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The Transformative Influence Of Artificial Intelligence In Dentistry

Wedad Saud Alaida[1] Safa Ali Gadi[2] Abdulaziz Abdulrahman Almujil[3] Naif Mohammed Alotaibi[4] Mohammad A Alrowias[5] Abdullah Saleh Alshehri[6]

ABSTRACT

Introduction: *In today's world, the importance of artificial intelligence is increasing in the field of medicine, including dental care. AI has gained significant popularity in different branches of dentistry, such as periodontics, prosthodontics, orthodontics, operative dentistry, oral and maxillofacial surgery. Several applications using artificial intelligence in the field of dentistry are dedicated to the diagnosis of conditions through the analysis of radiographic or optical imaging.*

Aim of work: *To provide an in-depth assessment of the influence and applications of artificial intelligence in dentistry.*

Methods: *A search was conducted in the MEDLINE database's electronic literature using the specified search terms: artificial intelligence (AI), deep learning, neural network, dentistry. The search was narrowed down to publications between 2020 and 2024 to find relevant material. I conducted a search on Google Scholar to find and analyze scholarly articles that are relevant to my topic. The choice of papers was influenced by specific inclusion criteria.*

Results: *The publications analyzed in this study encompassed from 2020 to 2024. The study was structured into various sections with specific [1]headings in the discussion section.*

Conclusion: *The dental industry is constantly evolving with the rapid development and adoption of new technologies. AI is an incredibly promising field, offering impressive accuracy and efficiency when trained with unbiased data and a well-developed algorithm. Many dental professionals recognize the potential benefits of incorporating AI into their practice. By utilizing AI technology, they can enhance the accuracy and precision of various aspects of their work, including diagnosis, treatment planning, and predicting treatment outcomes and disease prognosis.*

Keywords: *Artificial Intelligence (AI), Deep Learning, Neural Network, Dentistry*

INTRODUCTION

[1]Prosthodontist, Riyadh, Second Health Cluster, Ministry of Health, Riyadh, Saudi Arabia.
[2]Pediatric Dentistry Consultant
[3]General Dentist, Alyamamah Hospital
[4]Specialist in Oral Surgery, Alyamamah Hospital
[5]Orthodontic Consultant, Alyamamah Hospital
[6]General Dentist, Alyamamah Hospital

From its very beginnings, Artificial intelligence (AI) has transformed several facets of our everyday existence, bringing about substantial progress such as facial recognition, image classification and self-driving cars. The application of AI in various fields has shown promising results. For instance, in the surgical field, intelligent systems have been developed to assist surgeons during procedures, such as video-surgery. AI has also been used in automatic disease diagnosis, where decision support diagnosis systems analyze images to assist in accurate diagnoses. AI has also made significant progress in the field of personalized medicine. This includes the ability to assess an individual's susceptibility to diseases, accurately diagnose conditions, and determine the most suitable treatment options for them (Xu et al., 2021). Despite the seemingly limited impact of AI on the field of dentistry, certain areas are undergoing notable enhancements thanks to the integration of AI technology. Some of the advancements in dental technology involve the use of image-based systems to detect diseases and support diagnoses. Additionally, there are techniques for automatically detecting oral traits through image segmentation, as well as methods to enhance the resolution of dentistry-related images. Several recent advancements have made it possible to incorporate robotic support in the field of dentistry. Regardless, there are numerous opportunities for AI techniques to be applied in various aspects of dentistry within the emerging digital dentistry paradigm (Carrillo-Perez et al., 2022).

Several factors have played a role in the current surge of AI advancements in biomedicine. First, there has been a significant surge in data collection over the past few decades. However, data alone is insufficient. Thanks to recent advancements in high-performance computing, cutting-edge AI techniques now allow for a comprehensive and enlightening analysis of data (Khanagar et al., 2021). The process of extracting this information is commonly known as machine learning (ML), which is the data-driven aspect of AI. Its goal is to enable machines (algorithms executed in computer systems) to acquire knowledge about a particular subject based on a given dataset. Information extraction of this nature is commonly accomplished through the application of supervised learning techniques, which have proven to be highly effective in addressing various challenges. Supervised learning involves the process of training a model to accurately predict output values based on input data, using a collection of example input-output pairs. After mastering this function through training data, you can make new predictions on fresh samples (Schwendicke et al., 2020).

Through the power of data, machines have the ability to learn and develop algorithms, enabling them to independently tackle prediction problems without the need for human intervention. Neural networks (NNs) utilize artificial neurons that closely resemble human neural networks and imitate the workings of the human brain through a mathematical non-linear model. Artificial neural networks have the remarkable ability to replicate human cognitive skills, encompassing problem-solving, learning, and decision-making. NNs typically consist of three layers: the input layer, the hidden layer, and the output layer. The input layer receives information, the hidden layer processes the data, and the output layer makes decisions based on the processed information. With a set of mathematical models, NNs have the ability to map any input to an output. If a sufficient amount of data is available, neural networks can be trained to accurately represent the statistical patterns within the data. There are also more intricate artificial neural networks with additional hidden layers, known as multilayer perception (MLP) neural networks. The most frequently utilized types of neural networks include artificial neural networks (ANN), convolutional neural networks (CNN), and recurrent neural networks. Deep learning is a fascinating aspect of neural networks, where computers have the ability to autonomously learn and process data. Deep learning neural networks typically consist of a substantial number of neurons in the hidden layer, ranging from a few thousand to a few million (Javed et al., 2020).

The field of dentistry is experiencing a significant transformation with the integration of advanced technology and digitization. Computers are now capable of providing second opinions in various dental fields. Advancements in dentistry have allowed for the utilization of NNs to enhance the accuracy, speed, and effectiveness of the diagnostic process. This comprehensive review offers an insight into the impact and various uses of AI in the field of dentistry.

AIM OF WORK

To provide an in-depth assessment of the influence and applications of artificial intelligence in dentistry.

METHODS

A search was conducted on scientific websites such as Google Scholar and Pubmed using specific keywords like artificial intelligence (AI), deep learning, neural network, and dentistry to gather all relevant papers. Specific criteria were used to choose the articles. Upon careful examination of the abstracts and prominent titles of each publication, we excluded case reports, duplicate papers, and articles without entire content. The reviews included in this research were published from 2020 to 2024.

RESULTS

The present analysis focused on examining the impact and practical uses of artificial intelligence in the field of dentistry from 2020 to 2024. As a result, the review was published under many headlines in the discussion area, including History of AI, Classification of AI and AI applications in dentistry.

DISCUSSION

1. History of AI

The concept of artificial intelligence (AI) has captured interest since the release of Alan Turing's influential work "Computing Machinery and Intelligence" in 1950. Turing defined AI as the process of computers engaging in thinking. He suggested that robots had the ability to analyze information and draw logical conclusions in order to solve problems and make choices. Alan Turing developed the Turing Test, which assesses a computer's ability to attain human-level intelligence by discerning natural language interactions between a human participant and a machine (Ekmekci et al., 2020).

The concept of AI emerged in 1955 during a two-month workshop at the Dartmouth Summer Research Project on Artificial Intelligence. This workshop was led by influential figures such as John McCarthy, Marvin Minsky, Nathaniel Rochester, and Claude Shannon. Nevertheless, the idea remained theoretical because to limitations such as the absence of storage capability, high expenses, and traditional perspectives on artificial intelligence (Luger and Luger, 2021).

Between 1957 and 1974, the area of artificial intelligence saw significant expansion as a result of advancements in computer processing capabilities, increased availability of computers, and the development of sophisticated AI algorithms. One example is ELIZA, a computer software capable of understanding spoken language and resolving issues via text-based communication. Two periods known as "AI Winters" occurred after the first phase of development, resulting from a lack of practical applications and a decrease in research funding in the mid-1970s and late 1980s. The field of artificial intelligence saw a significant advancement throughout the intervening time, characterized by little progress (Kubassova et al., 2021).

2. Classification of AI

There are several methodologies via which AI may be attained; various forms of AI can do distinct jobs, and researchers have devised diverse categorization techniques for AI. Artificial Intelligence (AI) may be categorized into two types: weak AI and strong AI. Weak AI is designed to address individual or particular tasks, while strong AI is developed to handle several tasks via the use of complex algorithms. Reinforcement learning, computer vision, natural language processing, and data mining are all part of weak AI, also known as narrow AI. Instances of weak artificial intelligence include AlphaGo, Google translation, Amazon chat robots, Tesla Autopilot, and facial recognition (Kaur et al., 2020).

Strong AI, in contrast, seeks to develop versatile algorithms for decision-making across several domains, however research in this area proceeds with caution owing to possible ethical and hazardous concerns. Machine learning (ML) and expert systems are subsets of narrow artificial intelligence (AI). Machine learning may be categorized into three main types: supervised learning, semi-supervised learning, and unsupervised learning, which are determined by the underlying principles of the approaches. Supervised learning utilizes datasets that have been labeled to train a model, while unsupervised learning operates independently to discover characteristics of unlabeled data. Utilizing a combination of labeled and unlabeled data, semi-supervised learning allows for more efficient training (Kaur et al., 2020).

Weakly-supervised learning, an innovative strategy in the field of AI, has become more popular for reducing the expenses associated with labeling, especially in problems related to object segmentation. Deep learning (DL), a component of machine learning (ML), encompasses both supervised and unsupervised learning techniques. Deep learning is an artificial neural network that has three levels of nodes, with each layer including many linked layers (Tyagi and Chahal, 2022).

3. AI applications in dentistry

Neural networks, often known as NNs, are networks that are inspired by biological systems and serve as the foundation for deep learning algorithms. Various forms of neural networks exist, with the most significant ones being artificial neural networks (ANNs), convolutional neural networks (CNNs), and generative adversarial networks (GANs). ANNs are learning algorithms that operate by simulating the behavior of organic neural networks. They are applicable to supervised, unsupervised, and reinforcement learning situations and have been used to address a wide range of challenges. An ANN is composed of interconnected layers of neurons that work together to process information. An ANN is considered "deep" when it has numerous layers and a large number of neurons in each layer. The application of deep learning in dentistry is an area of great promise and potential within this field of study. These approaches can greatly improve the development of advanced decision-making support systems by allowing the identification of specific patterns from large databases of images (although various types of biological signals or data sources can also be utilized) (Corbella et al., 2021).

3.1 Neural Networks in Restorative Dentistry

Early detection of dental caries is vital due to its prevalence as the most frequent dental disease. Using dental probes, dentists are able to effectively screen and diagnose dental caries. By carefully examining the texture and coloring, they may ascertain the integrity of the tooth. This approach is highly dependent on the dentist's knowledge and experience. Specifically, the surfaces between teeth, known as approximal surfaces, might provide challenges during dental examinations (Chou et al., 2021). Supplementary examinations, such as radiography, are crucial in contemporary dentistry and may improve the identification of tooth decay. The most commonly used radiological images for caries screening include bitewings, periapical X-rays, and panoramic X-rays. CBCT is not commonly utilized for detecting tooth decay, as stated in a study by Prados-Privado et al. in 2020. Utilizing neural networks can enhance the diagnostic process for identifying dental caries on radiological imaging, leading to faster and more precise examinations. The application of neural networks in conservative dentistry has experienced significant advancements, yet its implementation continues to be restricted (Mertens et al., 2021). Algorithms may be used to identify the boundaries of anatomical and diseased structures, even when they seem identical owing to visual noise and poor contrast. Geetha et al. utilized an ANN to determine the presence or absence of caries in 105 radiograph images. Sixteen feature vectors were generated from the segmented picture and utilized as input nodes. The output nodes consisted of either decayed or healthy teeth. The accuracy for caries detection turned out to be 97.1%, with a false positive rate of 2.8%. According to Geetha et al. (2020), this research suggests that neural networks are much more accurate than standard dental exams in detecting tooth decay. The ANN In addition, the detection of dental restorations can be facilitated through the utilization of AI. Restorative dentistry can benefit from the application of AI, as demonstrated in Abdalla-Aslan et al.'s 2020 study, where dental restorations were accurately identified and categorized. The algorithms utilized in their research demonstrated a remarkable accuracy rate of 93.6% in identifying dental restorations within 83 panoramic photos. Furthermore, Abdalla-Aslan et al. (2021) classified restorations into eleven different groups by analyzing the shape and arrangement of grey values.

The ANN can be utilized to determine the most effective treatment and procedure for dental care. In their research, Javed et al. utilized ANN to predict the levels of Streptococcus mutans after dental caries excavation. This prediction was made using pre-Streptococcus mutans levels, and it was made possible through the use of an iOS App developed with an ANN. A total of forty-five primary molars with occlusal caries were selected for the study. The colony forming units for Streptococcus mutans before and after were measured and documented. The research shows that ANN has the capability to accurately forecast the most optimal excavation approach for each particular patient. The ANN achieved a precision of 99.03% and underwent microbiological verification. Avoiding the inspection, re-excavation, and re-examination of post-Streptococcus mutans, as well as pulpal damage with the excavated cavity, allows for the prediction of its occurrence (Javed et al., 2021). Neural networks have several applications in restorative dentistry for therapeutic objectives. Artificial intelligence can now aid in the frequent diagnosis and selection of treatment methods. An effective approach to adopt emerging technologies include using dental X-ray analysis for the identification of caries or restoration, as well as employing neural networks in microbiology to optimize therapeutic decision-making. Further research is required to incorporate new technology into everyday dental practice. Additionally, neural networks might potentially assist in decision-making in other areas of restorative dentistry. Neural networks have several applications in restorative dentistry for therapeutic objectives. Artificial intelligence can now provide assistance in the frequent diagnosis and selection of treatment methods. An effective approach to adopt new technologies involves using dental X-ray analysis for the diagnosis of cavities or restorations. Additionally, neural networks may aid in making optimal treatment choices in other domains, including microbiology. Further research is required to integrate new technology into everyday dental practice. However, neural networks might potentially benefit other areas of restorative dentistry by aiding in decision-making processes (Majanga and Viriri, 2022).

3.3 Neural Networks in Endodontics

The AI importance in endodontics is increasing. It can help identify periapical lesions and root fractures. Furthermore, it has advantages in assessing the structure of the root canal system, determining the health of dental pulp stem cells, measuring the working length, and predicting the success of retreatment procedures (Aminoshariae et al., 2021). ANN can be utilized as a decision-making system to detect the small apical foramen on radiographs. Studies have shown that endodontic files were utilized to assess the canal length on radiography images, both with and without the aid of ANN. The measurements were taken both before and after the tooth extraction procedure using stereomicroscopy. The evaluation of the endodontics showed an accuracy rate of 76%, while the ANN achieved an even higher accuracy of 96%. Artificial neural networks have shown superior ability compared to humans in accurately determining the location of the apical foramen (Ramezanzade et al., 2023).

Apical periodontitis mostly occurs due to bacterial infection inside the root canal system, resulting in an inflammatory response. It may be identified via radiographic diagnostics and appears as translucent areas around the apex of a tooth, which are also referred to as periapical lesions. Periapical translucencies can be identified through various imaging techniques, such as periapical or panoramic radiography and cone-beam computed tomographic imaging (Setzer et al., 2020). Setzer et al. employed advanced deep learning methods to detect and analyze periapical lesions found in cone-beam computed tomographic (CBCT) images. The accuracy in identifying the lesions was 93% according to Setzer et al. (2020). In the study conducted by Orhan et al., CNN was employed to detect periapical lesions on CBCT images. The accuracy rate of the convolutional neural network in diagnosing periapical lesions was 92.8%, correctly identifying 142 out of 153 cases. The results obtained by CNN were on par with those achieved by a skilled dental professional (Orhan et al., 2020). A CNN is a specialized type of artificial neural network that focuses on extracting valuable information from images by utilizing convolutional operations. Pauwels et al. used these convolutional neural networks in their study. The periapical radiographs were carefully analyzed to detect any periapical lesions found in bovine ribs. The findings were compared with three oral radiologists, and the CNN demonstrated a high level of accuracy, as reported by Pauwels et al. (2021). Sadr et al. used CNN to evaluate panoramic pictures for the detection of periapical lesions. The researchers determined that the evaluation of various tooth kinds on panoramic images is challenging due to the procedure of generating radiography images. The diagnostic uncertainty and the need for greater sensitivity are the reasons why, despite excellent findings in periapical lesion detection by neural network, there remains room for improvement. The sensitivity of the CNN in detecting dental issues was greater (87%) in molars compared to other teeth, but the specificity was lower (Sadr et al., 2023).

ANN have a wide range of applications, including dental radiology and genetics. In the field of endodontics, researchers have found that these networks can be particularly useful (Ghaffari et al., 2024). Neural networks have the potential to be beneficial in endodontics, particularly in the interpretation of X-rays and the identification of periapical abnormalities. There is room for improvement in the detecting method to achieve high accuracy for all teeth. AI has the potential to revolutionize various fields, including genetics, by streamlining the diagnostic process.

3.4 Neural Networks in Orthodontics

The field of orthodontics is experiencing a widespread adoption of artificial intelligence. Orthodontics commonly utilizes various algorithms such as ANN, CN, support vector machine, and regression methods (Bichu et al., 2021). Shimizu et al. used an ANN in their research to forecast the need of extractions in patients' treatment plans. Furthermore, they factored in the anchoring patterns. The accuracy of the ANN in predicting the effectiveness of the treatment plan for extractions was an impressive 94.0%, while its prediction accuracy for the usage of maximal anchoring reached 92.8%. The findings indicate that orthodontists can utilize ANN to enhance the precision of treatment strategies, as shown by Shimizu et al. (2022).

Taraji et al. devised an ANN-based approach to forecast the treatment results in patients classified as class II and III. The study has the potential to predict the simultaneous emergence of abnormal growth patterns in the body's size and shape, namely in the head and face. Additionally, it may identify specific areas that may be targeted for treatment of misalignment of the teeth and jaw. Research suggests that deep learning neural networks may be the most effective method for detecting Temporomandibular joint (TMJ) osteoarthritis. TMJ issues are prevalent in 5 to 12% of the population, making them the second most frequent musculoskeletal ailment. Additionally, the likelihood of experiencing persistent impairment due to TMJ osteoarthritis tends to grow as individuals age. The primary objective is to identify the dysfunction of the TMJ prior to the onset of structural deterioration. In Bianchi et al.'s study, TMJ CBCT scans, blood samples, and saliva tests were conducted to accomplish this objective (Bianchi et al., 2021). The research conducted by Muraev et al. used ANN to accurately position the cephalometric points on cephalometric radiography. A comparison was made between the accuracy of CP placement using an ANN and three groups of physicians: experts, normal doctors, and inexperienced doctors. The findings indicated that ANN) shown comparable accuracy to that of an experienced dentist in the design of cephalometric points. Furthermore, in some instances, ANN exhibited even greater precision than newly qualified dentists (Muraev et al., 2020). Furthermore, ANN may assist in identifying the specific stages of growth and development. The research study conducted by Kök et al. required gathering cephalometric and hand-wrist radiographs from individuals between the ages of eight and seventeen years old. Kök et al. (2020) employed ANN to predict the growth and development stages as well as gender using the cervical vertebrae. The findings were determined to be 94.27% accurate.

Overall, neural networks have proven to be valuable tools in various aspects of orthodontics. They can assist in diagnosing and planning treatments, conducting automated anatomical analyses, evaluating growth and development, and assessing treatment outcomes (Bichu et al., 2021). The potential for widespread adoption and future expansion of artificial intelligence in orthodontics is quite significant.

3.5 Neural Networks in Dental Surgery

Based on the literature, neural networks have potential applications in the field of dental surgery. Ryu et al.'s research aimed to assess and enhance the accuracy of image predictions for individual patients undergoing orthognathic surgery. Neural network simulations have the potential to enhance treatment plans for surgeons, orthodontists, and patients (Ryu et al., 2021). A study by Denadai et al. highlights the potential of AI in evaluating the impact of orthognathic surgery on facial aesthetics and perceived age. The study collected photographs of patients who underwent orthognathic treatment, comparing their appearance before and after the procedure. CNN were then trained using over 0.5 million images to calculate the patients' ages, and over 17 million ratings to evaluate their appearance. Based on the algorithms, the therapy led to a noticeable improvement in the look of the majority of patients (66.4%), resulting in a reduction in their perceived age by over one year. In the study conducted by Denadai et al. (2020), the author utilized a CNN to assess the attractiveness of individuals who had received cleft surgery.

Kim et al. employed CNN to predict the probability of experiencing paresthesia of the inferior alveolar nerve after removing third molars. Removing the lower third molar is a frequently performed dental surgical procedure. Numbness or tingling of the nerve is a common issue that can occur after the removal of wisdom teeth in the lower jaw. Before the extraction, the CNN utilized panoramic pictures to predict the chances of nerve paresthesia by examining the connection between the nerve canal and tooth roots. Nevertheless, the scientists reached the conclusion that panoramic radiographs presented as two-dimensional pictures may result in an increased number of false positive or negative outcomes. Consequently, more investigation is required to address this issue (Kim et al., 2021). Deep learning can offer significant benefits in identifying oral lesions. Ameloblastoma (AB) and odontogenic keratocyst (OK) are two common conditions that can impact the jaws, specifically the back part of the lower jaw. Liu et al. utilized panoramic radiographs to detect these two malignancies, as they offer a more budget-friendly and convenient alternative to CT or MR scans. Given the difficulty in differentiating between AB and OK in panoramic radiographs, a convolutional neural network was employed using the transfer learning technique. The radiographs were carefully created to improve contrast in the specific area of focus. Every lesion underwent thorough histological testing for verification. The accuracy of the CNN reached an impressive 90.36%, outperforming the other three neural networks utilized in the study. The research mentioned above indicates that neural networks could be advantageous for oral maxillofacial specialists in preoperative environments (Liu et al., 2021).

Prior research suggests that neural networks have the potential to be used in the field of implantology. The use of three-dimensional CBCT images may aid in the planning of dental implant therapy, and this process can be further enhanced by artificial intelligence (AI) systems (Kurt Bayrakdar et al., 2021). Furthermore, panoramic radiographs may be analyzed using convolutional neural networks to accurately detect the specific brands of dental implants and determine the stage of therapy. CNN can be utilized to assess the effectiveness of osteointegration. There can be complications when a layer of soft tissue forms around the area where the bone and the implant meet, potentially affecting osteointegration. Ultrasound scanning may reveal this layer, as demonstrated in a study by Kwak et al. (2021). Recent research has utilized artificial intelligence to measure the degree of bone loss surrounding dental implants (Lee et al., 2022).

3.6 Neural Networks in Periodontology

Periodontitis is a widespread concern that impacts a large number of people worldwide. If not addressed, it can lead to moving of teeth and, in severe cases, tooth loss. In order to avoid this occurrence, it is necessary to implement early illness identification and efficient treatment (Laudenbach and Kumar, 2020). In order to get a dependable diagnosis, a thorough physical examination must be conducted. Consequently, dental probing is employed to evaluate the depth of pockets and measure clinical attachment loss. The accuracy of periodontal probing can be affected by the personal judgment of the clinician performing the procedure. Dental radiographs, which are often used, need assessment that is contingent upon the examiner's level of expertise. Neural networks have been used by several authors to reduce mistakes in diagnosis. Chang et al. employed CNN to analyze panoramic radiographs in order to detect periodontal bone loss, which was quantified as a percentage of the tooth root length. The results were compared with the evaluations conducted by six experienced dental professionals. According to a study by Chang et al. (2022), the CNN demonstrated higher accuracy (83%) as well as reliability compared to dental professionals (80%) in detecting periodontal bone loss. Periapical radiographs can be utilized to detect any bone loss around dental implants. Nevertheless, there is a difficulty that arises when the bone margins around the implants are occasionally unclear or may overlap with each other. CNN can analyze the bone level, top, and apex of dental implants on dental periapical radiographs. The research conducted by Jun-Young Cha et al. included the calculation and classification of bone loss percentage using an automated approach. The degree of peri-implantitis may be evaluated using this approach (Cha et al., 2021). Lee et al. utilized a deep CNN to analyze radiographs and measure the degree of radiographic bone loss (RBL) for each tooth. The RBL %, staging, and presumptive diagnosis, determined by the recent periodontitis classification established by a reliable source, were compared to the measures carried out by independent examiners. The accuracy of the neural network reached an impressive 85%. Neural networks have proven to be highly effective in assessing RBL and providing image-based periodontal diagnostics, as demonstrated by Lee et al. (2022).

Neural networks have been used by other authors to assess radiographic bone loss. Through this approach, a new automated technique has been developed to classify the stages of periodontitis. This technique is based on the criteria that were discussed and updated at the 2017 World Workshop on the Classification of Periodontal and Peri-implant Diseases and Conditions. In their study, Chang et al. employed panoramic pictures and convolutional neural networks to accurately detect and analyze various dental structures, such as the periodontal bone level, the cementoenamel junction level, and the teeth. This innovative approach has the potential to aid in the diagnosis of periodontitis stage (Chang et al., 2020). Vadzyuk et al. considered psychological characteristics in order to forecast the progression of periodontal disease. The researchers determined that the patients' anxiety levels and levels of stress hormones had an influence on the development of periodontitis. Recent research has shown promising results in using advanced technology to predict the likelihood of periodontal disease in young individuals. By analyzing tooth hard tissues, oral hygiene level, and psychophysiological characteristics, researchers have found that neural networks can provide precise predictions (Vadzyuk et al., 2021). Neural networks have shown to be a valuable tool for both physicians and scientists in the field of periodontology. An accurate evaluation of bone loss is essential for determining periodontal disease and planning therapy. Further study and enhancements are necessary to integrate this technology into routine periodontal practice.

CONCLUSION

Dentistry is a rapidly evolving branch of medicine characterized by the rapid advancement of new technology. Currently, the field of dental radiography benefits greatly from the integration of artificial intelligence and neural networks. These advanced technologies help to simplify the tasks of diagnosis, treatment planning, and predicting treatment results. Neural networks are also used in several other fields of dentistry such as genetics, psychology, microbiology, and numerous more. Artificial neural networks and convolutional neural networks are widely utilized in various applications. Neural networks in restorative dentistry may accurately identify tooth decay or restorations and assist in determining the most appropriate strategy for removing caries. Neural networks are extremely beneficial in the field of endodontics. They can be used to identify periapical lesions and root fractures, evaluate the root canal system, estimate the vitality of dental pulp stem cells, determine working length, and predict the success of retreatment procedures. Orthodontics utilizes innovative methods to assist in the diagnosis as well as planning of treatment, identification of specific sites on the cephalometric analysis, examination of anatomical structures, evaluation of growth and development, as well as evaluation of treatment outcomes. Neural networks have the potential to greatly assist in dental surgery by aiding in tasks like surgical planning for orthognathic procedures, anticipating post-extraction complications, identifying bone lesions, and coordinating implant treatments. Moreover, artificial intelligence is expanding its presence in the field of periodontology. In the mentioned investigations, it was utilized to evaluate the degree of bone loss in the gums, bone loss around dental implants, and to predict the development of periodontal disease based on psychological traits. This study demonstrates the rapid progress of artificial intelligence in the last several years and suggests that it will soon be a common instrument in contemporary dentistry. This method has the following benefits: higher production; improved accuracy and precision; enhanced monitoring abilities; as well as time savings. Further research is required to fully integrate neural networks into the field of dentistry, enabling its regular use and streamlining the tasks of dentists.

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