Artificial Intelligence

Where does it fit in Today`s Orthodontics? There is probably not a single person in the entire globe who has not, at some point in their lives, realized the boundaries of their physical and/or mental capabilities. Because there was no route to go outside one's boundaries and merely increase ones talent in the past, these constraints frequently meant the difference between life and death. There is little doubt that the tools and machinery that man has created and devised have made life simpler, particularly physically. However, many inventors, researchers, and metaphysicists, who attempted to sketch human belief as a mechanical handling of symbols desired to combine the durability and dependability of machines with intellect and consciousness as human attributes.[1] One of the most important contributions to the fourth industrial revolution, which ushers in a new digital era, is artificial intelligence (AI). It is defined as "the study of intelligent agents, which includes any machine that can comprehend its environment and respond to increase its chances of success.[2] John McCarthy, a mathematician, introduced the phrase "artificial intelligence" in 1955. McCarthy is frequently credited with creating the field. He used this concept to illustrate how machines would be able to carry out what are sometimes referred to as "intelligent" tasks.[3] Digital dentistry is replacing analog dentistry at a rate that is similar to how quickly artificial intelligence is permeating every aspect of a modern dentist's day-to-day operations. These changes are not little nor trivial, especially when considered in a larger context, even if they are not often instantly seen or connected to AI. In order to improve dental care and dentistry, AI can be used in a variety of ways, including splitting recognizing teeth,[4] planning dental implant treatments, identifying and categorizing dental implant systems,[5] detecting and categorizing dental plaque,[6] detecting maxillary sinusitis on panoramic radiography,[7] recognizing cephalometric landmarks,[8, 9] or classifying roots.[10]

To assess Orthodontic patients and select the most appropriate course of treatment, orthodontists must draw on all of their expertise. Additionally, they must make precise clinical decisions when predicting the prognosis. Orthodontists occasionally lack the expertise necessary to make the best clinical choice in a short amount of time, though. They may use AI apps as a guide to help them make better decisions and perform better.

Every aspect of orthodontics, including patient communication, diagnosis, and treatment procedures, uses artificial intelligence. AI-based orthodontic software solutions are built on "machine learning" technology. In this technology based era, "the machine" uses raw data to gather information. These computer applications can evaluate diagnostic dental images and radiographs, as well as direct dentists via 3D intraoral scanning to quickly create an optimal model.[11] Numerous researches in the field of orthodontics explored various AI algorithms. A large database of patient examination records was required as input for each of these algorithms. The findings demonstrated that the number of diagnostic mistakes and the requirement for a skilled clinician during diagnosis were both decreased by the usage of AI. The researchers concluded that the orthodontic sector may benefit from using AI.[12,13,14]

Cephalometrics can be traced manually or digitally through soft wares. Although using soft wares for tracing reduce tracing errors and improve the diagnostic efficacy of cephalometric analysis, inconsistent anatomical landmark identification remains a significant source of random error.[15] For automated cephalometric tracing, Lee et al. (2020) utilized an analysis based on convolutional neural network. The created program, according to the authors, showed > 90% success rate in the accurate detection of cephalometric landmarks. A recent web-based product included a module for automatic tracing. It can model potential soft tissue changes following

planned orthognathic therapy and create soft tissue profiles in its surgical orthodontic planning module.[16]

One of the pivotal factors in orthodontic therapy is timing. The cervical vertebrae's levels of development are also used to gauge skeletal maturity. In order to determine the cervical vertebrae's level of matureness, Kök et al. (2019) evaluated (07) popular AI techniques. Superior results were attained using the Artificial Neural Networks (ANN) method made up of artificial neural cells. It was delineated that ANN may be applied in the future to determine the cervical vertebrae stage.[17]

The most important and crucial stage of orthodontic therapy is the planning phase. Since extractions are irreversible, they should be carefully planned. The dentist can then be guided by an artificial intelligence system to choose the extraction pattern developed on the analysis supplied from the aforementioned inputs. According to studies AI can help dentists by reducing decision-making mistakes and can provide 80 to 90% accurate extraction choice.[18,19]

Digital orthodontics research and development as well as 3D orthognathic surgery simulation have received substantial subsidies.[20] Additionally, personalized surgical set up planning and computerized treatment planning increase diagnostic accuracy, particularly for junior physicians.[21,22] Knoops et al. created a computer aided learning framework in the discipline of plastic and reconstructive surgery for planning and diagnostics.[23]

There have been enormous investments made in the dentistry thus far, and it is apparent that AI technology has a huge influence on this industry. Although early attempts appeared to be lacking, progress in the field of artificial intelligence is accelerating. Artificial intelligence has the potential to be a practical and effective tool for reducing mistakes and enhancing patient care.

The worry that corporate initiatives would eliminate professional physicians from the healthcare system and lower managment costs by utilizing AI is one of the most prominent objections leveled against AI technology. Furthermore, it is challenging to argue that this is an unjustified worry given recent events, which indicate that efforts in this direction have already begun. The growing use of 3D based orthodontic (AI) technologies, which aids in the interpretation of complicated data, will continue to draw attention, even if it is still obvious that AI is not likely to replace dentists in the foreseeable future.

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