It appears that artificial intelligence may soon become useful tool in near future. Artificial intelligence is emerging as a promising modality and could be anticipated to shape the future of dental health care delivery. It appears that artificial intelligence is the solutions that assist doctors, rather than replace them, and hence are more likely to be accepted by the health care professionals.

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