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Editorial

Stepping Ahead with Artificial Intelligence in the Futuristic World of Modern Dentistry

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Artificial intelligence (AI) is a system enables a robot, computer or software imitates a human brain. Artificial intelligence is characterized by the ability of a technology to use a form of its own intelligence, with the aim of developing machines capable of learning data, predicting and solving problems. The fundamental AI encompasses machine learning (ML), deep learning (DL), artificial neural networks (ANN), robotics, expert systems, speech recognition, and language processing. Machine learning utilizes algorithms to predict outcomes based on datasets promoting ML from data to solve problems without human interference. Neural networks calculating signals through artificial neurons, simulating the human brain. Deep learning (DL), a subset of machine learning employs multiple neural layers between input and output layers to automatically recognize pattern. DL utilizes a stratified arrangement of a complex algorithms called Artificial Neural Network (ANN), which is widely applied in processing large and complex images, specially in dentistry. In the field of Prosthetic dentistry, machine learning integration with CAD/CAM software can more preciously design (SOLIDWORKS xDesign) through cloud collaboration generated by AI, which effectively makes designing process faster and accurate minimizing the risk of manual errors. In the fabrication of RPD components, AI models and conventional neural networks (CNN) have been used. It can identify complete edentulous arches, partially edentulous situations like Kennedy's class 1, 2, 3,4 and modifications. It can be used to analyze the stress on adjacent tooth, implant or surrounding structures in collaboration with numerical and experimental models. AI is also useful in fixed prosthetic rehabilitation like detection of crown margins, generating 3D crown morphology corresponding to the antagonist and its morphology which results in minimization of interproximal and occlusal contact errors. AI and efficiently predict the prognosis of implants through analysis of osseointegration, calculation of stress concentration in bone implant inter phase, computing the modulus of elasticity at implant bone inter phase, implant alignment, risk factors, bone anatomy and positioning of surgical guide. In comprehensive manner, AI designed implants are useful to generate next generation implant prosthesis. AI powered shade selection, recognition of golden proportion, calculation of smile lines, white and pink scores are more accurate which can be ideally used in smile designing and esthetic rehabilitation. In periodontics, AI is efficient enough to detect the periodontal disease progression, radiographic periodontal bone loss, peri implant bone loss and peri-implantitis using periodontal parameters and subsequent planning of treatments. Deep CNN algorithms is successfully demonstrated for diagnosis and assessing the predictability of periodontically compromised tooth and for classification of stages of periodontitis. Some ANN are employed to distinguish between chronic and aggressive periodontitis based on immunological markers. In the realm of oral pathology, various AI techniques have been applied which include Artificial Neural Networks (ANN), Clinical Decision Support System (CDSS), Principal Component Analysis (PCA), Data Mining Techniques, Fuzzy Logic, Belief Merging, Genetic Algorithms (GA), Probabilistic and General Regression Neural Network, Dynamic Bayesian Networks, Atlas-Based Techniques etc. AI applications include addressing radiographic lesions, periapical pathologies, caries detection, bone density evaluation and detection fracture sites from panoromic radiographs. In the field of orthodontics CNN digital dental model (DDM) analysis exhibits 90% specificity, sensitivity and accuracy compared to manual vertical and sagittal skeletal analysis. AI has played a significant role in various aspects of orthodontics including automated cephalometric parameter analysis, assessing the impact of orthodontic treatment on facial attractiveness and age appearance, predicting the location and angulation of third molars in panoramic radiographs, analyzing cervical vertebrae, segmenting multiclass tomography, predicting tooth extractions, assessing craniofacial differences, automating cephalometric analysis, and monitoring orthodontic treatment. In the aspect of endodontics, AI is successfully utilized in locating apical foramen, detection of accessory canals and prediction of ndodontic success. CNN based AI models are also used to evaluate root mor-

phology, root fractures and root caries and vertical fractures from 3D CBCT imaging. In the field of Pediatric dentistry, CNN based deep learning are used in identification the presence of mesiodens or impacted canines, detection of early childhood caries (ECC) and categorizing fissure sealants.

AI is considered as a boon in dentistry as it minimizes the chances of errors, lessens the treatment span, caters more accurate prognosis, enhances the quality of treatment outcomes, increases the treatment predictability and patient compliance and provides comfort to both dentist and patient.