Maxillofacial Surgery and Artificial Intelligence

These are amazing times, as we witness a new world emerging with a blend of innovative technologies and surgical breakthroughs. Artificial intelligence (AI) offers incredible opportunities for the savvy surgeon who is willing to explore new possibilities and learn new skills.[1-3] We need to collaborate across disciplines and lead a healthcare transformation. We need to embrace a new era in surgery, where machine learning (ML) enhances the surgeon's clinical judgement. The simple healing scalpel becomes a smart tool! The ultimate goal of an oral surgeon and most of the healthcare system is to provide a system that is affordable, accessible and excellent, that can improve the patient quality of life and fight diseases.

Since the beginning of the year, AI has become the most searched, spoken and discussed term in all medical and surgical specialties.[1] Oral and maxillofacial surgery (OMFS) cannot be left behind in this AI storm. AI can transform the present concepts in reconstruction and rehabilitation of maxillofacial defects by providing various tools and techniques that can enhance the accuracy, efficiency and outcomes of surgical procedures. Some examples of AI applications in OMFS include computer-aided design and computer-aided manufacturing (CAD/CAM), ML and deep learning (DL) and artificial neural networks (ANNs).[1-3] CAD/CAM uses digital imaging, three-dimensional (3D) photography, intraoral scans and 3D printing to design and fabricate customised implants, prostheses, guides and plates for reconstructing maxillofacial defects.[4] CAD/CAM can reduce the cost, time and complexity of the reconstruction process and improve the fit, function and aesthetics of the devices.[4,5] Bioprinters can even fabricate scaffolds to receive grafts and tissue engineering products. ML and DL can analyse various types of data such as images, texts, sounds and signals to assist in diagnosis, prognosis, treatment planning, outcome prediction and evaluation of maxillofacial surgery. ANNs can model complex non-linear relationships between inputs and outputs to perform tasks such as image recognition, natural language processing (NLP), speech synthesis and generation. ANNs can be used to recognise facial features, emotions, expressions and gestures, synthesise realistic speech and faces, generate captions and descriptions for images and videos and create interactive avatars for maxillofacial surgery.

Computer vision (CV), a field of AI that deals with the processing and understanding of visual information. CV can be used to perform tasks such as face detection, face recognition, face alignment, face reconstruction, face verification, face beautification, facial landmark detection, facial expression recognition, facial action unit detection, facial emotion recognition, facial age estimation, facial gender estimation, facial ethnicity estimation, facial pose estimation, facial symmetry analysis, facial attractiveness analysis, facial skin analysis, facial wrinkle analysis, facial acne analysis, facial scar analysis, facial hair analysis and facial make-up analysis. CV can be used to assess the pre- and post-operative conditions of maxillofacial patients and monitor their progress and satisfaction.[1-3,6]

NLP is a field of AI that deals with the processing and understanding of natural language. NLP can be used to perform tasks such as text analysis, text summarisation, text generation, text classification and text sentiment analysis. NLP can be used to analyse the medical records and perform literature reviews, facilitating faster documentation and writing of records.

These are some of the benefits and applications of AI in OMFS. As with any new tool and technology, there would be an element of scepticism to adapt to the new technology. Equally important is the destructive resonance raised by potential pitfalls in the technology. A practicing OMFS needs to be aware and carefully integrate AI into his learning, teaching, research and clinical practice to provide the best to his patients.[1,6]

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References

1. Rokhshad R, Keyhan SO, Yousefi P. Artificial intelligence applications and ethical challenges in oral and maxillo-facial cosmetic surgery: A narrative review. Maxillofac Plast Reconstr Surg 2023;45:14.
2. Pereira KR. Harnessing artificial intelligence in maxillofacial surgery. In: Lidströmer N, Ashrafian H, editors. Artificial Intelligence in Medicine. Cham: Springer; 2021.
3. Rasteau S, Ernenwein D, Savoldelli C, Bouletreau P. Artificial

intelligence for oral and maxillo-facial surgery: A narrative review. J Stomatol Oral Maxillofac Surg 2022;123:276-82.
4. Cristache CM, Tudor I, Moraru L, Cristache G, Lanza A, Burlibasa M. Digital workflow in maxillofacial prosthodontics – An update on defect data acquisition, editing and design using open-source and commercial available software. Appl Sci 2021;11:973.
5. Chauhan D, Roy ID, Viswamnara M, Thakur A, Athwale R. Rehabilitation of auricular defect with implant-retained auricular prosthesis – A case report. Ann Maxillofac Surg 2021;11:164-8.
6. Krishnan DG. Artificial intelligence in oral and maxillofacial surgery education. Oral Maxillofac Surg Clin North Am 2022:S1042-3699(22)00017-6.

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